Handbook of Intellectual Styles

Preferences in Cognition, Learning, and Thinking

Editors
Li-fang Zhang
Robert J. Sternberg
Stephen Rayner

SPRINGER PUBLISHING COMPANY

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NEW YORK

Springer Publishing Company, LLC
11 West 42nd Street
New York, NY 10036
www.springerpub.com

Acquisitions Editor: Nancy S. Hale
Composition: Techset

ISBN: 978-0-8261-0667-4
E-book ISBN: 978-0-8261-0668-1

11 12 13/ 5 4 3 2 1

CIP data is available from the Library of Congress

Printed in the United States of America by Bradford & Bigelow

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Preface

"Intellectual styles," a generic term for all style constructs, with or without the root word "style," refer to people's preferred ways of processing information and dealing with tasks. The accumulated knowledge in the field of intellectual styles has reached a new level of maturity. We see this maturity reflected in the nature of the research questions asked, the range of issues and topics investigated, the scope of investigations, the increasing sophistication of the research methodologies employed, the adequacy of the theoretical advancements achieved to account for and integrate the increasing body of empirical data, and the connections between the literature on intellectual styles and scholarship in other areas of psychology, education, and business, as well as allied fields.

The goal of this handbook is to provide a complete, definitive, and authoritative single volume on intellectual styles. Specifically, the handbook is designed to achieve three objectives. The first is to create a reference for scholars and students from diverse areas (e.g., education, business, health sciences, and psychology) who wish to understand more about intellectual styles and their related constructs such as intelligence, creativity, metacognition, personality, and human development. The second is to provide an up-to-date, panoramic picture of the current state of research on intellectual styles. The third is to make available resources for anyone who is interested in applying the notion of styles to his/her work or personal life.

To this end, this book contains 19 chapters covering a wide range of issues and topics in this field, all written by leading experts who have either constructed conceptual frameworks or published work based on empirical investigations, or who have done both. The 19 chapters are divided into seven parts. Part I, the introduction, sets the stage for the remaining parts. In particular, it highlights some of the long-standing challenges facing researchers in the field, recounts the major achievements of the field in the past three decades, and makes suggestions for future research. Part II concerns the foundations of the field of intellectual styles: its historical literature, theory building, and measurement. Part III considers the development of intellectual styles: their etiology and their relationships to demographic characteristics and to culture. Part IV examines intellectual styles in comparison with related constructs: metacognition, intelligence, creativity, and personality. Part V looks at the roles of intellectual styles in human performance: academic achievement, learner developmental outcomes, management of careers, and work performance. Part VI focuses on applications of intellectual styles in various contexts: educational instruction and assessment, organizational behavior and management, and the education of exceptional learners. Part VII, the conclusion, addresses our continuing concern for a more strategic attempt at developing the identity of the field. It also is concerned with the continuing development of intellectual-styles theory, to support further basic, translational, and applied research within the paradigm.

The *Handbook of Intellectual Styles* is intended to be accessible to a diverse audience of readers. Although the editors come from a psychological background, the contributors are scholars from various academic areas, including business, education, sports, and health sciences, as well as psychology. The diverse topics relevant to intellectual styles will be of interest not only to students and scholars in the aforementioned academic disciplines but also to anyone who would like to understand intellectual styles and their effects on daily life.

Acknowledgments

We are grateful to Philip Laughlin for contracting the book. We sincerely thank our acquisitions editor Nancy Hale and assistant editor Kathryn Corasaniti for their continuing and tireless help with the book. We would like to thank all styles researchers whose publications have made this Handbook possible. We also would like to thank our children and our students, who have taught us so much about intellectual styles.

Handbook of Intellectual Styles

Preferences in Cognition, Learning, and Thinking

1

Intellectual Styles: Challenges, Milestones, and Agenda

Li-fang Zhang, Robert J. Sternberg, and Stephen Rayner

At one time or another, we have all come across one or more of the following phenomena: (1) Alice is considered to be bright by one teacher, but not by another; (2) Michael has failed a multiple-choice test, but has excelled on an individual project; (3) Professor Miller was evaluated very highly by one group of students, but very poorly by another; and (4) Mrs. Jones did not do well in one particular business setting, but she was a great asset in another. These phenomena and many other similar ones we observe in education and in business settings were traditionally attributed to either abilities or personality, or perhaps to attitudes. However, in the past several decades, the construct of intellectual styles has been used to explain aspects of these situations.

"Intellectual styles," an umbrella term for all style constructs, with or without the root word "styles," refers to people's preferred ways of processing information and dealing with tasks (Zhang & Sternberg, 2005). Different scholars have their own preferred style terms, both in their writings and in the talks they deliver, including "cognitive style," "learning style," "thinking style," "mind style," "mode of thinking," or "teaching style." However, many contemporary styles researchers agree that "style" constructs are encompassed by the term "intellectual styles," which was initially proposed by Zhang and Sternberg (2005) in their "a Threefold Model of Intellectual Styles."

The field of intellectual styles has a long and complicated history of nearly eight decades that is, if one accepts the view that the notion of styles was first introduced into psychology by Gordon Allport (1937), when he referred to "styles of life" as a means of identifying distinctive personality types or types of behaviors. Some fields in psychology and other sciences have a unified history and interconnected philosophical and theoretical foundations; others do not. The field of intellectual styles is one of those that does not. A thorough historical account of the diverse philosophical–theoretical foundations of the field is well beyond the scope of this chapter. Proper historical treatments of the field are available elsewhere (e.g., Dember, 1964; Grigorenko & Sternberg, 1997; Kagan & Kogan, 1970; Messick, 1994; Moskvina & Kozhevnikov, 2011; Rayner & Riding, 1997; Vernon, 1973; Zhang & Sternberg, 2006) and in this volume (Chapter 2). This chapter focuses on delineating

the challenges faced by the field, which arise from its having multiple origins, and discusses the impact of these challenges on research activities in the field in the past three decades.

The remainder of this chapter is divided into three parts. The first discusses some of the long-standing challenges faced by researchers in the field. The second records the key milestones of the field in the past three decades. In the final part, some conclusions are drawn.

MAJOR CHALLENGES

During its long history, the field of intellectual styles has faced several major challenges that, on the one hand, have been impediments to the advancement of the field and, on the other, have served as a major impetus for researchers to continue to pursue research that has been increasingly more able to meet these challenges. Several authors have attempted to identify the various challenges encountered by the developing field of styles at particular points in time (e.g., Messick, 1994; Miller, 1987; Riding & Cheema, 1991; Sternberg, 2001; Zhang & Sternberg, 2006). We see the field as having been presented with three principal challenges: (1) a lack of identity, (2) the existence of three major controversies concerning the nature of styles, and (3) the confusion brought about by several critical reviews of the field.

Searching for Identity

During its long history, the field of intellectual styles has been struggling to find an identity within the larger context of the education, psychology, and business literatures. Such a struggle is the result of several related difficulties. One difficulty has been the lack of a clear definition of the style construct because styles easily can be mistaken for abilities or personality traits. As suggested by Sternberg (2001), one of the principal factors that contributed to the decline in styles research during the 1970s was that some early theories proposed styles that could not be shown to be "pure" style constructs. These styles were not clearly distinguishable from either abilities or personality traits. As a result, investigation into styles easily became assimilated into that of either abilities or personality, so that a distinct area of research on styles no longer seemed to be necessary.

With regard to the relationship between styles and abilities, the focal point of discussion has been Witkin's (1954) construct of field dependence/independence (FDI). Although some scholars (Kagan & Kogan, 1970; Jones, 1997; Satterly, 1976) have fervently argued that the FDI is a cognitive style construct, others (e.g., Richardson & Turner, 2000; Zigler, 1963) have insisted that the FDI construct is not a style construct because intelligence plays a critical role in individuals' performance on tests of the FDI construct. Similarly, the relationship between styles and personality has also been the subject of much debate. Some scholars (e.g., Cattell, 1973; Korchin, 1982; Messick, 1994) have argued that styles should be organized within the broader personality systems. Others (e.g., Furnham, 1995; Meyers, 1988) have

taken the opposite view, placing more emphasis on the contributions of personality to styles. Still others (e.g., Kogan & Block, 1991) have adopted a more balanced position, contending that the relationship between styles and personality is bidirectional and interactive.

A second difficulty that has contributed greatly to the field's lack of identity has been the absence of a common language and a common conceptual framework within which work on styles could be understood. Such a lack of a common language and a common conceptual framework has been attributed to the huge number of style labels generated, accompanied by a corresponding number of style measures (e.g., Evans & Waring, 2009; Messick, 1994; Miller, 1987; Vernon, 1973). Indeed, the number of style labels has increased with time. When reviewing the then-existing work on styles, Hayes and Allinson (1994) noted that there were 22 different dimensions of cognitive style alone. A recent review (Coffield, Moseley, Hall, & Ecclestone, 2004) recorded, as Evans and Waring put it, "a bewildering library of style measures (over 71 theories of styles)" (Evans & Waring, 2009, p. 172).

This lack of a common language and a common conceptual framework for understanding work on styles eventually led to a reduction in the quantity (and, arguably, quality) of styles research between the early 1970s and the mid-1980s (e.g., Jones, 1997; Riding & Cheema, 1991). Riding and Cheema once compared the manner in which scholars were investigating styles to "the blind man and the elephant" (Riding & Cheema, 1991, p. 193). This "blind man and the elephant" phenomenon, despite becoming somewhat less apparent over time, especially within the last decade, still exists today.

A third difficulty that has contributed to the lack of identity of the field is the limited contact that the styles literature has had with the literatures in the larger setting of business, education, and psychology. Consider the case of styles in the context of psychology: It is commonly acknowledged (e.g., Kagan & Kogan, 1970; Messick, 1994; Morgan, 1997; Rayner & Riding, 1997; Vernon, 1973) that the field of intellectual styles is rooted in diverse philosophical and theoretical foundations, ranging from the classical Greek literature, to conceptions of individual differences, to Jung's (1923) theory of personality types. Similarly, work on styles has drawn on diverse research traditions, most notably cognitive-developmental psychology; differential psychology; Gestalt psychology; psychoanalytic ego psychology; and the experimental psychology of cognition (Messick, 1994). However, there has been neither much articulation on exactly how styles are rooted in and related to constructs in these aforementioned fields, nor adequate empirical evidence supporting the claim for such a historical account.

Also consider the case of styles in the context of business: Until recently, much of the styles work done within the context of business settings had been based on the Myers-Briggs Type Indictor (Myers & McCaulley, 1985), which has its origins in Jung's (1923) theory of personality types, and on the Kirton Adaption–Innovation Inventory (1976), grounded in Kirton's (1961) theory of decision-making styles. Although research based on these two style constructs had been fruitful, it was not clear whether or not the remaining multitude of style constructs would matter in business contexts.

Finally, consider the styles work that has been carried out within the context of education. No doubt, much of the published styles literature has come from research

in the education context. However, this literature had until recently been dominated by studies that examined the relationships of styles to academic achievement. Understanding the roles of intellectual styles in students' academic performance is important to both styles researchers and educators. Nonetheless, efforts to understand styles within other aspects of education are insufficient.

To summarize, the field has been struggling with its identity as a result of (1) the difficulty of distinguishing styles from abilities and personality, (2) the lack of a common language and a common conceptual framework, and (3) the lack of contact between the styles literature and other more general bodies of literature. In the history of the field, these difficulties have been a double-edged sword. On the one hand, they have prevented the styles field from making the degree of progress it should have made. On the other, they have also acted as a positive force in steering the field forward. Over the years, especially in the past three decades, great progress has been made in each of the above three areas (see the discussion in the next part, "Key Milestones in the Past Three Decades").

Three Controversial Issues Concerning the Nature of Intellectual Styles

The field has also been challenged by three major controversial issues concerning the nature of intellectual styles: (1) styles as different constructs versus similar constructs with different labels (also known as the issue of style overlap); (2) styles as traits versus states (also known as the issue of style malleability); and (3) styles as value-free versus value-laden (also known as the issue of style value).

Style Overlap

As noted earlier, one of the major contributors to the lack of identity of the field has been the massive production of style labels. One naturally wonders whether there are any relationships among these style labels. If one preferred to use a deep approach to study in a learning context, would one also tend to use an innovative decision-making style at work? What are the major differences among, say, cognitive styles, learning styles, and thinking styles? Are styles different constructs, or are they merely similar constructs that have been given different labels (e.g., Coan, 1974; Fowler, 1980; Miller, 1987; Riding, 1997)? Such questions have puzzled not only scholars in the field, but also laypeople who are interested in the notion of styles.

In the literature, although it was not until 2005 that Zhang and Sternberg openly addressed these questions by discussing the issues of style overlap, style overlap (or style uniqueness) has always been the subject of intense discussion. Broadly speaking, these discussions have taken place at two levels: the empirical and the conceptual.

Conceptualization of the relationships among the multitude of style labels has been a daunting task. Some scholars have implicitly addressed this issue through defining styles. In so doing, some of them have focused on the unique characteristics of particular style labels without acknowledging the existence of style labels other

than the ones they were trying to define. For example, Anastasi (1988) defined *cognitive styles* as broad, systematic features affecting an individual's responses to a variety of circumstances. Similarly, Gregorc (1979) defined *learning* styles as the distinctive behaviors that indicate how a person learns from and adapts to his/her environment.

Other scholars, however, have put more emphasis on the commonalities among style labels and have demonstrated more awareness of the coexistence of multiple style terms. For example, Tennant stated: " Cognitive style,' learning style,' and conceptual style' are related terms that refer to an individual's characteristic and consistent approach to organizing and processing information" (Tennant, 1997, p. 80).

Sternberg and Zhang (2001) took a position that both acknowledged the commonalities among all styles and recognized the unique characteristics that each style possessed. Specifically, while acknowledging that all styles share a key feature in that they are different from abilities, Sternberg and Zhang articulated the differences among learning styles, thinking styles, and cognitive styles by stating how each of the style constructs could be used: "Learning styles might be used to characterize how one prefers to learn about (particular material/information); . . . Thinking styles might be used to characterize how one prefers to think about material as one is learning or after one already knows it; . . . Cognitive styles might be used to characterize ways of cognizing the information" (Sternberg & Zhang, 2001, p. vii).

It is not surprising that such diverse views on the relationships among different styles have engendered efforts to clarify the issue of style overlap. In this regard, the most explicit efforts at the conceptual level have been manifested in the series of attempts to integrate the various style terms. Between 1983 and 2009, six major attempts were made (see the section "Integrative Style Models").

Style Malleability

As previously noted, styles have often been mistaken for either abilities or personality traits. It is widely believed that abilities can be enhanced through either maturation or deliberate exposure and training. In contrast, personality, until recently (Caspi, Roberts, & Shiner, 2005; Helson, Kwan, John, & Jones, 2002), had been regarded as a set of inner traits that was hard to change, if it could be changed at all. Where does the concept of style stand regarding its malleability? Answers to this question form the second long-standing controversial issue in the field. Two opposing views have been expressed.

To begin with, the disagreement over the malleability (or stability) of styles can be clearly discerned in the definitions of styles that various scholars (Kalsbeek, 1989; Messick, 1984) have proposed. Although these definitions share a major similarity, in that all styles communicate the idea that people have a predilection for attending to information in certain ways (but not in other ways), they differ in a fundamental way. Some definitions portray styles as a "characteristic mode or way of manifesting cognitive and/or affective phenomena" (Royce, 1973, p. 178), suggesting that styles are essentially stable traits, whereas others depict styles as being socialized and teachable (Sternberg, 1997). From the perspective of the

fundamental issue of the human capacity for change, Henson and Borthwick contended: "Since it is readily recognized that the majority of humans are capable of changing, both teaching and learning styles can therefore be manipulated" (Henson & Borthwick, 1984, p. 6).

Another perspective from which the issue of style malleability has been discussed is that of one particular style construct. In this regard, Witkin's FDI construct has always been a focal point for discussion, with some scholars (Bock & Kolakowski, 1973; Wertheimer, 1945; Wittig, 1976) in favor of the view that people's levels of FDI are fixed and others (Connor, Schackman, & Serbin, 1978; Renner, 1970; Sherman, 1967) insisting that FDI can be modified. Another style construct whose malleability (or stability) has often been discussed is Kirton's (1961) adaption–innovation (A–I) construct. Thus far, the prevailing view has been that A–I styles are stable (e.g., Clapp & De Ciantis, 1989; Kirton, 1976; Tullett, 1997).

Over the years, similar arguments from both sides have continued to be made, and the confusion created by these arguments has inevitably prevented the field from progressing in some ways. At the same time, such debates have led to efforts to find more balanced ways to address the issue of style malleability. For example, Vermunt (1992) asserted that although learning styles (later on termed as "learning patterns" in the context of research based on Vermunt's Inventory of Learning Styles) exhibit quite a high degree of stability, there still may be some learning components with stable characteristics (see also Tracey & Robbins, 2005). Further discussion on more recent efforts to address the issue of style malleability can be found in the next part ("Key Milestones in the Past Three Decades") of this chapter.

Style Value

As noted earlier, many style models have been created in the history of the field of styles. Within each style model, there are at least two different individual styles (e.g., field-dependent and field-independent styles in Witkin's theory of psychological differentiation; the 13 thinking styles in Sternberg's theory of mental self-government; and so forth). One would naturally wonder whether some styles are better than others. Are some styles more worth developing than others? These questions concern the issue of style value.

In the history of styles, no one has pursued the issue of style value as persistently as have Nathan Kogan and Samuel Messick. Kogan (1973) proposed a threefold distinction among styles regarding their value implications and their functional distance from the ability domain. Type I styles closely resemble abilities, as they are assessed by maximal-performance measures reflective of accuracy versus inaccuracy of response. By implication, Type I styles, which require accurate responses, are uniformly valued. For Type II styles, measurement cannot be characterized in terms of accuracy of response. However, some Type II styles are valued more than others in performance. Type III styles are characterized by their detachment from accuracy of performance as well as from value judgment. Kogan and Saarni referred to these styles as "value-free, preference-oriented Type III cognitive styles" (Kogan & Saarni, 1990, p. 4).

In his review of Witkin's 1977 Heinz Werner Lecture, Kogan commented that the FDI construct is not "quite as value free as Witkin would have liked it to be" (Kogan, 1980, p. 597) FI individuals perform better than do FD ones on the standard indicators of the FDI construct. Kogan believed that the alleged compensating strengths of FD individuals in the interpersonal sphere had yet to be demonstrated. Subsequently, using convincing examples that ranged from the domain of performance to deliberate training of styles, Kogan (1989) asserted that styles were not and never had been value free.

At the same time, the issue of style value appears to have been one of Messick's focal points in his exposition of the nature of intellectual styles. For example, when Messick (1984) commented on Kogan's (1973) threefold distinction of styles, particularly with regard to Type II styles, he argued that the normally not-so-valued styles might show strengths under some circumstances. That is to say, styles could be value differentiated.

Ten years later, within the context of illustrating the differences among styles and abilities, Messick (1994) slightly shifted his emphasis from styles as mainly value differentiated to styles as mainly value directional. He affirmed that although there was ample evidence indicating that FD individuals were interpersonally oriented, there was hardly any evidence that they demonstrated superior interpersonal skills. To be exact, the FDI construct leans more toward being value directional.

Finally, Messick (1996) once again cogently articulated his view of style value this time, within the context of discussing problems associated with the notion of style match. He convincingly made the case that matching styles itself is profoundly value laden.

Apart from Kogan and Messick, other scholars have also raised the issue of style value. For example, Shipman argued that one of the most appealing aspects of the style concept is that it was "intended to characterize the how' rather than the how much' of cognition . . . Nevertheless, with some styles, one pole *is* explicitly more valued than another, while with others, no particular value preference is noted" (Shipman, 1989, p. 6). Also, for example, in defining thinking styles, Sternberg noted that styles are not better' or worse'" (Sternberg, 1996, p. 347).

Over the years, Sternberg has developed a new perspective on the issue of style value. In 2005, together with his collaborator Zhang, Sternberg contended that Type I intellectual styles, which are more creativity-generating and denote higher levels of cognitive complexity, are normally more adaptive than Type II intellectual styles, which communicate higher degrees of norm-conformity and suggest more cognitive simplicity (Zhang & Sternberg, 2005).

Critical Reviews

The field of styles has been periodically challenged by trenchant critiques. These critiques have attempted to "undo or discount the style as a meaningful construct or to discredit its purported indicators as measures of something else entirely, such as intellective ability" (Messick, 1994, p. 131).

As noted earlier, several authors (Jones, 1997; McKenna, 1983, 1984; Richardson & Turner, 2000; Zigler, 1963) have discounted the FDI construct as a style construct for the simple reason that performance on the Embedded Figures Test tends to be correlated with intellectual tasks that require visual disembedding. However, such a judgment is quite hasty. The overlap of one construct with another does not warrant the discrediting of either construct because each construct still possesses its unique characteristics and each explains a different phenomenon. In fact, scholars (e.g., Kogan, 1983) have long recognized that individuals' styles of cognition necessarily overlap with their problem solving and general intellectual functioning. Indeed, in the very same article in which McKenna (1983) was arguing that measures of FDI should be considered as ability measures, McKenna (1983) cited the work of Turner, Willerman, and Horn (1976) that found substantial overlap between Cattell's (1969) personality trait Independence and the Wechsler Adult Intelligence Scale. By implication, one could ask if such an overlap would cause Cattell's personality trait measure to be regarded as an ability measure. Probably not.

Another widely known attack on styles work was launched by Tiedemann (1989). After reviewing as few as eight style concepts and their measures, Joachim Tiedemann expressed his disillusionment with the notion of styles: "At the moment, nobody can claim that cognitive styles do not exist. But life is short, and so my personal opinion on the state of research into cognitive styles has to be: There is no point in chasing a chimera!" (Tiedemann, 1989, p. 273). However, as Messick (1994) has pointed out, throughout his review, Tiedemann mistook style measures for style constructs. Moreover, Tiedemann rejected some concepts (e.g., cognitive complexity versus simplicity) as style constructs because they are value directional; yet, as discussed earlier and to be elaborated more fully later, some styles are bound to be value directional.

Another attack on styles work was launched by Frank Coffield and his colleagues (Coffield et al., 2004) at the University of London. This critique was not without its merits, as it did raise some valid and important points, including some of the challenges that we discussed earlier.

However, the critique was dismissive of the relevance of styles for education. Rayner, for example, argued that the critique adopted a fundamentally flawed methodology of review. It traversed different paradigms in evaluating the styles literature at different stages of the review, and it used secondary sources in its argument that the majority of style measures lacked rigor. As another example, the authors criticized the field of styles as "fragmented, isolated, and ineffective" (Rayner, 2007, p. 136). However, the authors largely ignored the progress in other parts of the field. Most notably, at the time when the reviewers were preparing the report, at least four major attempts (Curry, 1983; Grigorenko & Sternberg, 1995; Miller, 1987; Riding & Cheema, 1991) had been made to bring together the fragmented body of literature, which are not considered in the critique.

As a final example, the authors questioned the relevance of styles to education, contending that individualized instruction was difficult and perhaps even unnecessary. We think that the authors quite simply missed the point about the relevance of styles to education. No one would be so ambitious as even to think about having

teachers "routinely changing their teaching style to accommodate up to 30 different learning styles in each class . . ." (Coffield et al., 2004, p. 122). This aspect of the critique is the subject of a classical debate in the field of styles: the debate over the "matching hypothesis." Indeed, the so-called matching hypothesis is a constant point of criticism, as it is in the next critique.

A recent critique emanated from a group of American psychologists (Pashler, McDaniel, Rowher, & Bjork, 2008). In this critique, the authors argued that because there is no adequate empirical evidence supporting the so-called matching hypothesis, style assessments should not be incorporated into general educational practice. The authors even went so far as to recommend: "Thus, limited education resources would better be devoted to adopting other educational practices that have a strong evidence base . . ." (Pashler et al., 2008, p. 105). They were very limited in the sample of studies they used to form their critique. The authors equated a selected number of what Grigorenko and Sternberg (1995) called "activity-centered" styles (e.g., learning styles as conceptualized into the popular VAK visual, auditory, kinesthetic) with the entire body of style theories and research that had been presented and debated.

Based on her research into university students' preferences for teachers' teaching styles, Zhang (2007) argued that a style match should be broadly interpreted as a situation in which teachers' teaching styles or the learning environment created by the teachers meet the learning or personality needs of students. If a teacher is "teaching" in a way that fails to meet the learning needs of the student, the teacher is not really teaching.

Despite its limitations, the critique by Pashler and his colleagues (2008) was reported by the Chronicle of Higher Education (CHE) (January 8, 2010) under the title "Customized Teaching Fails a Test." The author of the CHE article (Glenn) did try to present a more balanced view by citing the counter-arguments of such heavyweight style researchers as David Kolb, Richard Meyers, and Robert Sternberg. However, titles such as "Customized Teaching Fails a Test" and the one-sided and unqualified arguments against the notion of styles are likely to stay in the minds of those who are not familiar with the styles literature, scholars and the general public alike.

KEY MILESTONES IN THE PAST THREE DECADES

Despite the challenges illustrated in the preceding, and indeed, partially because of them, the field of styles has regained great momentum in the past three decades. This renewed interest in styles work has been manifested through scholars' concerted efforts to produce work that is better able to address the nature of intellectual styles as it pertains to (1) the relationship of styles to ability and personality, (2) the three controversial issues concerning styles, and (3) the place of the styles literature within the larger context of psychological, educational, and business literatures. Theoretical conceptualization and empirical findings from a large number of studies (such as the ones reviewed in the relevant chapters in this volume) conducted during the past three decades and earlier in the history of the field can be used to address

many important aspects of the three aforementioned issues. However, four types of publications produced in the recent three decades can be perceived as landmark works in the field, and they directly and systematically address these issues. These publications include: (1) six integrative style models, (2) one individual style model, (3) 10 special issues on styles published in five academic journals, and (4) four scholarly books.

Integrative Style Models

Facing the various challenges presented to the field, several scholars have attempted conceptually to integrate the style labels that have existed at different points in time. Between 1983 and 2009, six integrative models resulted from these endeavors: (1) Curry's (1983) "onion" model of learning styles; (2) Miller's (1987) model of cognitive processes and styles; (3) Riding and Cheema's (1991) model of cognitive styles; (4) Grigorenko and Sternberg's (1995) model of style traditions; (5) Zhang and Sternberg's (2005) threefold model of intellectual styles; and (6) Sadler-Smith's (2009) duplex model of cognitive style. We introduce the essence of each of these models and discuss how each model has taken up aspects of the aforementioned challenges.

Curry's "Onion" Model

Curry (1983) pioneered the effort to systematize the diverse style labels in the field by constructing a model of nine *learning*-style measures (subsequently expanded to 21 inventories) that can be organized into three layers resembling those of an onion. The innermost layer of the style onion is composed of measures of personality dimensions. The middle layer comprises style measures that assess information processing. The outermost layer consists of measures assessing individuals' instructional preferences. According to Curry (1983), learning behaviors are fundamentally manipulated by styles grounded in the deep structure of personality, translated through information-processing styles, and ultimately, interact with instructional preferences. Such dynamics ascribed to learning behaviors clearly represent Curry's position on style malleability. Curry anticipated and proved (through providing test–retest reliability data) that styles in the outermost layer of the onion demonstrated the largest degrees of modifiability, and that styles in the innermost layer were the least modifiable.

Curry's model also explicitly addressed the issue of style overlap. Indeed, Curry noted that the validity of the onion model could be demonstrated by data that (1) reveal strong associations among measures in the same layer; and (2) suggest that styles in the innermost layer are psychometrically essential to those in the other two layers.

Finally, Curry's model also has heuristic value for understanding the relationships of styles to personality and behavioral constructs. As Rayner and Riding (1997) pointed out, the onion model can be perceived as a useful effort to integrate cognition-, personality-, and activity-centered research.

Miller's Model of Cognitive Processes and Styles

Miller (1987) perceived *cognitive* styles as comprising individual differences in the various subcomponents of an information-processing model of three fundamental types of cognitive processes: perception, memory, and thought. Miller suggested that all cognitive styles are subordinate to a broad stylistic dimension (analytic–holistic) that is composed of cognitive styles, each contributing to a consistent individual difference in cognitive processing.

Among the six existing models, Miller's model stands out as one that has made the most explicit effort to establish links between the concept of styles and other literatures in this case, that of cognitive processes. Moreover, in his subsequent work, Miller went far beyond examining cognition-oriented styles. He incorporated a personality typology of cognitive, affective, and conative dimensions into his original model (e.g., Miller, 1991) and provided preliminary empirical evidence for his revised model.

Miller's model did not directly address any of the three controversial issues concerning styles. However, Miller's position on style malleability and on style overlap can be clearly discerned in his articulation of his model. Miller held the view that styles represent a way of characterizing stable individual differences, although he did not claim that styles are static. Furthermore, given that all styles, according to Miller, fall along the analytic–holistic dimension, one could anticipate extensive overlaps among styles within the same pole of the style dimension.

Riding and Cheema's Model of Cognitive Styles

Anchored in their analysis of the descriptions, correlations, methods of assessment, and effects on the behavior of more than 30 style labels, Riding and Cheema (1991) concluded that these style labels could be classified along two primary cognitive-style dimensions: wholist–analytic and verbal–imagery. The former dimension pertains to whether an individual tends to process information in wholes or does so in parts; the latter concerns whether an individual has a propensity to represent information by thinking verbally or in terms of mental pictures.

Of all the aforementioned challenges presented to the field, two have been overtly addressed in Riding and Cheema's model. The first is the model's attempt to establish its link to other literatures, most noticeably that of cognitive neuroscience (Riding, Glass, Butler, & Pleydell-Pearce, 1997). Furthermore, in presenting their model of cognitive styles, Riding and Cheema made the issue of style overlap another primary point for discussion. Specifically, the authors maintained that styles that are strongly associated with one another should be subsumed under the same end of a style dimension.

Grigorenko and Sternberg's Model of Style Traditions

Grigorenko and Sternberg (1995) made their contributions to bringing order to the considerable number of style labels by recognizing three traditions in the study of styles: cognition-centered, personality-centered, and activity-centered. Styles in the cognition-centered tradition most closely resemble abilities. Moreover, like abilities,

styles in this tradition (e.g., Witkin's field-dependent/independent styles; Witkin, 1962) are measured by tests of maximal performance with "right" and "wrong" answers. The personality-centered tradition considers styles as most closely resembling personality traits. Furthermore, like personality traits, styles in this tradition (e.g., Jung's personality styles; Jung, 1923) are measured by tests of typical, rather than maximal, performance. The activity-centered tradition emphasizes that styles are mediators of activities that arise from both cognition and personality (e.g., learning approaches; Biggs, 1978; Entwistle, 1981).

Clearly, such a classification of styles work speaks directly to the long-standing issue of what styles are vis-à-vis abilities and personality. Styles are neither abilities nor personality. However, some styles are more related to abilities and others more to personality. Zhang and Sternberg (2006) have analyzed this model's implicit positions on the three controversial issues. However, within the context of proposing their model, Grigorenko and Sternberg (1995) simply alluded to the issue of style malleability. They commented that the activity-centered style tradition took little account of the development of styles and that the other two traditions did a better job in doing so.

Zhang and Sternberg's Threefold Model of Intellectual Styles

Zhang and Sternberg (2005) proposed the threefold model of *intellectual* styles. It is important to keep in mind that although only 10 individual style models were reviewed at the time it was proposed, the threefold model adopts an open system. That is to say, any individual model can be included in this threefold model as soon as it meets the criteria set in the original threefold model. The term "intellectual styles" is used as a generic one that encompasses all style constructs proposed in the history of styles, whether or not these constructs carry the root word "style."

The threefold model harnesses all existing style constructs into one of three types: Type I, Type II, and Type III intellectual styles. Type I styles tend to be more creativity-generating and denote higher levels of cognitive complexity. Type II styles suggest a norm-favoring tendency and denote lower levels of cognitive complexity. Type III styles may manifest the characteristics of either Type I or Type II styles, depending upon the stylistic demands of the specific task being dealt with. Unlike any of the other existing integrative styles models that classify any one individual model into one group of style models or another, the threefold model classifies styles by cutting across each of the individual style models (e.g., the two styles from Witkin's model are categorized into two different style types, with the field-independent style being a Type I style and the field-dependent style as a Type II style). Such classification enables people to understand their own or others' intellectual styles in terms of five easy-to-monitor dimensions of preferences. These are: one's preference for high degrees of structure versus low degrees of structure, for cognitive simplicity versus cognitive complexity, for conformity versus nonconformity, for authority versus autonomy, and for group versus individual work (see Zhang & Sternberg, 2005, for details).

Another distinct feature of the threefold model is demonstrated through the explicit stance that it has taken on each of the three controversial issues concerning the nature of styles. Based on both empirical evidence and conceptualization, Zhang and Sternberg contended that most styles are value-laden (or at least

value-differentiated) rather than value-free; that they have both trait-like and state-like aspects, but for the most part are modifiable and hence more state-like; and that they overlap highly across theories. Specifically, Type I styles tend to carry more adaptive values because they are often strongly related to desirable human attributes and because almost without exception, all training programs aim at developing Type I styles. Type II styles tend to carry less adaptive values because they are often strongly associated with undesirable attributes and because all training programs are targeted at reducing the use of Type II styles. Type III styles may show more or less adaptive values depending on the stylistic demands of specific situations. Due to their high level of contingency upon situations, Type III styles are more malleable than are Type I and Type II styles. Finally, the threefold model posits that various style constructs share common variations. In particular, Type I styles are often positively related to one another, as are Type II styles.

Sadler-Smith's Duplex Model of Cognitive Style

Based on dual-process theory in general and Cognitive-Experiential Self-Theory (Epstein, Pacini, Denes-Raj, & Heier, 1996) in particular, Sadler-Smith (2009) proposed two fundamental information-processing modes that individuals may prefer to engage in during decision making and problem solving: intuitive and analytic. The intuitive mode is considered more affect-laden, relatively fast in operation and slow in formation; it is cognitively undemanding, imagistic-based, and unavailable to conscious awareness. The analytic mode is thought to be affect-free, relatively slow in operation and fast in formation; it is cognitively demanding, symbolic-based, and open to conscious awareness.

The duplex model addresses two of the challenges discussed earlier. At the outset, rooted in theories of information processing, the duplex model of cognitive style has established a preliminary link between the field of styles and that of cognitive psychology. At the same time, the duplex model addresses the issue of style malleability, both covertly and overtly. Sadler-Smith contended that when averaged out over a variety of tasks over a long period of time, most individuals have a propensity to process information using one of the two modes. What underlies this assertion is that individuals' preferred styles of dealing with tasks can be developed as the result of task exposure. Sadler-Smith took a step further in discussing style malleability more openly by stating that within the context of the duplex model, cognitive style has a hierarchical structure. At the specialized level, each of the two modes represents relatively stable preferences. At the more flexible level, the versatile style is formed. The versatile style is such that the intuitive and analytic modes of information processing are used interchangeably, depending upon the stylistic demands of the tasks.

Summary

Each of the six integrative models, in addition to bringing together different style constructs, addresses at least one aspect of the aforementioned challenges. Clearly, different scholars have emphasized different issues, and none of the models was intended to serve as an all-purpose one for addressing all challenges. Such an approach to problem solving (i.e., focusing on only one or two issues) is understandable because issues that were at the forefront of research activities earlier may well have

faded from view at a later time. For example, by the time Zhang and Sternberg (2005) proposed their threefold model of intellectual styles, what the field needed the most were (1) a generic term that would represent the colossal number of style labels, no matter which system a particular style construct originated from, be it cognitive, affective, physiological, psychological, or sociological (or to use Grigorenko and Sternberg's classification, cognition-centered, personality-centered, or activity-centered); (2) a common framework within which all styles could be conceptualized; and (3) a classification system that could address the three recurrent controversial issues: style value, style malleability, and style overlap. These three major tasks are precisely what the threefold model of intellectual styles has accomplished.

One might naturally want to see a model that could act as a panacea for addressing every single aspect of the aforementioned challenges and perhaps other problems related to the theorization of styles. However, while establishing such a model is not impossible, it is certainly an ambitious task, especially if one desires to construct a model that does indeed address all the challenges and beyond that, embraces the majority of, if not all, features of a good theoretical model. The authors of Chapter 3 in this volume have discussed the need for, and practicality of, building a grand theory of styles by taking forward the threefold model of intellectual styles. However, before such a daunting task can be accomplished, it is advisable that the issues collectively addressed by the six existing integrative models be taken into account when studying and applying the notion of styles.

An Individual Style Model: The Theory of Mental Self-Government

Many of the earlier individual style models have been criticized for portraying stylistic dimensions rather than presenting a coherent model of styles. Aiming to overcome the shortcomings inherent in the then-existing stylistic dimensions, Sternberg (1988, 1997) proposed the theory of mental self-government. Using "government" metaphorically, Sternberg (1988, 1997) contended that just as there are different ways of governing a society, so there are different ways that people use their abilities. These different preferences for using abilities can be construed as thinking styles. The theory specifies 13 thinking styles that fall along five dimensions of mental self-government: (a) functions, (b) forms, (c) levels, (d) scopes, and (e) leanings of government as applied to individuals (see Chapter 12 for the definition of each style).

In many ways, Sternberg's model of thinking styles is superior to all other existing individual style models because it addresses several aspects of the challenges discussed earlier, and embraces all three traditions in the study of styles (Grigorenko & Sternberg, 1995). The styles in this theory are cognitive in their way of looking at things (e.g., judicial style, global style, and so forth) and correspond to preferences in the use of abilities. However, because the styles are typical-performance rather than maximal-performance, they resemble the personality-centered tradition. Finally, the styles resemble the activity-centered tradition in that they can be measured in the context of activities. Such an articulation of the nature of thinking styles within the realm of the three style traditions clearly acknowledges the relationship of styles to abilities and personality. In his 1997 book, Sternberg actually

discussed at length the distinctions between styles and abilities and emphatically stated that "Styles are preferences in the use of abilities, not abilities themselves" (Sternberg, 1997, p. 79).

Although he did not directly address the three controversial issues concerning styles, the way in which Sternberg specified the major tenets in his theory clearly revealed his position on each of the three issues. He presented empirical data to communicate the idea that thinking styles do overlap with styles from other models. In putting forward a list of 15 "principles of thinking styles," Sternberg asserted that "Styles are not, on average, good or bad it's a question of fit" (Sternberg, 1997, p. 97), suggesting that styles are value-differentiated. Within the same context, Sternberg argued that styles are at least partially socialized and are teachable.

Journal Special Issues on Styles

For the most part, the establishment of the six integrative models and the construction of the theory of mental self-government represent the efforts of individual scholars. These individual attempts have been paralleled by collective efforts that aimed at facing the challenges of the field. These collective efforts have resulted in the publication of special issues on styles in academic journals and scholarly books. This section introduces the 10 journal special issues on styles identified in the literature.

In the history of styles, only five journals have devoted special issues to work on styles. The very first special issue on styles (titled "Cognitive Style and Early Education" and guest-edited by Saracho) appeared in the journal *Early Child Development and Care* in 1989. This was followed by two double issues published by *Educational Psychology,* one in 1991 (titled "Learning Styles" and edited by Riding) and one in 1997 (titled "Learning Styles and Strategies" and edited by Riding and Rayner). The year 1999 saw the publication of a special issue (titled "Cognitive Styles and Psychopathology" and guest-edited by Riskind) by *Journal of Cognitive Psychopathology. Educational Psychology*'s continuing interest in work on styles was demonstrated by the publication of two more issues (2000 and 2004), both titled "Learning Styles," with the former edited by Riding and Rayner and the latter by Wheldall and Riding. The most recent special issue (titled "New Directions with Styles Research" and guest-edited by Evans and Cools, 2011) was published by *Learning and Individual Differences*. Finally, one special issue on styles (titled "Styles of Practice" and edited by Evans and Kozhevnikova) will be published by *Research Papers in Education.*

The publication of these special issues is significant because each of these publications represents a major attempt to strengthen the field of styles. Across these special issues, five recurrent themes stand out: (1) examining similarities/differences among styles and distinguishing styles from abilities and personality; (2) elucidating the nature of styles as it relates to the three controversial issues; (3) integrating existing style constructs and addressing problems with styles measures; (4) establishing links between the styles literature and other literatures (e.g., cognitive psychology, developmental psychology, differential psychology, education, health sciences, and management sciences); and (5) applying the notion of styles to education and work settings.

These recurring themes are clearly ones that aim at addressing the key challenges illustrated earlier. Given these themes, the outcome of the discourse conducted in these special issues of journals is fruitful. Due to limited space, detailed analysis of this work is not provided here. However, one particular phenomenon should be noted. While the titles of early special issues include either "cognitive style" or "learning style," the two most recent issues adopt the more general term "styles" in their special issues. Moreover, the editors (Evans & Cools, 2011; Evans & Kozhevnikova, in press) made a special point in setting the parameters for using the various style terms. Although it may appear to be a "trivial" task to some people, the importance of such a practice should be applauded because it signifies yet another attempt to create coherence in the literature.

Recent Scholarly Books

The concerted efforts to address the various challenges presented to the field have also resulted in the publication of scholarly books, and these books are predominantly edited ones. Earlier publications are excellent resource books for people who want to understand styles within the context of learning and instruction. These include Saracho's (1990) edited book *Cognitive Style and Early Education*, Jonassen and Grabowski's (1993) *Handbook of Individual Differences: Learning and Instruction* (which partially concerns work on styles), Sims and Sims's (1995) edited book *The Importance of Learning Styles*, Morgan's (1997) *Cognitive Styles and Classroom Learning*, and Riding and Rayner's (1998) *Cognitive Styles and Learning Strategies*.

However, it is the four most recent books on styles that have demonstrated the maximum concerted and direct efforts to address some of the major difficulties of the field. These are: (1) Sternberg and Zhang's (2001) edited book *Perspectives on Thinking, Learning, and Cognitive Styles*, (2) Zhang and Sternberg's (2006) *The Nature of Intellectual Styles*, (3) Zhang and Sternberg's (2009) *Perspectives on the Nature of Intellectual Styles*, and (4) Rayner and Cools' (2011) *Style Differences in Cognition, Learning, and Management: Theory, Research, and Practice*. The major accomplishments of each of these four recent books are discussed in the final chapter of this volume. Suffice it to state here that collectively, these recent books have led the field to new advances.

To summarize, in the past three decades, a number of landmark accomplishments have been made despite the difficulties that the field has faced. These major accomplishments, along with other types of efforts, especially those as manifested in the publication of thousands and thousands of research articles, dissertations, and other scholarly books, have now led to the situation where *Handbook of Intellectual Styles* could be produced.

CONCLUSIONS

The field of intellectual styles does not have a unified history and cohesive philosophical and theoretical foundations. Largely due to this lack of historical and theoretical roots, the pace of advancement of the field has been slowed by many

challenges in the history of styles. Despite these difficulties, the field has flourished during the past three decades. Our hope is that it will flourish even more during the next three.

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2

A Historical Review of the Styles Literature

Tine Nielsen

INTRODUCTION

The chapter provides an overview of the historical development of the field of styles, focusing on the styles literature. First, a brief historical overview of the field of styles as a whole is provided, which is followed by a discussion within each of the subfields defined by five major style concepts: cognitive, learning, teaching, thinking, and intellectual style. This is followed by sections providing in-depth accounts of the developments within three specific topics of the field of styles: styles and ability, styles and personality, and quality of measurement. The first two topics are particularly important within the field of styles because they have been present from the very start of the field and are as yet not settled. The topic of quality of measurement is equally important because measurement is at the basis of all activities in the field. In each section, two perspectives on the historical developments are given: one on the development as it can be traced in what is defined as the review literature of the field, and the other on how this development is reflected in the empirical literature of the field. The chapter concludes with a number of proposals regarding the future directions of some of the unresolved issues that will have emerged throughout the chapter.

THE LITERATURE

This review covers a range of publications, including textbooks, text collections, conference articles, and journal articles. The literature was divided into categories defined, by the content, as being of a general overview/review nature or not, resulting in two categories of literature, which are referred to throughout the chapter: the review literature (Figure 2.1) and the empirical literature (Table 2.1).

The Overview/Review Literature

The review literature of the styles field covers four types of publications: (1) handbook-style text collections providing an overview of the field by covering a wide range of style theories and central topics of the field; (2) single contributions

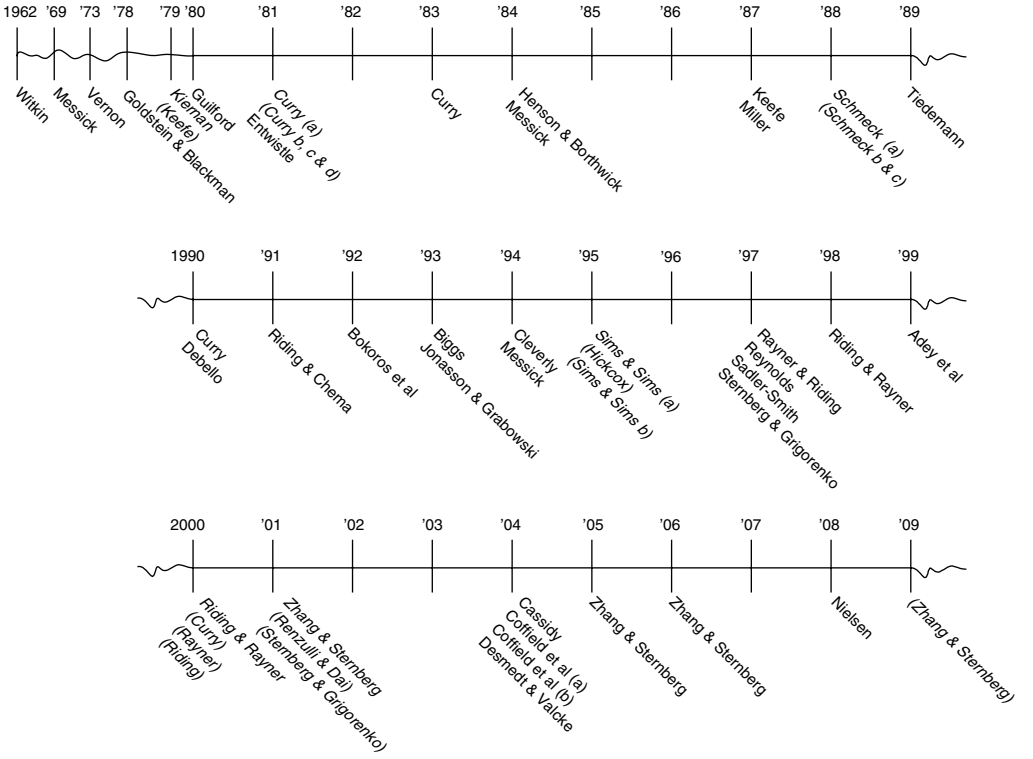

FIGURE 2.1
Timeline of included review literature.
Note. Italicized references signify edited text collections that have an overview/review nature to them. Italicized references in parentheses () signify single contributions of a review nature in the edited text collections.

TABLE 2.1
Number of Articles With Titles Including Search Terms, Divided by Decades

	Search Terms					
Decade	**Cognitive Style**	**Learning Style**	**Teaching Style**	**Thinking Style**	**Intellectual Style**	**Total**
2000s	311	445	67	129	6	958
1990s	326	463	49	26	1	865
1980s	415	247	70	16	4	752
1970s	217	41	31	1	1	291
1960s	52	(1966) 2	(1965) 6	(1968) 2	(1969) 1	63
1950s	(1953) 2	0	0	0	0	2
Total	1,323	1,198	223	174	13	2,931

Note. The years appearing within parentheses in some cells give the year of the first article discovered.

in the text collections, either reviewing a number of style theories or discussing topics central across theories; (3) textbooks providing an overview of the field, and (4) journal and conference articles reviewing a range of theories and/or discussing central topics.

The search for the review literature was extended over a period of 1 year in order to identify as many texts as possible, and it was limited to texts in English. The search was conducted as an iterative process, with the author's personal library and reference database as the starting point. The second loop of the process consisted of searching, through the references cited in the first batch of the review literature identified, for additional texts and then obtaining these. This process was continued until no new review texts could be identified.

The resulting pool of review literature consists of 53 texts distributed across five decades (Figure 2.1), with the earliest identifiable piece of review literature being Witkin's (1962) article on the origins of cognitive styles.

The Empirical Literature

Desmedt and Valcke's (2004) transference of Kreuzman's statement on the establishment of intellectual traditions in philosophy to the styles literature field was the main inspiration when designing the approach for determining the articles on styles to be included in this chapter as empirical literature. Desmedt and Valcke (2004), citing Kreuzman, claim that the organization of the styles literature is

> usually done in a variety of informal ways, for example, by interpreting the writings of the relevant individuals and by looking at the focus and the tone of the work. Although such approaches are useful, they are subject to the biases of the individual doing the classification. The resulting classification may reveal more about the person doing the analysis than the writings being examined.
>
> *Kreuzman, p. 527, cited in Desmedt and Valcke, 2004, p. 446*

Thus, the resulting reviews are difficult to compare, and the overall field remains opaque. This has not been entirely the case within the styles field as excellent reviews drawing on vast amounts of literature have been produced within the field. However, as shown by Nielsen (2008), the existing reviews in the styles field are difficult to compare as they draw on different, and in some cases not even overlapping, selections of literature. Accordingly, Desmedt and Valcke do make a point worth taking into account in designing the article-search approach.

Aiming at limiting the bias imposed by the author's personal knowledge of the styles field and at the same time maximizing the number of articles discovered, the following approach to the article search was defined and employed. (1) The search was conducted using the PsychInfo and ERIC databases because psychology and education are the areas from which the styles research originates and is most widely used the PsychInfo database covers 2,100 journals dating back to 1887 and the ERIC database contains references to more than 1,300,000 records; (2) the search included articles in a multitude of languages as the databases include titles and abstracts in English; (3) the search included the four major style

concepts cognitive, learning, teaching, and thinking style, as well as the broader concept of intellectual style due to the recent development toward unification of the different style concepts under this label; (4) the search included appropriate search terms for concepts such as personality, ability, or intelligence for the subsections of the chapter; (5) the search for specific search terms was conducted exclusively in the titles of articles; and lastly, (6) all discovered pools of articles were reduced manually to weed out duplicates.

The search resulted in a pool of 2,931 articles, classified under specific concepts of style and decades (Table 2.1). In the following sections, the articles within each of the five concepts of style will be reviewed.

For those curious to know the particular articles identified as the first with the five respective style concepts in the title, these were as follows: Gardner's (1953) article on *cognitive styles* and categorizing behavior; Horowitz's (1966) article on *learning styles* and learning outcomes; Solomon's (1965) article on *teaching style* and family composition; Fischer's (1968) article on *thinking styles* and socioeconomic status; and Cropley and Field's (1969) article on *intellectual style* and achievement. These articles do not, of course, denote the actual beginning of the styles field, so we will turn to this next.

A BRIEF HISTORICAL OVERVIEW

The Beginning of the Styles Field

The beginning of the styles field is not easily captured. A number of the review texts contain claims toward this, and as a contrast to many other questions and subjects within this field, there is close to agreement on this point. To supplement the claims made in the review literature (Figure 2.1) as to the sources of the first occurrences of the five style concepts, namely, cognitive, learning, teaching, thinking, and intellectual style, additional literature searches in both titles and abstracts of all types of texts were conducted.

The most commonly named source for the start of the styles field in the review literature (Cassidy, 2004; Keefe, 1979, 1987; Riding & Cheema, 1991) is Allport's (1937) book on personality, where supposedly the term "cognitive style" was used for the first time to "refer to a quality of living and adapting influences by distinctive personality types" (Keefe, 1979, p. 5) or to refer to "an individual's typical or habitual mode of problem solving, thinking, perceiving and remembering" (Cassidy, 2004, p. 420). Rayner (2000), Riding and Rayner (1998), Sternberg and Grigorenko (2001), and Zhang and Sternberg (2006) also attributed the first use of the term "style" to Allport (1937) and asserted that it was used in association with cognition. A diverging claim in the review literature was put forward by Vernon (1973) and Messick (1994), who both attributed the first mention of cognitive style to Gardner's (1953) article on "cognitive styles in categorizing behavior." In order to ascertain further which of the mentioned sources was actually the first to use the term "cognitive style," an electronic search was conducted in Allport's (1937) book. This search disclosed that the term "cognitive style" is *not* used in the book. However, the term "style" is used in

abundance and in a range of different meanings. Some of these meanings have nothing to do with cognition, for example, styles of movement and styles of clothing, while others are closely associated with expressions of cognition, for example, temporal style, creative styles, and an individual's style of adjustment and mastery within his behavioral environment. It is clear that Allport (1937) did indeed include cognition in his concept of style. It is, however, equally clear that Allport found style to be something different from today's concepts of cognitive style as he wrote that style can "... only be fully understood, as an expression of central traits of personality" (Allport, 1937, p. 489), that "style represents the most complex and most complete form of expressive behavior" (Allport, 1937, p. 489), and that "... there are as many styles as mortals who live; they cannot be compressed into one mold" (Allport, 1937, p. 494).

Different claims as to the precursors of the term "style" or "cognitive style," and as such, the actual start of the styles field, are made in the review literature. Sternberg and Grigorenko (2001) stated that the precursor to styles in the Allport sense is Jung's (1923) theory of psychological types. Riding (2000) attributed the start of the styles field to Galton's (1883) *Inquiries into Human Faculty and Development* and James' (1890) *Principles of Psychology*, where, in the chapter on reasoning, James did distinguish between the abstract reasoner and men of intuition. Vernon (1973) traced the interest in types, as a precursor to style, to as long ago as the Romans and Greeks (Galen and Hippocrates) and the four temperamental types: sanguine, choleric, melancholic, and phlegmatic.

The First Use of the Term "Learning Style"

In the review literature, three texts are concerned with the first use of the term "learning style": Sternberg and Grigorenko (2001) wrote that Riessman (1964), as the first, argued for the concept of styles in learning, defining a learning style as a "more wholistic (molar) or global dimension of learning operative at the phenomenal level" (Riessman, 1964, cited in Sternberg & Grigorenko, 2001); Riding and Cheema (1991), without giving a source, wrote that the term "learning style" emerged in the 1970s as a more common term, while Keefe (1987) stated that the term "learning style" was probably first used by Thelen (1954). To ascertain further which of these sources was actually the first, an electronic search for the term "learning style" was conducted in Thelen's (1954) book. This search disclosed that Thelen was *not* the first to use the term "learning style" as this term is not used in the book. However, the broad additional search in the databases disclosed that Riessman (1962) used the term "learning style," which must then be considered the first occurrence of the term.

The First Use of the Terms "Teaching Style," "Thinking Style," and "Intellectual Style"

In the review literature, no claims as to the first use of the terms "teaching style," "thinking style," and "intellectual style" are made. However, the electronic search for the term "learning style" in Thelen (1954) disclosed that Thelen, in fact, used the

term "style of teaching" as well as the term "style of leadership," and as such, this text must be considered as the first to use these terms. The additional literature search also disclosed that Babarik's (1966) article on preferences and creativity is the first that used the term "thinking style," and Drews's (1964) book/dissertation on intellectual styles in gifted adolescents is the first that used the term "intellectual style."

It cannot, of course, be claimed that the additional searches definitively provide the sources for the first uses of the five style concepts, as there might be texts not referenced in the two databases, which are the definite first sources. However, the findings do provide new information compared to what has previously been available, particularly for the concepts of learning, teaching, thinking, and intellectual styles, as previous works have rarely looked into the matter of first use of the concepts.

The Activity of (or Interest in) the Styles Field

During the years the present author has been involved in the styles field, one of the claims that has repeatedly caught the author's attention is the claim that interest in the field was at its peak in the 1960s and 1970s and declined after that. This review provided an excellent opportunity to examine this claim.

Looking first at the claim itself as it appears in the review literature, this is, in fact, made in eight of the texts, although not as an identical claim. The claim was first made by Curry (1983), who wrote that interest in learning styles and individual differences was very much in fashion in the 1960s and 1970s but declined in the early 1980s. In 1987, Miller cited Kogan (1983) for claiming that basic research within many cognitive styles has withered away and at that point in time appeared dated, as a result of researchers dying or moving on to something else. Curry's (1983) original claim was picked up by Riding and Cheema (1991), who, in a slightly muddled way, stated that the field was very much in fashion in the 1960s and 1970s and that there was little interest in the field in the last two decades (meaning the 1970s and 1980s), but the field was coming into prominence in the early 1990s. In 1997, Reynolds, giving Riding and Cheema (1991) as the source, repeated the claim, and Sternberg and Grigorenko (1997) wrote that research into styles had been out of fashion in later years. Seen as a whole, these review texts identify all three decades from the 1970s to the 1990s as decades with a declining interest in the styles field. Turning to the latest two review texts that deal with the movements of interest and activity in the styles field, Cassidy (2004) wrote that the intensity of activity in the styles field had varied through the previous four decades, but that in recent years a marked upturn in the number of researchers in the field and the number of disciplines from which research into styles is conducted had appeared. A similar claim was put forward by Zhang and Sternberg (2006), who wrote that research into styles declined in the late 1970s and early 1980s, but that renewed interest was apparent in the last two decades.

Put together, the review texts do not provide an entirely clear picture of the interest/activity movements in the styles field. There is agreement that interest/activity was high in the 1960s and that interest was declining through the 1980s. There is disagreement as to whether the level of interest/activity in the 1990s was

still low or picking up. Lastly, one text claimed that the level of interest/activity has picked up in the decade of 2000.

Turning to the time-wise distribution of the review literature (Figure 2.1), it is obvious that this genre does not take off until the 1980s a natural development as theories, style constructs, measures, and research had to grow to substantial amounts before the writing of reviews/overviews was an actual possibility. Across the last three decades, the number of reviews/overviews has been constant. Accordingly, this perspective does not elucidate the claim of declining interest and activity from the 1980s onward.

Looking at the time-wise distribution of the empirical literature made up of the articles in Table 2.1, there appears to be little foundation for the claims put forward in the review literature (Figure 2.1) that research into styles should have suffered a down-period in any particular decade, and certainly not in the 1980s. Looking across the decades in Table 2.1, the total number of articles with specific style terms in the title was rising steadily from the 1950s to the 2000s. Looking particularly at the articles on cognitive style, the 1980s appeared to be the most active decade yet with regard to publications. The number of articles on learning style has almost doubled in the decades following the 1980s, while articles with thinking style in the title have multiplied in the last decade. Unless the search strategy employed has failed to discover many hundreds of articles on styles from the 1960s and 1970s, there appears to be no grounds for the claim that these two decades were the most active in the history of the styles field. Quite the contrary, the activity of the field appears to be growing steadily.

Concept-Specific Movements in the Empirical Literature

The number of articles included in this review as the empirical literature is very large: 2,931 single articles on the five style concepts are distributed across six decades (Table 2.1). Such a high number of articles does not warrant a detailed review of the empirical literature in its totality. For this reason, different approaches are used in the concept-specific reviews in the following sections.

Cognitive Styles

The search for articles with the concept *cognitive style* in the title identified 1,323 articles (Table 2.1). Due to this high number, only the titles were reviewed.

Table 2.2 shows how different conceptualizations of cognitive style are represented across the six decades from the 1950s to the 2000s. From the article titles alone, 26 separate conceptualizations of cognitive style could be identified distributed across 182 articles. This means that for 86% (or 1,141) of the articles on cognitive styles, it is in fact not possible for researchers or practitioners to determine the specific conceptualization from the title of the articles, because, the title only includes the concept of cognitive style.

The three most common conceptualizations were Witkin, Dyk, Faterson, Goodenough, and Karp's (1962) field-dependence–independence styles (67 articles

TABLE 2.2
Conceptualizations of Cognitive Style in 1,323 Articles Divided by Decades

Terms in Article Titles	1950s	1960s	1970s	1980s	1990s	2000s	Total
Abstractness–concreteness CS				1			1
Adaptor–innovator CS/Kirton				4	13	3	20
Analytic–nonanalytic CS			1				1
Auditory–visual CS				2			2
Automatization		2	1				3
Categorization width/ breadth CS				1	3		4
CS	**2**	**46**	**187**	**374**	**274**	**259**	**1141**
Cognitive style analysis/CSA/ Riding's CSA/wholist–analytic						8	8
Cognitive style index/ intuition–analysis CS					2	7	9
Cognitive style indicator						1	1
Cognitive style questionnaire						4	4
Conceptual tempo CS/ reflective–impulsive CS			12	5	10	4	31
Defensive CS				1			1
Dysfluency–fluency CS					1		1
Explorer–assimilator CS			1				1
Equivalence range CS		1					1
Field-dependence–independence CS/Rod and Frame Test/Embedded Figures Test/Witkin's CS		3	12	20	18	14	67
Generalizing–particularizing CS			1				1
Gregorc's CS					1		1
Hemispheric lateralization/ brain dominance CS				3	2	2	7
Hill's CS				1			1
Looming CS						3	3
Myers-Briggs's CS				2			2
Object–spatial–verbal CS						2	2
Sharpening–leveling CS					1		1
This I Believe Test			1				1
Verbalizer–visualizer CS			1	1	1	6	9
Total	2	52	217	415	326	312	1323[a]

Note. CS = cognitive style; CSA = cognitive style analysis. Empty cells signify zero frequency.

[a]Several articles deal with more than one framework. Therefore, the total is not appropriate.

distributed across five decades), Kagan, Rosman, Day, Albert, and Phillips's (1964) conceptual tempos (31 articles distributed across four decades), and Kirton's (1976) adaptor–innovator styles (20 articles distributed across three decades).

Learning Styles

The search for articles with the concept *learning style* in the title identified 1,198 articles (Table 2.1). Again, this high number of articles meant that only the article titles were reviewed.

Table 2.3 shows how the different conceptualizations of learning style are represented across the five decades from the 1960s to the 2000s. Twenty-five separate conceptualizations of learning style could be identified (Table 2.3) distributed across 110 articles (or 9% of the articles on learning style). As was the case with cognitive styles, for the majority of the articles on learning styles, it is not possible for researchers or practitioners to determine the specific conceptualization from the title.

The only conceptualization of learning style standing out with a substantial number of articles was Kolb's (1984) learning styles with 42 articles distributed across three decades as identified from the title alone.

Teaching Styles

The search for articles with the concept *teaching style* in the title identified 223 articles (Table 2.1), with only nine article titles providing information as to the teaching-style framework employed. For this reason, departure was taken from the common notion of teaching styles being a concept connected with teachers alone, and the review of the article titles was aimed at determining whose teaching styles the articles were dealing with.

The majority of the articles on teaching style were dealing with teachers' teaching styles, although in three variations (Table 2.4): first, the straightforward concept of teaching styles as something that can be measured through self-assessment or other instruments completed by the teachers themselves; second, the equally straightforward concept of teaching styles as something that can be measured through trainee teachers' completion of self-assessment or other instruments; and third, the not-so-common concept of teachers' teaching styles as something that can be measured through students' evaluations of teacher behavior by the completion of different instruments. These three variations on the concept of teaching styles are employed in the majority of articles (171) and, as such, correspond to the prevailing conceptualization of teaching style in the review literature (Figure 2.1).

In addition and equally interesting, three more unusual conceptualizations of teaching styles were disclosed in the articles reviewed (Table 2.4), namely, students' preferred teaching styles, mothers'/parents' teaching styles, and last but not least, the teaching styles of young children. In the review literature (Figure 2.1), two texts deal with the teaching styles of mothers/parents: Witkin (1962) and Goldstein and Blackman (1978). The review literature does not appear to deal with students' preferred teaching styles or the teaching styles of young children.

TABLE 2.3
Conceptualizations of Learning Style in 1,198 Articles Divided by Decades

Terms in Article Titles	1960s	1970s	1980s	1990s	2000s	Total
4Mat LS				2	1	3
Canfield's LSI				1	1	2
Grasha–Riechmann LS				1		1
Dunn and Dunn's LS				6	1	7
Entwistlean LS				1		1
Felder–Silverman LS/global–sequential LS					6	6
Field-dependence–independence LS					2	2
Focus–scan LS			1			1
Gardner's LS					1	1
Gregorc's LS				1	1	2
Hill's CSI			2			2
Honey and Mumford's LS				2	3	5
Kolb's LS			8	18	16	42
LS/LSI	**2**	**41**	**227**	**424**	**393**	**1,087**
LSP					1	1
Marmara LSS					1	1
Mental self-government LS					1	1
Myers-Briggs's LS				2	1	3
On-the-job LS					3	3
Perceptual LS			4	3	5	12
Renzulli and Smith's LSI			1			1
Temperament-based LS					4	4
Vermunt's LS/Inventaris Leerstijlen				2	4	6
Verbal–imagery LS			3			3
Verbal–visual LS			1			1
Total	2	41	247	463	445	1198[a]

Note. LS = learning style. Empty cells signify zero frequency.

[a]Several articles deal with more than one framework. Therefore, the total is not appropriate.

Thinking Styles

The search for articles with the concept *thinking style* in the title identified 174 articles (Table 2.1). As expected, hardly any conceptualizations of thinking styles could be identified from the article titles alone. However, a detailed review of the 174 articles revealed 13 separate conceptualizations of thinking styles across the four decades from the 1960s to the 2000s (Table 2.5).

The conceptualizations of thinking styles most often employed in the articles are mental-self-government (MSG) thinking styles (79 articles) and criminal thinking

TABLE 2.4
Conceptualizations of Teaching Style in 223 Articles Divided by Decades

Teaching Styles in Articles	1960s	1970s	1980s	1990s	2000s	Total
Teachers' TS	1	16	47	35	44	143
Trainee/student teachers' TS	1	3	2	6	5	17
Teachers' TS as evaluated by students	2	2	5		1	10
Students' preferred TS		4	1	4	7	16
Mothers'/parents' TS	1	4	7	1	2	15
Children's TS	1				1	2
Total	6	29	62	46	60	203[a]

Note. TS = teaching style. Empty cells signify zero frequency.

[a]Some article titles did not convey information on whose teaching styles the article was dealing with.

styles (CTS) (34 articles), all published through the 1990s and the 2000s. The remaining conceptualizations of thinking styles are represented by 10 or fewer articles. Of the 79 articles on MSG thinking styles, 58 are concerned with the thinking styles of students, and the remainder with the thinking styles more generally or of other person categories, for example, teachers (Zhang & Sternberg, 2002) and creative writers (Kaufman, 2002). Only four of the articles on MSG thinking styles are validity

TABLE 2.5
Conceptualizations of Thinking Style in 174 Articles Divided by Decades

Theoretical/Conceptual Frameworks	1960s	1970s	1980s	1990s	2000s	Total
Brain dominance TS			3	3	4	10
Cognitive TS				1		1
Criminal TS				5	29	34
Gregorc's Theory of Mind Styles					2	2
Inquiry mode TS				2		2
Managerial TS					2	2
Mental self-government TS				8	71	79
Preferential TS			3			3
Rational–experiential TS				3	7	10
Situation-specific TS					1	1
TS in the depressed			2		1	3
TS related to symptoms of strain/stress			2			2
Verbalizer–visualizer TS					1	1
TS	2	1	5	3	23	34

Note. TS = thinking style. Empty cells signify zero frequency.

studies. Of the 34 articles on CTS, the majority (27) are concerned with the CTS of different offenders typically, prison inmates while two were concerned with the CTS of college students and one with the CTS of drug users. Two thirds of the articles (19) within this subfield are psychometric and validity studies concerned with instrument development; see, for example, Walters (1995).

Intellectual Styles

The search for articles with the concept *intellectual style* in the title identified only 13 articles (Table 2.1), which is why a detailed review was chosen. The articles either discussed intellectual styles in connection with different subjects or were studies on intellectual styles employing different conceptualizations of intellectual style (Table 2.6).

The first article discovered with the term "intellectual style" in the title was Cropley and Field's (1969) article on high school students' academic achievement and intellectual style. The single article from the 1970s (Field & Poole, 1970) was also concerned with intellectual style and achievement. In the 1980s, the subfield of intellectual styles picked up slightly with four identifiable articles. The most influential was Sternberg's (1988) introduction of the theory of mental self-government, where intellectual style is conceptualized as 13 aspects of self-government in later writings, the term "thinking style" was adopted.

In 2005, Zhang and Sternberg's groundbreaking paper on the threefold model of intellectual styles appeared. In this combined review and empirical article, Zhang and Sternberg proposed to unify 10 theoretical frameworks under the umbrella concept of intellectual style, while at the same time constructing three main types of styles across the 10 frameworks by employing six separate criteria for their placement. After Zhang and Sternberg's (2005) paper, the movement of "intellectual styles thinking styles intellectual styles" has come full circle so to speak, with an empirical article on intellectual styles (Zhang, Fu, & Jiao, 2008), where the conceptualization is in fact thinking styles as in the theory of mental self-government in the intermediate time period (Sternberg, 1997). Two other articles do, however, include a range of the theories incorporated into the three types of intellectual styles presented in Zhang and Sternberg (2005), namely, Zhang (2005a, 2007).

TABLE 2.6
Conceptualizations of Intellectual Style in 13 Articles Divided by Decades

Theoretical/Conceptual Frameworks	1960s	1970s	1980s	1990s	2000s	Total
Divergent–converging–all rounders IS		1				1
IS	1		3	1		5
Mental self-government IS/TS			1		1	2
IS as umbrella term					5	5
Total	1	1	4	1	6	13

Note. IS = intellectual style. Empty cells signify zero frequency.

SPECIFIC DEVELOPMENTS IN THE HISTORY OF STYLES

Many specific subjects are interesting when looking at the history of the styles field, many more than this chapter can contain. For this chapter, the choice has fallen upon three particular subjects that are classical to the field of styles and dealt with extensively in both the review literature (Figure 2.1) and the empirical literature (Table 2.1). The relationship between styles and ability and the relationship between styles and personality were chosen because discussions on the nature of these relationships have been present in the field from the very start and are still ongoing. The function of the sections on styles and ability and on styles and personality is to outline the different positions on these relationships in both the review literature and the empirical literature (articles) over time. The issue of quality-of-style measurement was chosen due to its fundamental significance for the styles field because measurement is at the basis of all activities in the field. The function of the section on quality-of-style measurement is to outline the ways in which the styles field has been concerned with this subject over time, both in the review literature and in the articles on cognitive, learning, teaching, thinking, and intellectual style.

Styles and Ability

The 165 included articles (Table 2.7) indicated what appeared to be a growing interest in the subfield connecting styles with abilities, because the number of articles doubled from the 1970s to the 1980s and again from the 1990s to the 2000s. This growing interest in abilities was mainly found in the articles on learning styles, while interest in abilities in connection with cognitive styles has been declining in the last two decades.

TABLE 2.7
Number of Articles With Titles Including Search Terms, Divided by Decades

	Search Terms: "Ability" or "Academic Performance" or "Academic Achievement" or "Intelligence" Combined With Style Terms					
Decade	Cognitive Style	Learning Style	Teaching Style	Thinking Style	Intellectual Style	Total (% of Articles, Table 2.1)
2000s	19	32	2	(2000) 9	(2005) 2	64 (6.7%)
1990s	20	17				37 (4.3%)
1980s	34	7	1			42 (5.6%)
1970s	13	(1975) 3	(1970) 3			19 (6.5%)
1960s	(1960) 3					3 (4.8%)
Total (% of articles, Table 2.1)	89 (6.7%)	59 (4.9%)	6 (2.7%)	9 (5.2%)	2 (15.4%)	165 (5.6%)

Note. The years appearing within parentheses in some cells give the year of the first article discovered.

The articles on abilities coupled with cognitive, learning, or teaching styles had the largest time span, and the first articles to appear were Broverman's (1960) article on intraindividual differences in abilities (cognitive style), Rychlak's (1975) on the role of social class, race, and intelligence in affective learning styles (learning style), and Domino's (1970) on the interactive effects of achievement orientation and teaching style on academic achievement (teaching style). Articles on abilities and thinking or intellectual styles were only found in the last decade; two articles make up the starting point for studies on thinking style and ability, namely, Cano-García and Hewitt Hughes's (2000) on the relationship between students' learning and thinking styles and their influence on academic achievement and Zhang's (2000) on the relationship between thinking styles and learning approaches and their contribution to academic achievement. The first paper on intellectual style and ability was Zhang's (2005a) on the predictive power of abilities for thinking styles.

In the review literature (Figure 2.1), 15 texts distributed across the five decades from the 1960s to the 2000s are concerned with styles and abilities, with two texts in each decade except for the 1980s where seven texts on the subject were identified. Most of the review texts dealing with the relationship between styles and abilities exclusively discuss this relationship for cognitive styles (Goldstein & Blackman, 1978; Guilford, 1980; Messick, 1969, 1984, 1994; Miller, 1987; Sternberg & Grigorenko, 2001; Tiedemann, 1989; Witkin, 1962), whereas Keefe (1979), Henson and Borthwick (1984), Jonasson and Grabowski (1993), and Renzulli and Dai (2001) extended the discussion to include learning styles. The dominating view in the review texts is that styles and abilities are distinguishable, in the sense that abilities are concerned with the level of being able to do something, while styles are concerned with how the individual prefers to utilize her abilities, and that abilities are value directional, while styles are value differentiated (see, e.g., Messick, 1994).

On the content or subject side, the 165 articles (Table 2.7) fall into three general subject categories:

Category one: Articles on the distinction between styles and abilities.

The decade-wise distribution of the articles falling into this category was: the 1970s (1 article), the 1980s (2), the 1990s (2), and the 2000s (2). In this category, the most common approach is to investigate the distinction between styles and abilities empirically with specific measures of cognitive styles and ability: For example, Genser, Häfele, and Häfele's (1978) study showed cognitive styles (reflection–impulsivity) to be independent of intelligence. A slightly different approach was taken by Zhang's (2004) study, where the nature (ability or style) of cognitive style in the field-dependence–independence conceptualization was tested empirically by measuring field-dependence–independence, thinking styles, and achievement. Zhang concluded that field-dependence–independence is an ability construct rather than a style construct a conclusion shared by a number of the review texts (Goldstein & Blackman, 1978; Guilford, 1980; Keefe, 1979; Messick, 1969; Miller, 1987; Sternberg & Grigorenko, 2001; Witkin, 1962). Lastly, this category also contains some discussion articles on this subject.

Category two: Articles on the relationship between speci"c measures of style and different types of abilities, or on the relationships between styles and abilities on the one side and other individual or group-wise characteristics on the other side.

The decade-wise distribution of the articles in this category was: the 1960s (3 articles), the 1970s (17), the 1980s (37), the 1990s (30), and the 2000s (57). An example is Luk's (1998) study on the relationship between cognitive styles and academic achievement in distance education, and Dillbeck, Assimakis, Raimondi, and Orme-Johnson's (1986) study on the longitudinal effects of transcendental meditation on cognitive styles and cognitive ability.

Category three: Articles on miscellaneous studies including both styles and abilities in some form or discussing these.

The decade-wise distribution of articles in this category was: the 1980s (3 articles), the 1990s (5), and the 2000s (3). An example is Pettigrew and Buells' (1989) study on teachers' abilities to diagnose students' learning styles.

Styles and Personality

In the review literature (Figure 2.1), 10 texts distributed across three decades are concerned with styles and personality two in the 1980s, four in the 1990s, and four in the 2000s. Four different views on the relationship between styles and personality are represented in these texts.

First view: Personality is viewed as styles and incorporated into larger frameworks with other types of styles

This is the case in Curry's (1981a) onion model of learning style theories, where the innermost layer (of three) was made up of what was termed *cognitive personality style* and contained constructs such as the field-dependence–independence (Witkin, 1950), the personality styles as measured by the Myers-Briggs Type Indicator (Myers & McCaulley, 1985), and impulsivity–reflectivity (Kagan et al., 1964). Cognitive personality style was seen as a "... function of the deep, more permanent personality that becomes manifest only indirectly by looking for universals within a person's behavior in any learning situations" (Curry, 1981a, p. 119). Messick, in his review of attempts to integrate personality and styles, concluded by saying that if we started with a guiding personality theory, we might reach the point where "... styles can be treated ... as the manifestation of form-giving personality structures in cognition, affect, and behavior" (Messick, 1994, p. 133). Sternberg and Grigorenko's (1997, 2001) categorization of style theories into *cognition-centered*, *activity-centered*, and *personality-centered* style theories. The theories denoted personality-centered are the Myers-Briggs Type Indicator in the Jungian personality tradition (Myers & McCaulley, 1985) and Gregorc's (1979, 1985) theory of mind styles. Zhang and Sternberg (2005, 2006) incorporated the Jung-based Myers-Briggs Type Indicator (Myers & McCaulley, 1985) into the umbrella concept of intellectual styles side by side with other style constructs, thereby viewing this particular construct of personality as a style phenomenon.

Second view: Personality is indirectly viewed as different from styles through the discussion of relationships between speci"c styles and personality traits

This is the case in Guilford (1980), where the relationships between specific styles, such as scanning, tolerance for unrealistic experiences, and reflection versus impulsivity, and what is termed personality traits, such as meticulousness, interest in autistic thinking, and temperament factors, were discussed.

Third view: Personality consists of several components, one of which is style in speci"c conceptualizations

This is the case in Coffield, Moseley, Hall, and Ecclestone's (2004a) five families of learning styles, where the middle or third family was denoted "learning styles are one component of a relatively stable personality type," and contained constructs such as the Myers-Briggs Type Indicator (Myers & McCaulley, 1985), Miller's (1991) personality typology, and a number of other constructs that are not equally clearly representing personality.

Fourth view: Personality and styles The relationship unresolved

This is the case in Riding and Rayner (1998), who on the one hand wrote ". . . it is possible that style is merely another form for . . . an aspect of personality" (Riding & Rayner, 1998, p. 99), while on the other, did not reach a conclusion in the discussions of the relationship between specific cognitive styles and personality traits. Jonasson and Grabowski (1993), on the one hand, discussed Miller's (1991) personality model and categorized a number of style frameworks as belonging to the affective and the conative dimensions of personality, thereby incorporating style into the concept of personality. On the other hand, Jonasson and Grabowski also discussed personality dimensions as "related to the learning process" and "as affecting learning and instruction," thereby suggesting that personality and styles are separate constructs.

TABLE 2.8
Number of Articles With Titles Including Search Terms, Divided by Decades

	Search Term: "Personality" Combined With Style Term					
Decade	**Cognitive Style**	**Learning Style**	**Teaching Style**	**Thinking Style**	**Intellectual Style**	**Total (% of Articles, Table 2.1)**
2000s	13	10	3	9	(2005) 1	36 (3.8%)
1990s	14	16	3	(1999) 2		35 (4.0%)
1980s	8	1	2			11 (1.5%)
1970s	4	(1979) 1				5 (1.7%)
1960s	(1969) 1		(1967) 2			3 (4.8%)
Total (% of articles, Table 2.1)	40 (3.0%)	28 (2.3%)	10 (4.5%)	11 (6.3%)	1 (7.7%)	90 (3.1%)

Note. The years within parentheses in some cells give the year of the first article discovered.

With regard to the 90 articles (Table 2.8), the majority of these were on personality and cognitive or learning styles. The articles on personality coupled with cognitive, learning, or teaching style have the largest span time-wise, while articles on personality and thinking or intellectual styles were only found from 1999 onward. The earliest articles identified with each of the five style concepts were: Hunt and Joyce (1967) on teacher–trainee personality and *teaching style*; Shouksmith (1969) on the relationship between personality attributes and two *cognitive style* measures; Calvey (1979) on the effect of *learning styles* and personality on children's recall of prose; Demetriou, Kazi, and Georgiou (1999) attempting to place personality, self, and problem solving (i.e., *thinking style*) into an overarching model of self; and Zhang (2005a) on the prediction value of self-rated abilities for cognitive development, *intellectual styles*, and personality.

Content-wise, there appeared to be no discernible patterns within each of the five style concepts or across decades within the articles (Table 2.8). However, within the articles as a whole, the most widely researched topic was the relationship between personality and styles 58 articles were concerned with this as the relationship between specific measures of personality and specific measures of cognitive, learning, teaching, or thinking styles (cf. the second view above). In addition, three articles represent the view that personality consists of several components, one of which is style (cf. the third view above).

Quality-of-Style Measurement

Ten of the review texts (Figure 2.1) were concerned with the quality-of-style measurement, as were 99 articles (Table 2.9). The number of articles concerned with the quality-of-style measures has increased over time since the 1970s, with the subfields

TABLE 2.9
Number of Articles With Titles Including Search Terms, Divided by Decades

	Search Terms: "Validity" or "Reliability" or "Validation" or "Psychometric" or "Questionnaire and Development" or "Scale and Development" or "Measure and Development" or "Test and Development" or "Construct and Development" or "Measurement and Issue" Combined With Style Term					
Decade	Cognitive Style	Learning Style	Teaching Style	Thinking Style	Intellectual Style	Total (% of Articles, Table 2.1)
2000s	11	24	(2007) 1	12		48 (5.0%)
1990s	6	19		(1995) 4		29 (3.4%)
1980s	(1980) 6	11				17 (2.4%)
1970s		2				2 (0.7%)
1960s	(1966) 3					3 (4.8%)
Total (% of articles, Table 2.1)	26 (2.0%)	56 (4.7%)	1 (0.4%)	16 (9.2%)	0 (0.0%)	99 (3.4%)

Note. The years within parentheses in some cells give the year of the first article discovered.

of learning and thinking styles having the highest share of articles, while the subfields of teaching and intellectual style had the lowest share. Because the concept of intellectual style is mainly used as an umbrella concept, it is no surprise that no articles on measurement quality were found.

A detailed review of the 26 articles on cognitive styles and quality of measurement revealed that in fact only 20 of these articles were concerned with the quality-of-cognitive style measures, while six articles turned out to be validity studies on instruments measuring something else or studies of a different nature. These 20 articles on the quality-of-cognitive style measures employed 17 different instruments, with the majority of instruments employed in only one or two articles. The 20 articles investigated the quality of specific instruments in different ways: the psychometric properties, typically reliability and criterion validity, in connection with instrument development (five); the factor structure (four); different types of validity (nine); and reliability exclusively (six articles, of which four were employing Riding's [1991] Cognitive Style Analysis).

The 56 articles on learning styles and measurement quality included a single meta-analytic article and two discussion articles, while the remainder investigated the quality of specific instruments in different ways: the psychometric properties in connection with instrument development (nine); factor structure (13); construct validity (11); other types of validity and reliability (26); and reliability exclusively (26 articles, all on different versions of Kolb's learning style inventories). Three articles were concerned with bias issues; two employed Kolb's learning style inventories and one reported on the development of an additional scale for the Danish Self-Assessment Learning Styles Inventory (Nielsen, Kreiner, & Styles, 2007) within Sternberg's (1997) theory of mental self-government. The majority of the articles (36) were different types of validity/reliability studies employing a range of Kolb's original instruments (Kolb, 1976, 1985a,b 1999; Smith & Kolb, 1986) and alternative instruments based on Kolb's theory (1984). An additional 11 instruments were employed in only one or two articles.

Of the 16 articles on thinking styles and quality of measurement, 10 employed Walters's (1995) Psychological Inventory of Criminal Thinking Styles (PICTS) and investigated the quality of the PICTS in the following ways: the psychometric properties (four); further validation (six); factorial structure (two); standardization and development of norms (one); and investigation of bias (two). Of the remaining six articles, five employed different versions of the Sternberg and Wagner (1992) Thinking Styles Inventory (TSI) and were all concerned with the factorial structure.

Only one article on teaching style and quality of measurement was identified: Carifio and Everritt (2007). *No* articles on measurement quality and intellectual styles were identified.

From a general point of view, the approach taken to quality of measurement in the review literature (Figure 2.1) contrasts the approach in the empirical literature (articles), because the review literature is more concerned with the "bigger issues" of measurement quality and can be divided into two categories across the decades.

The "rst category is characterized by a mixed concern with both the more general issues of measurement quality and the quality of single instruments. The general issues brought forward, most of which are still unresolved, are the following:

The issue of fairness of tests was brought up by Messick in his discussion of how cognitive styles are also operating in aptitude testing situations (what is later termed response style), and he concluded: "... We should consider the "fairness" of our aptitude and achievement tests not only for different cultures and different sexes, but for individuals having different stylistic propensities" (Messick, 1969, p. 336). This fairness recommendation (i.e., absence of bias or differential item functioning depending upon psychometric tradition) is *not* extended to instruments for the measurement of styles by Messick (1969) or any of the other review texts why this is so is left to the reader's speculation.

Curry (1981a) approached the issue of measurement quality from a variety of perspectives: the problem of reliability as a measure of stability, due to the nonpermanent nature of learning styles; the (too) many instruments; that factor analysis is not sufficient for validity studies a point made also by Vernon (1973) and Biggs (1993); and that the responsibilities of test administrators and analyzers are not taken seriously enough. Curry (1983) added two issues of measurement quality, namely, the confusion of different definitions of the concept of learning style and the wide variety in the things that learning styles are claimed to predict. Curry (1990) added further the two problems of not dealing with the results due to the Hawthorne effect and not dealing adequately with regression to the mean effect in longitudinal studies the latter has, to the author's knowledge, only been picked up by Nielsen, Karpatschof, and Kreiner (2007), who supplied a simple method for dealing with this. Last, Curry (2000) added two more issues: the lack of inclusion of independent measures of behavior change in effect studies and the lack of control for interaction or confounding variables. It is the author's impression that the latter is gaining weight see, for example, Nielsen (2005, 2009) for learning styles, Zhang (2005b, 2008) for thinking styles, and Cools and Van Den Broeck (2006) for cognitive styles.

Tiedemann (1989) discussed the quality of measurement within the subfield of cognitive styles and was particularly concerned with the distinction among cognitive styles, cognitive controls, and abilities as well as the relationship between theory and instruments. The latter concern was shared by Biggs (1993) within the "approaches to learning and studying" subfield, who extended this concern to include simplified interpretations of results leading to questionable uses of these. Sternberg and Grigorenko (2001) brought up two general quality issues the general problem of defining style as a theoretical construct as well as the problem that most findings in the styles field, although often generalized, are instrument specific, and only a few replication studies were conducted.

The second category is characterized by concern with the quality of single measures of style (much as in the articles) giving only slight attention, if any, to the broader issues of measurement quality. This category includes Goldstein and Blackman (1978), who thoroughly evaluated the quality of the instruments within five frameworks of cognitive style; Hickcox (1995), who stated that assessment of the reliability and validity of learning style constructs is crucial in reviewing the field,

but then proceeded without doing so; Reynolds (1997), who was concerned only with research that, in his words, was critical of learning styles as they are used in management development; and lastly, Coffield et al. (2004a) and Coffield, Moseley, Hall, and Ecclestone (2004b), who claimed to have critically reviewed the literature on learning styles, resulting in a list of 71 learning style instruments and theories, of which many are actually theories and instruments of cognitive styles, thinking styles, and so on, and an in-depth review of what was stated to be the 13 most influential theories and instruments of learning styles. However, the criteria for selecting the 13 theories and rejecting others were not defined precisely. Furthermore, the employed selection of the literature appeared limited and therefore insufficient for a detailed review.

Unresolved Issues and Future Directions

As is apparent from this and other reviews within the styles field, there are many unresolved issues and many possible future directions. However, this section touches only briefly on the ones springing directly from the present review.

With approximately 90% of the discovered articles on cognitive and learning styles, it is not possible to determine from the article titles which theoretical framework or instrument is employed. This was true to an even greater degree for the articles on teaching styles, while it was true to a lesser degree for the articles on thinking styles. Being surprised (and a little disappointed) by this finding, the author finds it appropriate to suggest that the styles research community as a whole change their practice when making up the title of a research article on styles, so that it includes at least the theoretical framework and possibly the instrument employed, as it is more often practiced within the subfield of thinking styles. Such a change in practice would be of great value both to researchers and to practitioners, and particularly so with learning styles because these are most often considered for practical implementation in the field of education. We cannot expect teachers to mull through thousands of articles to find the results that might tell them whether the theory and instrument that they are considering for practical use are actually useful or not for their purpose.

In addition, the author proposes that researchers in the styles field commit to a more precise use of style concepts, in the sense that, if a measure of cognitive style is employed, but it is interpreted as learning or teaching style, then this should be communicated clearly rather than renaming the cognitive style measure as a measure of learning or teaching style this, of course, goes for all the five style concepts. Such a tightening up will not only help researchers, but will also make the research appear less confusing to practitioners and researchers from other fields.

Concerning the relationship between *styles* and *abilities*, the author would not propose putting the discussion of the intricacies of this relationship to bed. To the author's mind, it is very useful to have the discussion ongoing in the field, and it does keep us on our (thinking-wise) toes. Instead it is proposed that the field adopts a new perspective on this, one that is also useful to practitioners and which will also accommodate some of the critique posed from outside the styles field. First, that the discussion is brought "down" to a level more easily accessible to a

broader audience, from a general discussion on styles and abilities, which is mainly a discussion of value to researchers and theorists, to a number of research-based and theory-based discussions on the relationship between the five major style concepts and abilities (which do actually exist for cognitive style). Second, that the tradition from the subfield of cognitive styles of researching and discussing the relationship between particular concepts of cognitive style is extended to the subfields of learning, teaching, and thinking styles.

Concerning the relationship between *styles* and *personality,* it is clear that there are different positions and that the issue is far from resolved. Having found a discrepancy in the level at which this relationship is treated in the review literature and the empirical literature reviewed, the author sees two obvious roads leading forward with regard to this issue: on the one hand, more studies, not only on the relationship between single instruments for the measurement of personality and style but also on several instruments investigating the relationship as proposed in the different theoretical contributions, and on the other, reviews aimed at reviewing the empirical literature with regard to one or more of the proposed theoretical models of the relationship between styles and personality.

With regard to the issue of *measurement quality,* the most crucial issue for the styles field as a whole is the bias or fairness issue, which is noticeable through its absence in the review literature and only rarely crops up in the empirical articles concerned with the quality-of-style measures. It would serve the field well if this is discussed as well as reported on in the development and further validation of style instruments, since this would show that the quality of instruments is taken very seriously. Also, documenting, for example, equivalence across cultures and language versions of an instrument would allow for genuine cross-cultural studies, where scores of cultural groups could be compared meaningfully (Hambleton, Merenda, & Spielberger, 2005).

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3

Understanding an Integrated Theory of Intellectual Styles: Moving From Models to Measures and Meaning

Stephen Rayner, John Roodenburg, and Esther Roodenburg

INTRODUCTION

The intention of this chapter is to present a critique of theory and the style construct found in the psychology of individual differences. For this reason, the chapter begins by considering some of the generic implications involved in constructing theory and developing new knowledge. This is then applied to a consideration of the research and development of cognitive and/or intellectual styles as an idea, as well as the theoretical development of the style construct in the psychology of an individual's cognition, learning, and behavior. A second more implicit purpose in this discussion is to examine the basis for using a generic term, *intellectual styles*, as an integrating construct used to further develop a *grand theory* for style differences in human individuality. None of this is easy, given the elusive and slippery nature of the style construct, the contemporary plethora of so-called style models, labels, or the diverse nature of psychometric assessment produced during the past 50 years or more, and the situated position of the style construct in what is described as a polymorphic knowledge domain, characterized by contested, disparate, and divergent theory (Coffield, Moseley, Hall, & Ecclestone, 2004a; Rayner & Peterson, 2009).

There is, unsurprisingly, continuing disagreement among many mainstream psychologists about the nature or significance of style and/or styles, as it is applied to an understanding of affect, behavior, and cognition (Rayner, 2000, 2001; Rayner & Cools, 2011; Riding & Rayner, 1998). We believe, however, and agree with Sternberg's claim (1996a, p. 363) that "styles matter!" We also hope to demonstrate how a theory of styles *emphatically matters* for knowledge production in the research of a psychology of the individual as a person, and as a crucial factor in a widening range of applied contexts for understanding individual differences in human performance. The following discussion therefore foregrounds a consideration of the part played by theory in knowledge production and its construction. The way in which a theory is a necessary framing of knowledge located within a subject discipline (psychology) is linked to an understanding of how we perceive and conceive

psychological phenomena related to individuality. Messick (1976, 1994, 1996), albeit some time ago, both predicted and then commented upon the academic aspect to this debate as unfortunately being more about heat and conviction (ideology) rather than light (intellectual rigor). Disappointingly, this controversy with the style concept has not subsided over time. Messick, for example, argued that there were "... various critiques of style research that appear to be excessively polarized in either supporting or undercutting styles as meaningful constructs. This polarization seems to reflect different stances not just with reference to scientific evidence but also with respect to ideology" (Messick, 1994, p. 121). Pashler et al., taking a particular and somewhat traditional view that seemed to suggest the "jury is still out" on the validity and value of learning styles, concluded that "... any credible validation of learning-styles-based instruction requires robust documentation of a very particular type of experimental finding with several necessary criteria" (Pashler, McDaniel, Rowher, & Bjork, 2008, p. 105). The present intellectual status of style theory is contested, thereby emphasizing yet greater need for a more clearly stated research methodology to facilitate a robust and integrated theory of style differences in human individuality.

To sum up, this chapter is composed of three parts: The first examines the role of theory in research and new knowledge production; the second looks more closely at understanding style theory, as it is reflected in a number of models, measures, and meaning; and the final part of the chapter reconsiders the need and practical utility for a grand theory in the field and thinking about a way forward for researching intellectual styles.

EXPLAINING THEORY: KNOWLEDGE CONSTRUCTION AND PRODUCTION

Theory of any sort, as we present it here, is a specific tool, as well as a necessary stage in the design of research and the work of knowledge production. Theories vary in scope and in level of abstractness, with grand theories usually broadest in scope and more abstract. We propose three key aspects to a continuum of theory formation (see Figure 3.1). These are first, *basic theory*; second, *inquiry as theory*; and third, *grand theory*. A grand theory represents a holistic or "global" description of a body of knowledge. Grand theory is invariably aimed at unifying a field of knowledge, albeit this synthesis need not, in any likelihood, be unitary; it should nevertheless be inclusive and comprehensive in mapping the specific field or domain.

A second pathway moving along the same continuum in this approach involves the practice of research, the place of applied contexts, and the question of locating aspects of theory in practice. In point of fact, a researcher will ideally move from time to time between this distinctive second lane and the first on the road toward knowledge creation. Both lanes (forms of activity) are essential to the work of theory formation. Moving down this second lane ideally involves activity that may be *applied* and/or *translational research* linked in turn to *knowledge synthesis*, and in a third and separate action, forming *domain-speci"c* or *applied theory*. At the same time, this work will refer to and involve activity in the first lane. A reciprocal relationship between research and theorizing at these three levels is conceived as a constant

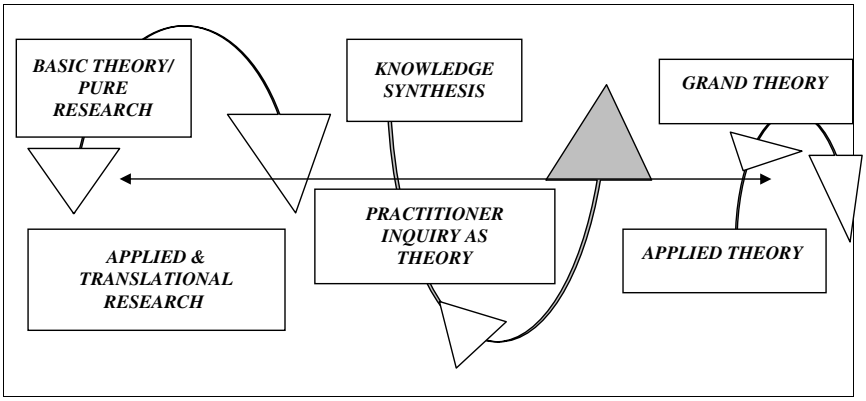

FIGURE 3.1
A theory formation continuum.

but iterative process. It is also a continuing requirement for worthwhile and robust knowledge production. An interplay between applied and basic research activity is crucial to this general approach to constructing new knowledge.

The first steps in research, however, are not always lined up in a linear progression as traditionally presented. The process of research is perhaps more helpfully conceived as an interactive, dynamic system and at its best, an iterative process comprising specific procedures, and generalized but related activity. This activity will, for example, include

- Collecting and grouping of information, data, and extant knowledge.
- Contextualizing the subject (framing of boundaries, components, and limits).
- Referencing extant models and axioms in the same subject field.
- Forming a logical and rational system of content (conceptual consistency).
- Ensuring commensurability with extant knowledge (data or theory).
- Generating relevant hypotheses, propositions, and predictions about the subject.
- Interrogating the theory to further develop its content.
- Avoiding overcomplication, simplification, and reified formalization.
- Providing the basis for further validation, reliability, verification, and generalizability.

Managing inquiry and research is tricky. Forming and reframing basic theory is the constant challenge and ultimate objective at the heart of this operation. Once realized, this results in new knowledge (albeit sound or unsafe, valid or spurious). Edmondson and McManus (2007) argue that this work of engaging in basic theory (called nascent theory) is located at one end of the research continuum, and theory formation or knowledge production is best understood as a movement between this basic research, and applied or grand theory and is one that yields mature theory. The latter most often comprises a conceptual structure involving models, constructs, and explanation reflecting intellectual consensus in the form of a cumulative body of knowledge. Time and study seemingly produce one key measure of theoretical maturity; it encourages levels of replication and critical evaluation, leading to

intellectual robustness and trustworthiness in the work of theory formation. Caution should be exercised, however, in any complete dependence upon the "test of time" or "received wisdom." Finally, while a hierarchical value might be inferred in a two-lane structure described in Figure 3.1, describing a journey from basic to mature levels of research, this would be an error of understanding as its iterative, reciprocal, and cyclic movement is not mechanically linear in terms of causal progression.

An alternative notion of theory formation is presented by Sternberg (2007), describing two types of psychological theory: the first, domain-general and the second, domain-specific. Yet more importantly, Sternberg identifies the effects of fracturing the relationship between the two in field development and argues that over time, this has occurred in the psychology of education, resulting in an impoverished development of unified models to convincingly explain phenomena and better inform practice. It is, to some extent, a similar fracture to the one identified here in mainstream psychology and more particularly, in style research, which has frustrated much needed consensus and the development of unified or grand theory. This provides critics with a good case, as exemplified in the critique leveled by Coffield et al. (2004a) and Coffield, Moseley, Hall, and Ecclestone (2004b), to lampoon style theory as weak, inconsistent, and contradictory, offering no or at best little relevance for the applied context.

Inquiry as theory is an important part of this continuing production of knowledge and should be used to both inform and exploit basic and grand theory. It should also be used to guard against traditional methodology creating a stagnant orthodoxy, and so be used to interrogate, review, and revise established grand theory. In some ways, this is a deliberate check on theories that have stood the test of time. It is exactly this kind of intellectual atrophy identified by critics of style theory that might be seen as the result of an endless one-track production approach of hypothesis-driven research methodology, psychometric design, individual experiments, new tests, and yet more rather than less rigorous self-report assessment (Coffield et al., 2004a; Messick, 1996). The point is, as forcibly argued by Prieler (2007) and Kolstad (2010), new approaches to the experimental paradigm in psychology are urgently required. Embretson (2010) and Roodenburg and Roodenburg (2011) go further and suggest that traditional psychometric modeling carry inherent assumptions that serve as constraints and limit the integration of measurement and psychological theory.

Theory as Knowledge: Models, Maps, and Schema

Establishing and maintaining a grand theory in the style field poses difficult issues around any effort at conceptual integration, of alternative perspectives shaped by what are often conflicting forms of ontology and epistemology. It is, nonetheless, in large part a task involving a conceptual mapping of the intellectual territory in a subject domain (Rayner & Peterson, 2009). The need for unified theory is clearly stated: This should involve knowledge synthesis and work that is directly concerned with theory construction and reconstruction, building new knowledge gained from basic research, and inquiry as theory. The implications for grand theory formation are implicated in the structure represented in Figure 3.2.

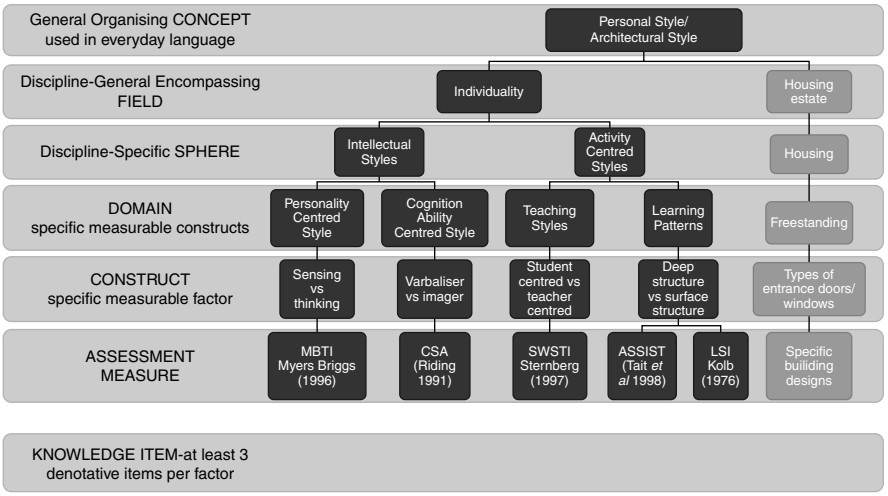

FIGURE 3.2
Integrating style theory: A schema.

The aim in this illustration is to demonstrate how establishing a schema requires a framing of meaning using a schema that offers an *encompassing scope*. The process begins with identifying denotative items and moves up to working with more connotative abstract generalizations, thereby reflecting a hierarchical structure. The schema illustrates how a field will comprise many types and levels of constructs. Such constructs need to be differentiated, because at various levels, constructs will have significantly differing attributes, roles, and functions. For example, higher-order constructs are typically more theoretical, abstract, and inclusive, setting hermeneutical constraints. Lower orders are more intuitive, tangible, and applied, can be understood with little or no reference to theory, and need no or little interpretation. Yet, while the foundations are crucial, and the doors, windows, and walls are most visible, none of these parts stand alone, but form the final shape, structure, and rigor of the construction. The inclusion of several leading models of cognitive and learning styles as key measures of assessment in this figure represents a judgment that each plays a central part in the progression of construction (theory) and thereby, as a contribution to the meaning of intellectual styles. To sum up: The reformation of a formal theory is usefully served in the construction of a *taxonomy* of intellectual styles charting the constituent parts of a carefully examined set of knowledge (in this case, comprising the conceptual bases of several different models of style).

As previously argued, however, there are serious difficulties inherent in trying to integrate different models of styles. There is a firmly established orthodoxy and methodological template for producing new knowledge in the styles field. This is also the case in other related fields of individual differences, for example, in differential, dispositional, personality, and cognitive psychology. Such an approach privileges measurement and adopts nomothetic methodology as a principal template for validating theory at the heart of what is a predominant approach to research and development. More generally, the approach reflects a tendency for theory to remain locked in to a methodology shaped by assumptions inherent in positivism, realism, and what is often lauded as "hard science."

For example, as described by Eriksson (2003), in quantitative modeling, traditional deterministic methods are being challenged by nondeterministic approaches such as those using more sophisticated probabilistic methods, generic algorithms, neural networks, and hyperincursive computing. Eriksson's work describes a metamodel for understanding, classification, use, and development of these many contributions to the field of modeling.

Furthermore, in a discourse more closely grounded in the field of individual differences, several academics have debated similar implications for construct validity and psychometric assessment (Embretson, 2010; Kane, 2007; Lissitz & Samuelsen, 2007; Moss, 1992, 2007; Nesselroade, 2002; Prieler, 2007; Rodgers, 2010). Yet, a continuing demand for hard science is reflected in the recent critique of learning styles (Pashler et al., 2008), in which Pashler et al. concluded that any credible validation of learning styles-based instruction should involve experimental research shaped in a classical aptitude by interaction design. In effect, these authors have drawn upon traditional psychology, citing the relevance and reliability of a hard science invoked in psychometric tradition (Cronbach 1957; Cronbach & Snow, 1977; Thurstone, 1938). The need to think more carefully about methodology and research design is paramount. Do we need, as suggested by Peterson, Rayner, and Armstrong (2009), better and more rigorous experimental design? Should style research involve forms of longitudinal survey (see Cools & Rayner, 2011)? Or would the kind of randomized field trials described by the UK Medical Research Council (MCA, 2000) better enable claims of validity as generally understood by the researcher community in experimental psychology (see Boon & Gozna, 2009; Kolstad, 2010; Slife & Williams, 1995)? The $64 question remains one of how to prove and/or validate a theory of style as part of developing new knowledge, and it is this we turn to in the rest of the chapter.

CRITIQUING STYLE THEORIES: MODELS, MEASURES, AND MEANING

This section builds upon the previous examination of theory formation and more closely reappraises the style domain. The aim is to gain an understanding of the role of intellectual styles in the production of an integrated formal or grand theory of style differences in human performance. We consider the use of the term *intellectual styles* and its value as a conceptual tool in further facilitating a unified, coherent, and sensible theory of the "style differences" concept. The discussion is organized as a series of questions intended to provoke more thinking on how to further develop and strengthen a valid, robust, and trustworthy grand theory in the field of styles research.

What Is the Style Concept?

To fully answer this question as a researcher we need a recognized grand theory. Research, review, and critical analysis are key research tools for this task. The challenge is therefore, in large part, one of theoretical modeling aimed at making sense and deepening an understanding of a popular and widely held idea of a person-centered repertoire of stylistic features in an individual's psychological

functioning and performance. This work in turn involves the previously identified steps of

- Collecting and grouping of information, data, and extant knowledge.
- Contextualizing the subject (framing of boundaries, components, and limits).
- Referencing extant models and axioms in the same subject field.

An outcome of this work will ideally be a logical and rational system of content that represents a description and explanation of the style concept. This perhaps, as we have previously argued, involves moving the researcher beyond a concern for styles as a concept in the contemporary paradigm to one that is largely predicated upon one fundamental domain of differential psychology, that is, cognition-based style as psychological processes and impulses (cognitive, thinking, or intellectual styles).

A review of intellectual styles theory presented by Sternberg, Grigorenko, and Zhang (2008a) makes a similar point, when reexamining the history and development of cognitive styles and its associated development as an individual difference. Personality-based styles are identified in this review, but described as "preferences" reflecting a series of mental processes relating to other aspects of the self in shaping personal choices over time in the deployment of cognition-based styles and abilities at work. This reflects a primary focus upon cognition as a process. It is argued here, however, that ideally, further research and new theory should be developed to build upon an integrative model of styles in order to encompass explaining how aspects of style feature in the wider conative and affective work of mental functioning in the individual person.

Rayner and Peterson (2009) suggested that three dimensions affect, behavior, and cognitions serve as a superstructure for modeling a heuristic framework for defining style in a human performance. Profiling an individual's personal *modus operandi* when at work or play in respect to these three foundational dimensions of human individuality should further facilitate sound comprehensive modeling that may contribute in turn to a consensual understanding of style differences in the field. In so doing, Roodenburg (2003) considers it is important for advancing style to emphasize that style is in itself not an object (i.e., not real) but as with occupational interests, it represents a construction or as Messick (1994) calls it, a manifestation of mental functioning and processes (which are real). A particular style in this kind of modeling is not defined as a trait but is perceived to be a choice a person makes in adapting to the demands and needs of a specific situation. Such an approach to style modeling is clearly exemplified in Sadler-Smith's Duplex Model (2009).

What Is the Style Construct?

This question differs markedly from the previous one by more sharply focusing upon nascent theory underpinning any wider explanation for the idea of style differences. This means a researcher, when trying to answer this particular question, must seek to

- Ensure a commensurability with extant knowledge (data or theory).
- Generate relevant hypotheses, propositions, and predictions about the subject.
- Avoid overcomplication, simplification, and reified formalization.

The term *construct* when applied to style, as explained earlier, refers to a psychological label or term that in essence is a complex concept usually made up of several aspects, such as intelligence or personality. Or to put it differently, a construct is a *knowledge theorem*. It is in essence what we might helpfully regard as a subcomponent of theory, or as we would like to suggest, a *hermeneutic heuristic* (defined as a fusion of best fit summative and interpretive explanation for a body of related data, ideas, concepts, and argumentation). This idea resembles Gadamer's dialectical *fusion of horizons*, describing the eventual union of subjective and objective ontology (Gadamer, 2004). It is in this respect reminiscent of the literary critical device, *objective correlative*, originally coined by T. S. Eliot (1975).

A recent study in defining style constructs using a Delphi-based approach for an exercise in issues-clarification in a researcher community (Peterson, Rayner, & Armstrong, 2009) reached consensus with the following definitions for the two core constructs identified in the field of styles research: (1) cognitive styles and (2) learning styles.

> Cognitive styles are individual differences in processing that are integrally linked to a person's cognitive system. More specifically, they are a person's preferred way of processing (perceiving, organising, and analysing) information using cognitive brain-based mechanisms and structures. They are partly fixed, relatively stable, and possibly innate preferences . . . .
>
> Learning styles are an individual's preferred ways of responding (cognitively and behaviourally) to learning tasks which change depending on the environment or context. Therefore a person's learning style is malleable. (Peterson, Rayner, & Armstrong, 2009, p. 3)

What is missing from this account is reference to an affective dimension in style modeling, or a consideration of conative functioning, a point to which we return later in this chapter when thinking more carefully about the theoretical utility of the term *intellectual styles* in the grand theory being debated here (see, e.g., Miller, 1987; Myers-Briggs & McCaulley, 1988). Further discussion of this aspect to style theory is considered in our chapter dealing with personality and style in this volume, see Chapter 11.

What Do We Know About Styles?

The straightforward answer to this question is that researchers hypothesize the style construct, measure it and so substantiate it, and are then able to make predictions about how it works as a psychological function. An attempt is then usually made to measure effect. In turn, the researcher can then extrapolate the implications and impact of these effects upon performance. The task facing the researcher is usually tackled in an empirical way. The researcher uses tools associated with experimental design and psychometric assessment. As indicated in Figure 3.2, selected key style models historically have comprised psychometric building blocks with which

theory is further elaborated. The important point here is that these measures represent a selected profile of constituent models in the iterative construction of theory formation in the style differences domain (see Rayner, 2001).

Various studies reporting upon the validity, utility, and reliability of these tools and/or tests may be sourced in the domain literature in what we regard as traditional *inquiry as research* (examples include Armstrong & Cools, 2009; Coffield et al., 2004a; Curry, 1991; Grigorenko & Sternberg, 1995; Kozhevnikov, 2007; Messick, 1976; Moskvina & Kozhevnikov, 2011; Pashler et al., 2008; Rayner & Riding, 1997; Sadler-Smith, 1997; Zhang & Sternberg, 2005). Furthermore, the core principle here, in terms of knowledge production, is the adoption of empirical research comprising the following key steps in developing nascent or basic theory:

- Generating relevant hypotheses, propositions, and predictions about the subject.
- Avoiding overcomplication, simplification, or reified formalization.
- Providing the basis for further validation, reliability, verification, and generalizability.

A great deal of the work reported by various style researchers in the field reflects this approach and it is exemplified here for the purpose of theory formation in the development of nascent theory associated with intellectual styles (see, e.g., Zhang, 2000, 2002, 2003; Zhang & Sachs, 1997; Zhang & Sternberg, 2005).

What is arguably missing in much of this style research is the design and use of innovatory research design. As we have pointed out, there is a long history of experimental study using stand-alone style tests and psychometric measures, ascertaining structure through factorial analysis. Conversely, and as a growing part of a related approach, increasing use of cross-sectional surveys of larger populations to generate sampling data for factorial analysis of data reflects a second traditional approach to researching between group differences (see various contributions in the collection edited by Rayner & Cools, 2011). There is a need, therefore, for considering novel or alternative ways of investigating phenomena, data collection, and reconstructing aspects of style theory. From the point of view of personal and social behavior in human performance, we suspect that new forms of statistical modeling, psychometric measurement, and research methodologies such as those previously mentioned will generate a new methodology for eliciting and analyzing data, shaping a new and hopefully better organization of knowledge and theory (Embretson, 2010; Eriksson, 2003; Kolstad, 2010; Shye, Elizur, & Hoffman, 1994).

Then, moving from the applied context to inform basic and pure research might also be equally worthwhile for new research. This is most certainly not to argue for a rejection of the nomothetic paradigm or quantitative methods. An example of methodological redirection can be found in the work of Marton: After an early career researching the psychometric bases, he reoriented and developed phenomenography as a research method (Marton, 1981, 1986). This is further developed in style research in an approach to the study of learning patterns and teaching styles by Vermunt (1996) and Vermunt and Vermetten (2004). What is proposed here encourages further consideration of context and performance, adopting mixed methodologies in research design (Cools & Rayner, 2011), along with the use of qualitative and

interpretive accounts to provide further evidence of style other than that produced by self-report questionnaires and formal psychometric measurement.

In this way, narrative and other qualitative approaches represent one possible methodological counterpoint to a nomothetic orthodoxy and vulnerability to naive realism, rejecting in turn what Gorsuch (1983) described as statistical fundamentalism. For example, Thorne and Nam explain that narrative psychologists provide insight into how people are not "... in pursuit of objective truth, but to make subjective and inter-subjective sense of who they are, where they have been, and where they are going" (Thorne & Nam, 2009, p. 491). The legitimacy of narratives in providing an epistemology for counseling suggests that person-centered narratives offer a fertile potential epistemology for styles as they enable us "to capture the rich detail and uniqueness of individual personalities" (DeYoung & Gray, 2009, p. 324).

Is There a Grand Theory of Styles?

This question goes directly to the issue of whether there is a valid, robust, and meaningful knowledge set for the style construct. A full answer should provide us with the necessary basis for securing a sense of impact in the world of practice. It gives us the means by which we can safely say (or not) that "styles matter." The task requires a full iteration of the theory formation process (see Figure 3.1). Moreover, it means

- Referencing extant models and axioms in the same subject field.
- Rechecking theory validation, verification, and generalizability.

At this point in theory formation, there is a need as documented by Zhang and Fan (2011) for the deliberate growth of "mature theory." In subsequent work, and drawing upon empirical research, the threefold intellectual styles model is related to other aspects of individual performance in learning and cognition (see Sternberg et al., 2008a; Sternberg, Grigorenko, & Zhang, 2008b) and a consideration of the idea of "mature style theory" (Zhang & Fan, 2011). Indeed, Zhang and Fan argue that the original theory of mental self-government is a "... foundation for the construction of the most encompassing integrative model of styles in the present time the threefold model of intellectual styles" (Zhang & Fan, 2011, p. 56). They cite six decades of research, and a recent publication (see Zhang & Sternberg, 2009), capturing a relevant debate on the topic of styles theory and its implications for learning and education. Indeed, their approach is not dissimilar in argument to our own and that of an earlier call for a *new style theory* made by Sternberg (1997, p. 155).

We believe that there is considerable merit in Sternberg's position on styles. Much of this is captured in recent and continuing discussion of the application of intellectual styles in the psychology of education (Hunt, 2008; Mayer, 2008; Sternberg, 2007; Sternberg et al., 2008a,b). However, there is yet more to consider in fully interrogating extant theory to further develop its content and synthesize other extant knowledge in the field. For example, Sternberg (1997) originally proposed a model

of thinking styles grounded in the theory of mental self-government. The theory is predicated on an argument that these structures are not merely arbitrary or random constructions, but rather "in a certain sense are mirrors of the mind . . . on this view, then, governments are very much extensions of individuals" (Sternberg, 1997, p. 148). The model of mental self-government and the subsequent modeling of thinking and then intellectual styles integrate several aspects of the self in a formal theory (abilities, intelligence, creativity), represented in what we have called individuality (see Figure 3.2). This perhaps represents the initial cycle of an extended and sustained formation of grand theory.

In a similar way, however, it might be argued that Kolb offers an alternative example of a grand style theory (Boyatzis & Mainemelis, 2011; Kolb, 1984, 2007; Sharma & Kolb, 2011). This theory is based upon an extended model of experiential learning and learning styles building upon the theories of Dewey and more extensively, Lewin (see Kolb, 1984). There are other models of cognitive and learning styles that also attempt grand theory (but some perhaps not as persuasively), and although many of these are identified as leading models in the field, many may be criticized for developing theory that is less securely located in a *morphogenic psychology* of individual differences, individuality, performance, and the human mind (see Allport, 1981; Rayner & Peterson, 2009). The way ahead, as identified by Kozhevnikov (2007), and then Moskvina and Kozhevnikov (2011), must ideally involve conceptually reintegrating several theories and models of cognitive style or learning styles into a wider psychological conceptual framework of the person, individuality, and human performance.

We would argue as well that there is a need for more work on psychometric modeling, test construction, and construct validity. In their presentation of an argument for accepting only the existence of two types of style, Sternberg et al. (2008a) refer to maximum performance (*ability-based*) or typical performance (*personality-based*) differences or preferences in learning or thinking. The distinction, however, is one that risks glossing over the important role of the affective dimension in individual functioning. Further, more consideration is needed for the way in which these preferences reflect an array of self-regulating processes in the individual. Ideally, this will lead to more research into aspects of the self as a learner, including systems of metacognition and self-perception.

How Useful Is the Term Intellectual Styles in Theory Formation?

The relatively recent introduction of the term intellectual styles is a very deliberate and welcome attempt at facilitating a unifying theory in style research discussed in this chapter. This might perhaps at one level simply be viewed as an attempt at bringing a new version of grand theory to the field. The following tasks are crucial in taking this approach forward and should include

- Ensuring appropriate commensurability with extant knowledge (data or theory).
- Further interrogating the theory to develop its content.

However, Zhang and Sternberg in beginning this process unequivocally state those intellectual styles can be

> "... used as a general term that encompasses the meanings of all major style' constructs postulated in the past few decades, such as cognitive style, conceptual tempo, decision-making and problem-solving style, learning style, mind style, perceptual style, and thinking style" (Zhang & Sternberg, 2005, pp. 1–2).

An immediate thought arising from this assertion is to ask how we can ensure theoretical commensurability and a full and appropriately developed inclusion of theories, models, and assessment reflected in this description of the individual person's cognitive functioning. To a great extent, Zhang and Sternberg (2005) address this issue by declaring criteria for identifying and incorporating existing relevant models to the threefold model of intellectual styles. This includes selecting models that are considered influential in the styles literature; incorporating style constructs that are operationalized and thus are empirically based; and assimilating style constructs as defined in a model that has been tested against at least one other style construct.

Nonetheless, our same concern for conceptual commensurability occurs when we are told that

> To varying degrees, an intellectual style is cognitive, affective, physiological, psychological, and sociological. It is cognitive because whatever styles one uses to process information, one must be engaged in some kind of cognitive process. It is affective because one's way of processing information and of dealing with a task (i.e., employing an intellectual style) is partially determined by how one feels about the task. (Zhang & Sternberg, 2005, p. 2)

There is, for example, a need to know more about how this definition of intellect encompasses other related psychological constructs and the self-system. There is also a crucial need to further explore the distinctive structural modeling of ability-based and personality-based styles identified by Sternberg et al. (2008a). In a more inclusive model of the person's individual psychology, how do these styles interrelate? And how do these variables and/or other intraindividual differences in turn contribute to the formation and maintenance of individuality defined as either/or traits or states if at all?

The intellectual styles theory to date has generally focused upon the five basic dimensions of preferences: These are identified by Zhang and Sternberg (2005) as underlying (thinking) intellectual styles and are a combination of abilities (intellectual skills and cognitive strategies and processes) and cognitive functioning. Each, in turn, is subsequently defined as a set of personal preferences for employing cognitive processing; for example, a preference for high versus low degrees of structure; cognitive simplicity versus cognitive complexity; a tendency to adopt conformity versus nonconformity; a preference for tasks involving authority as against autonomy; and finally valuing social rather than individual activity in the workplace. Nonetheless, insofar as this debate acknowledges several important points, namely, improving clarity and definition in the use and understanding of terms and concepts,

desirable progress in grand theory formation is clearly taking place. Hunt sums this up when stating:

> For the present, there are different ways to look at the program Sternberg et al. have put forth. If you look at it solely from the viewpoint of summarization of data, the evidence has just a tinge of ugliness. It's oversold. If you look at it from the viewpoint of reductionism, it's irrelevant. If you look on it as the use of a theory of intelligence in educational settings, the criteria change it is an interesting and worthwhile effort. It should be and will be applied in many future studies. (Hunt, 2008, p. 518)

In many respects, the weaknesses identified here by Hunt are countered by findings reported in research utilizing aptitude-treatment intervention as well as a good range of individual studies identified by Zhang and Fan (2011). These provide evidence to support an assertion that the threefold model

> . . . has not only brought together the disparate work completed on styles in nearly the past six decades and, for the first time, taken unambiguous stands on some of the long-standing controversial issues in the field, but also inspired much debate over the nature of intellectual styles. Equally importantly, findings documented in this literature have their practical implications for education and beyond. (Zhang & Fan, 2011, p. 56)

It is our contention, however, that the use of intellectual styles as an integrative term in style theory represents the beginning of a new stage in style theory formation rather than its end, and the term should facilitate further knowledge production in the field. Returning to Figure 3.2, we indicate that there are aspects of an individual's repertoire of styles (affective, conative) and individuality (personality-based styles) that require more theory and research, as well as more clarity in distinguishing between previously identified ability-based and personality-based styles. Put more simply, is there more to the intellect than cognition, thinking, reason, specific abilities, and general intelligence? Is there, for example, a need as originally argued by Allport (1981), and from a slightly different perspective by Messick (1996), and further addressed by Rayner (2000), to differentiate between modeling a personal *style* (singular) as well as a series of intellectual *styles* (plural), with both combining to characterize an individual's typical *modus operandi* in any context?

Whither Styles: What Is the Best Way Forward for Style Theory and Research?

This question formed the basis of an ELSIN Conference symposium at Trinity College, Dublin University in 2007, and generated yet more questions than answers. The work of producing improved grand theory must always relate to extant work in other areas of individual differences. The key tasks in this work are

- Avoiding overcomplication, simplification, and reified formalization of theory.
- Securing the basis for further validation, verification, and generalizability of theory.

While a great deal of "styles" research (including intellectual styles) focuses upon a construct of style modeled as mental function and its underlying cognitive processes, this might in turn usefully be reconnected to an idea of *style* as a second-order, super-ordinate, and unifying structure of the individual as a person. To this end, a unifying formal theory of styles will make further reference to work previously completed (e.g., Messick, 1976, 1994, 1996), and also more recently Kozhevnikov (2007) to assimilate conceptualizations of styles (and other contributions to the idea of individuality). In this approach, a continuing referral would be made to the notion of the self as a complex system of mental functioning (affective, cognitive, and behavioral), using intellectual styles as a term and model for further refining style theory. Such an approach would also require a deliberate paradigm shift and a managed inclusion of the researcher community. A very good example of this kind of work is exemplified in the development of self-regulated learning as a discrete body of knowledge with the formation of formal or grand theory, and more latterly a maturing domain of knowledge extrapolated from what was a disparate and highly contested field of research (see Zimmerman, 2008). Sounds familiar!

Next, we believe that a clearer and explicit rationale for modeling and theory articulation in all style research is required of active researchers in the field. In particular, this should include laying out the positional nature of the research and a clearly stated reference to the question of methodological perspective (ontological, axiological, and epistemological). Armstrong and Rayner (2002) presented an early example of this form of paradigm dialogue and explicit positioning located in the style field. Knowledge in the form of research design and kinds of data would benefit from this kind of *theory tagging*, if it is to be evaluated fairly and its contribution to new knowledge and applied practice appropriately realized.

Lastly, we agree with Sternberg et al. (2008a) when they call for *applied research* to further enhance a range of *basic research* in the style field. As part of this approach, we have argued in this chapter for the continuing role of applied research in knowledge production and theory formation (see Figure 3.1). A further twist to this perspective is the need for explicitly modeling intellectual styles and other aspects of the self in specific individual performance, thereby integrating the many parts of mental functioning making up the way in which individuals differently work or play. A discussion of this idea and some of the wider implications for such an approach to style differences is presented by Rayner (2011) and Rayner and Peterson (2009).

CONCLUSION

Sternberg (1997) suggested some time ago that the field perhaps needed another style theory. He seemed to want to clear the theory board and start again in order to sort out the fragmented style domain. We suggest that a new theory is not required! We do think, however, that there is a pressing need to continue working on developing a more meaningful grand theory in the style domain, necessarily involving direct work with the researcher community. In so doing, we should not simply jettison previous knowledge but encourage researchers as members of a particular academic community to work toward better managing the continuum of theory formation

and knowledge production (Peterson, Rayner, & Armstrong, 2009; Rayner, 2011). As Corr and Matthews argued, when writing about weaknesses in the broad field of personality, "there has never been a greater need for proponents of different research traditions to talk to one another in the service of theoretical integration" (Corr & Matthews, 2009, p. xxxi). The same is equally true of the field in styles research.

In summary, we want to repeat that the function of theory, albeit as a conceptual framework, taxonomy, concept map, schema, or super-ordinate model, is to provide a rational articulation of knowledge. Van De Ven and Johnson (2006) argue that to do this successfully means deliberately and self-consciously engaging in scholarship. They describe a role for *engaged scholarship*, both enhancing the relevance of research for practice and advancing research knowledge in a discipline. In an interesting reference to Aristotelian philosophy as a basis for defining knowledge creation; the authors describe the crucial part communication plays in developing theory. They refer to three key elements: (1) *logos* the message; (2) *pathos* the power to elicit sympathy and empathy; and (3) *ethos* the credibility, legitimacy, and authority that shape the effect of any communication. This is not dissimilar to Klein and Zedeck's (2004) advice that a good theory is novel, imaginative, and interesting, and generates new research, which leads to modification and refinement of theory over time. A theory is both the means and the result of this kind of communication, and forms of theory should be an outcome at each stage of knowledge production in any setting (practical, theoretical, academic, political, and social). The researcher community ideally represents the center stage upon which this communication and scholarship is mobilized as well as enacted.

Lastly, Sternberg (1997) lists five criteria for a successful theory: Ensure that it is elegant, reasonably parsimonious, internally coherent, empirically valid, and heuristically useful. In following this recipe, we are tempted to call theory formation the real stuff of academic scholarship. Furthermore, it is a recipe that calls for the researcher actively mixing meaning with models and measurement to enable advancing our understanding of the style construct in human performance. There is still a great deal to know and we are reminded of a purple cow, the importance of asking the right questions, and the potency of application and utility in research. Sternberg (1996b) described all of these when appraising the state of the field in personality theory. It is hoped that we have tackled the issue of style theory in a similar way by asking some of the right questions, and have shown there is much more work required in further developing theory and new knowledge in the area of intellectual styles and individuality.

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4

Measurement and Assessment of Intellectual Styles

Simon Cassidy

INTRODUCTION

This chapter deals with the issue of measurement of intellectual styles. A number of key topics are considered in order to provide a critical account of approaches to the measurement and assessment of intellectual styles and support sustainability and future development of the field. Part I of this chapter discusses the conceptual basis of intellectual styles, providing essential context for a more focused examination of measurement. Part II of this chapter deals specifically with approaches to the measurement of intellectual styles, examining in detail the self-report approach and associated psychometric issues. Part III of this chapter outlines fundamental issues relevant to, and necessary for, the future development of intellectual styles research and practice, presenting proposals for development of the field along a more cohesive, consensual, aligned, transparent, accessible and methodologically robust path than has previously been the case.

PART I: A CONCEPTUAL GEOGRAPHY OF STYLE

Style as an Individual Difference

Individual differences psychology is the branch of psychology concerned with the study of behavioral and cognitive differences among individuals. It is the study of human variation, forming the foundations of scientific psychology and originating with the work of Sir Francis Galton in the 1860s (Jensen, 1987). The work of German psychologist Wilhelm Wundt in the field of *experimental psychology* in the 1880s is credited with forming the second discipline of scientific psychology (Jensen, 1987). "Style," that is, a habitual pattern or preferred way of processing information or doing something (Allport, 1937; Grigorenko & Sternberg, 1995) is one example that has emerged as a significant individual difference factor in educational, learning, and work-based contexts.

Style Concepts and Constructs as "Intellectual Styles"

There is evidence that the way individuals habitually approach different tasks, situations, and events that is, *style* has an impact on processes such as decision making, problem solving, perception, and learning (Cools, 2009) and ultimately influences behavior and outcomes. Attempts to conceptualize these habitual approaches has led to the evolution of the field of *style* research and the emergence of concepts and constructs such as cognitive style (Allport, 1937), learning style (Kolb, 1976; Vermunt, 1994), learning patterns (Vermunt & Vermetten, 2004), learning strategies (Pask, 1976), approaches to learning and study (Biggs, 1987; Entwistle, 1981; Marton & Saljo, 1976), learning preferences (Dunn, 2003), and thinking styles (Sternberg, 1997). The degree to which these concepts and constructs can be differentiated, and the degree to which they are associated, are critical issues, particularly when discussing appropriate measurement, and will be considered later in the chapter. However, for the purposes of this chapter, and in an attempt to unify the field of style research, these concepts will be referred to collectively using the inclusive term "intellectual styles" proposed by Zhang and Sternberg (2005) as preferred ways of learning, thinking, and teaching. Sternberg uses the term "intellectual styles" as a general term intended to encompass the meanings of *all* the style constructs and labels referred to in the literature (Zhang, 2007; Zhang & Sternberg, 2006). The term proposes a biopsychosocial approach to styles, suggesting that styles are, to varying degrees, cognitive, affective, physiological, psychological, and sociological (see Table 4.1). They are cognitive because styles involve engaging in forms of cognitive processes; affective because the manner in which the task is engaged with is determined in part by motivation toward the task and its outcomes; physiological because styles involve reception of information through the senses (vision, touch, hearing, etc.); psychological because the use of a particular style is dependent upon the interaction of aspects of personality and the environment; and sociological because the preferences for various ways of thinking of the particular society in which an individual lives influences the use of styles (Zhang & Sternberg, 2006). Adopting the term "intellectual styles" as a superordinate descriptor for

TABLE 4.1
Domains of Intellectual Style

Style Domain	Construct Label	Key Dimensions
Cognitive	Cognitive style	Holist–analytic and verbal–imagery
Affective	Approaches to learning and studying	Meaning–reproduction or deep–surface (i.e., depth of processing)
Physiological	Learning preferences (perceptual modes)	Visual, aural, read/write, and kinesthetic (i.e., VAK or VARK models)
Psychological	Learning preferences (personality modes)	Introversion–extroversion (i.e., personality centered)
Sociological	Learning preferences (learner regulation modes)	Structured–unstructured or internal–external regulation

Source. From Zhang & Sternberg, 2006.

a conceptual area populated with so many subordinate constructs provides a helpful starting position from which to consider the thorny issue of styles measurement. In fact, Dunn (2003) adopts a similar approach when describing learning style, referring to subordinate constructs as "strands." Table 4.1 illustrates how the conceptualization of "intellectual styles" may relate to examples of construct labels and key dimensions from existing models of style. These existing models are considered in detail in the section "Reductionism and Styles: Systems and Frameworks" of this chapter.

The Problem With the Notion of Styles

Despite the extensive volume and range of research activity within the field, concerns regarding conceptual validity and construct measurement continue to dominate and, to some extent, undermine, weaken, and pose a significant threat to the credibility of styles research and practice. The concept has been heavily criticized for a lack of consensus among researchers in terms of theoretical basis, conceptual models, construct measurement and validity, construct definitions and terminology, and perhaps most critically, relevance (e.g., Cassidy, 2004; Coffield, Moseley, Hall, & Ecclestone, 2004a; Coffield, Moseley, Hall, & Ecclestone, 2004b; Curry, 1987). Consequently, the field of styles is facing significant challenges. There is a need to deal with both overarching conceptualization of styles and associated terminology in order to identify commonalities and reduce complexity, increase clarity and awareness for researchers and practitioners alike, encourage a critical approach, and promote a properly integrated and theoretically defensible body of research and practice-based activity. Thus, the recent focus for styles research has been on exploring ways to provide clarity and consensus in conceptualizing the construct (e.g., Cassidy, 2004; Peterson, Rayner, & Armstrong, 2009), and ways of reestablishing its relevance by examining it in the contexts of both traditional and novel educationally pertinent contexts (e.g., Cassidy, 2008).

Reductionism and Styles: Systems and Frameworks

Critical review of theories, conceptual models, and associated construct measures has become imperative in order to sustain and advance the field of styles research and application. Given that the concept "style" has been characterized in a number of different ways based on a range of theoretical models, one approach taken in order to achieve a degree of intelligibility is to devise a simplified conceptual framework capable of defining the array of style models along key and common style dimensions. There are perhaps four notable attempts to present such overarching frameworks: Curry's *onion model*; Riding and Cheema's *Fundamental Dimensions*; Riding and Rayner's *Cognitive-Centered, Learning-Centered, and Personality-Centered* approaches; and Zhang and Sternberg's *Threefold Model of Intellectual Styles*.

Curry's "Onion" Model

Curry's (1983, 1987) use of the onion as a metaphor for styles helps to illustrate the inner and outer layers of the concept using the various ways in which styles are measured to propose a layer-like model of intellectual styles and learner behaviors. The first layer is *instructional preference* and refers to individuals' preferred choice of learning environment, including learner preferences for perceptual mode, time of day, structured/unstructured learning, design of the physical environment, and regulation of (i.e., responsibility for) learning (Fleming, 1995). Instruments cited as measuring instructional preferences include the Learning Preference Inventory (LPI) (Rezler & Rezmovic, 1981) that measures preferences for abstract, concrete, individual, interpersonal, student-structured, and teacher-structured learning. Rezler and Rezmovic (1981) present evidence supporting the validity and particularly the reliability of the LPI, although it was developed using samples of health professions' students and many of the published studies using the LPI relate to similar populations. The second layer is *social interaction* and relates to an individual's preference for social interaction during learning. This includes preferences for working with peers and working independently and can be measured according to an individual's type and level of interaction along the dimensions *independent/dependent*, *collaborative/competitive*, and *participant/avoidant*. The Grasha–Reichmann Student Learning Style Scales (GRSLSS) (Grasha, 1996; Reichmann & Grasha, 1974) provide measures of preferences for social interaction along these dimensions, focusing on student attitudes toward classroom activities, teachers, peers, and learning. The GRSLSS continues to be a popular instrument for studies examining student learning preferences (e.g., Diaz & Cartnal, 1999; Meeuwsen, King, & Pederson, 2005) despite the noted paucity of available reliability and validity data for the instrument (Novak, Shah, Wilson, Lawson, & Salzman, 2006). *Information processing style* is presented as the third layer of style and described as an individual's intellectual approach to the processing of information. Instruments associated with the measurement of this layer include Schmeck, Ribich, and Ramanaiah's (1977) Inventory of Learning Processes (ILP) and Entwistle and Tait's (1996) Approaches and Study Skills Inventory for Students (ASSIST), which assess depth of processing according to deep-surface dimensions. Both these instruments have been extensively employed in studies involving students, particularly university students. The ILP, despite evidence supporting its internal consistency and test–retest reliability (Schmeck et al., 1977), has been heavily criticized by Richardson (2004), who concludes that the ILP cannot be recommended for use in investigating student learning. Duff (2000), on the other hand, recommends the continued use of the Revised Approaches to Study Inventory (Entwistle & Tait, 1995) a close forerunner of the ASSIST for educational management and research activity following an examination of the instrument's psychometric properties. The fourth layer of style proposed by Curry is *cognitive personality style*, described by Riding and Cheema as a "relatively permanent personality dimension ... apparent only when an individual's behaviour is observed across many different learning situations" (Riding & Cheema, 1991, p. 195). Construct measures associated with the assessment of cognitive personality style include Witkin's Embedded Figures Tests (EFT) that assess field

dependence–independence according to an individual's ability to disembed a shape from its surrounding field and related to functions of psychological differentiation (Witkin, Oltman, Raskin, & Karp, 1971), and Allinson and Hayes's (1996) Cognitive Style Index (CSI) measuring analysis–intuition and reflecting preference for an approach favoring spontaneity and insight versus reasoning. Both the EFT and the CSI are associated with reasonably robust reliability and validity evidence (Coffield et al., 2004a; Jonassen & Grabowski, 1993; Witkin et al., 1971), although the EFT has been criticized on the basis that it is a measure of ability rather than style given its association with measures of intelligence (Arthur & Day, 1991).

Riding and Cheema's Fundamental Dimensions

From the literature available at the time, Riding and Cheema (1991) were able to identify more than 30 style labels used to describe a variety of cognitive and learning styles. According to Riding and Cheema, it is possible to categorize each of these style labels within a broad categorization system (*families*) developed along two fundamental dimensions. These dimensions represent, first, the way in which information is processed, the *holist analyst* dimension, and, second, the way information is represented, the *verbalizer imager* dimension. Riding (1991) went on to develop the Cognitive Style Analysis (CSA) test, a computerized cognitive style assessment tool based on these fundamental dimensions. Riding's (1991) CSA instrument identifies an individual's position along both the holist–analytic dimension and the verbalizer–imager dimension, representing the integration of the two proposed fundamental dimensions of cognitive style. The CSA has been reported as the most popular computerized measure of cognitive style in the United Kingdom (Rezaei & Katz, 2004), though Peterson, Deary, and Austin (2005) have raised concerns regarding the reliability of the tests verbalizer–imager dimension.

Rayner and Riding (1997) suggest that a growing interest in the application of styles in professional contexts provided the basis for the emergence of *learning-centered* approaches to styles, which is described as emphasizing the impact of styles on pedagogy. The approach is further subdivided according to *process-based* models, *preference-based* models, and *cognitive-skills-based* models. Process models are defined in terms of perceiving and information processing, including Entwistle's (2000) Approaches to Learning model; preference models focus on the individuals' preferences for the learning situation, such as preferred time of day for study, temperature, and includes the Dunn and Dunn Learning Style model (Dunn, 2003). Cognitive-skills-based approaches reflect attempts to apply cognitive-centered models such as field-dependence/independence in the context of the learning environment, but also include perceptual modality (e.g., Edwards Learning Style Identification Exercise; Reinert, 1976) and memory functioning (e.g., Cognitive Style Delineators; Letteri, 1980).

Cognitive-Centered, Learning-Centered, and Personality-Centered Approaches

Rayner and Riding (1997) use Grigorenko and Sternberg's (1995) discussion of the origins of style-based theory and its limitations to consider styles within a framework of specific aspects of individual stylistic functioning. These aspects are

personality-centered, *cognitive-centered*, and *learning-centered* approaches. Although Rayner and Riding acknowledge the personality-centered approach, they focus on cognitive-centered and learning-centered approaches, considering the personality-centered approach to have had only limited influence in the field, evidenced by there being only one model, the Myers-Briggs's style model (Myers et al. 1998), which explicitly refers to personality as a major influence on style type.

Cognitive-centered approaches focus on the tradition of identification of styles based on individual difference in cognitive and perceptual functioning (Grigorenko & Sternberg, 1995). Rayner and Riding (1997) integrate the earlier work of Riding and Cheema (1991) within their discussion of cognitive-centered approaches, categorizing style models into "families" according to the fundamental style dimensions holist–analytic and verbalizer–imager. That both Witkin's field dependence/independence perceptual style and Allinson and Hayes's (1996) intuition-analysis dimension are cited as examples falling within the holist–analytic family illustrate that, even within same-family categories, there are distinct differences between style constructs.

From Sternberg's Thinking Styles to Zhang and Sternberg's Threefold Model of Intellectual Styles

From his theory of mental self-government (Sternberg, 1988), Sternberg presents a model of 13 thinking styles across five dimensions to represent the different ways individuals manage and use their abilities. Although the original model offers a further perspective on styles and, as suggested by Zhang (2006), has a major strength in reflecting the three traditions of styles proposed by Grigorenko and Sternberg (1995), it is the reconceptualization of the model by Zhang and Sternberg (2005) that provides a basis for rationalizing styles research. According to Zhang (2002), the 13 styles are refined, based on empirical study of student learning and development variables, into only three style types (Types I, II, and III). Most importantly in terms of conceptual shrinking and utility, aspects of existing models of styles (e.g., deep-surface approach; holist–analytic) are represented and integrated within the three thinking style types (see Chapter 12 for details).

Reductionism and Styles: Systematic Reviews

The relevant literature includes a number of review articles, which, though not necessarily proposing an explicit conceptual framework, nevertheless still seek to address the absence of a consensual theory of styles and, in doing so, attempt to advance the field (e.g., De Bello, 1990; Curry, 1987; Riding, 1997; Swanson, 1995). Most reviews have taken a similar approach to the selection of models for review. This normally involves some attempt to develop and implement a set of inclusion criteria that offer an element of objectivity to the process of selection, though often the extent of the review is determined by the author's knowledge, experience, and opinion of which models are most influential and therefore worthy of review. In an attempt to find structure and promote cohesion, Cassidy (2004) selected 23 models

of styles for review and assimilation within the existing style reviews offering explicit conceptual frameworks. These frameworks are aligned to create a taxonomy of styles that allows selected models to be placed in the broader context of styles theory and thus enables proper interpretation and integration within the wider research context. Regardless of differences in emphasis, ultimately each of the reviews shares the common aim of seeking to address issues of conceptual fragility, construct operationalization, and reliable and valid construct assessment.

Deconstruction of Styles

Still the major obstacle continuing to threaten the sustainability of the concept of styles in terms of both research and practice is the lack of common understanding in the field regarding theory, measurement, and defined terms. Arguably the most significant review of styles research to date is provided by Coffield et al. (2004a). The findings of their review question both the reliability and validity of the majority of style models and the relevance of the styles approach to pedagogy. Applying common psychometric criteria, including internal consistency, test–retest reliability, and predictive and construct validity, only six of the 13 conceptual models identified as most influential, and examined closely by Coffield and his colleagues, were considered to achieve "acceptable" reliability and validity. The critique is perhaps not solely responsible for but has undoubtedly contributed to the current deconstruction and reevaluation of the field of styles good or bad.

Similarly, Cassidy (2004) identified the need for further empirical investigation to establish the validity of models but recognizes that it is unrealistic to expect that convergence on a single model is possible. Instead, several models may offer a different emphasis that will need to be matched with the particular nature or objectives, that is, the *context*, of each investigation or project. This sentiment is reflected by Coffield et al. (2004b) and by Rayner (2007), who suggested that there may not be "one" learning style model capable of accommodating all instances, but rather that the investigator's selection of the "right" model is dependent upon the context of the work. In fact, it is further suggested here that it may be helpful and progressive to view "styles" as a research area, umbrella term, or hypernym rather than a construct per se which is broad enough to incorporate a number of subordinate constructs. This has already been alluded to by Zhang and Sternberg (2000), who considered the possibility that "style" may simply be a common root word utilized by theories describing different constructs, and by Grigorenko and Sternberg (1995), who suggest that, rather than offering general theories of styles, some style theories are in fact describing only specific and distinct aspects of stylistic–cognitive functioning. Suggested subordinate constructs would include "cognitive style" (e.g., intuitive-analyst; Allinson & Hayes, 1996); "approaches to learning" (e.g., deep-surface; Entwistle & Tait, 1996); and "approaches to studying" (in everyday study situations) (Entwistle, 2000) (e.g., strategic–apathetic; Entwistle & Tait, 1996); and "student learning and instructional preferences" (e.g., environmental, emotional, sociological; Dunn, 2003). It could be argued that as separate and independent subordinate constructs of styles, their validity remains intact. It is only when these

constructs are artificially fused *within* particular measurement instruments that yield a single composite "score" of style, aggregated across subordinate constructs, that construct validity is compromised. Thus, the issue of construct specificity should be a central consideration in both the selection and evaluation of measures of styles.

PART II: MEASURING STYLES

The origins of styles research probably began with Witkin's experimental approach to the measurement of information processing. Perceptual style was assessed using the rod-and-frame test that assesses ability to adjust the rod to a true vertical position within a moving frame (Witkin & Asch, 1948) indicating field dependence/independence. There are some other examples of task-based assessments such as the verbal-imagery dimension of Riding's (1991) CSA test, but the majority of styles assessment relies on self-report measures rather than direct objective observation of style-related behavior. The self-report approach encompasses a number of generic limitations common to any field that adopts the methodology, as well as some specific psychometric considerations and potential shortcomings associated with questionnaire-based instruments. This becomes a major concern for the field of styles given as both Riding (1997) and Cools (2009) noted, the prevailing tradition of psychometrics and self-report assessment in styles research and the inherent weaknesses of the approach.

Self-Report Measures of Styles and Psychometrics

Self-report measures are often considered both inaccurate and unreliable because of a propensity for individuals to report in a certain way because of the influences of social desirability; lack of familiarity with or experience in the area of interest limiting the basis upon which responses are made; or, in relation to retrospective self-report, normal failings of human memory and the capacity for accurate recall (e.g., Riding, 1997). In considering the limitations of self-report methodologies, Razavi (2001) cited theoretical and empirical evidence suggesting that self-report responses are, in fact, a combined product of psychological, sociological, linguistic, experiential, and contextual variables that may be unrelated to the construct being examined. Confounding influences such as these would undermine construct validity and may call into question self-report questionnaire-based measures.

Because of this, it is critical that the psychometric properties of style measures are acceptable, or failing this, that they are at minimum considered and their limitations acknowledged in the particular context of the study (Curry, 2006). As Razavi pointed out "... the danger of self-report assessment lies in its misapplication ..." (Razavi, 2001, p. 5). In this respect, Coffield et al.'s (2004a) extensive systematic review of a number of familiar and influential style measures provides a valuable resource in the context of style measurement. Coffield et al.'s report centers on the detailed review and assessment of the psychometric properties of 13 selected

self-report measures of styles (from 71 originally identified). The review examines reliability and validity through the key psychometric indices of test–retest reliability, internal consistency, construct validity, and predictive validity.

Test–Retest Reliability

Test–retest is perhaps the simplest way of measuring reliability and demonstrating the stability of a measure over time, that is, its *external* reliability. Depending upon the fluidity of the construct and the time interval between test and retest, and notwithstanding the occurrence of a significant intervening factor or event, test–retest coefficients are expected to be high, for example, greater than 0.8 (Anastasi & Urbina, 1997; Kline, 1993). In the context of self-report style instruments, depending upon which functional aspect of a style is being measured and its associated fluidity (or the "hypothetical stability of the construct"; Razavi, 2001, p. 14), test–retest reliability becomes more or less important. Kozhevnikov (2007) discusses evidence suggesting the potential for individuals to "switch" style under certain circumstances according to a mobility–fixity dimension of a particular style. For example, there is evidence to suggest that demands of the learning situation are a pertinent factor in determining approach to learning (Entwistle & Tait, 1990). Thus, the stability of this particular functional aspect of style may be low and test–retest reliability may be compromised depending on the parameters imposed for test–retest. Having said this, of the 13 measures examined in depth by Coffiled et al. (2004a, 2004b), only four are reported as failing to demonstrate acceptable test–retest reliability. A further two are reported as having no evidence either against or in favor of test–retest reliability.

Internal Consistency (Reliability)

Internal consistency demonstrates the degree to which a measure or test is consistent within itself, that is, its *internal* reliability. The internal consistency of psychometric self-report measures can be demonstrated in either of two ways. One is the split-half method, where the test items are randomly divided in order to construct two subtests, both of which are completed by the same sample of participants. The scores from the subtests are then correlated to provide a quantitative measure of internal reliability. The alternative to the split-half approach is to use Cronbach's Alpha (Cronbach, 1951) as an alternative estimator of internal consistency. This is a coefficient that is mathematically equivalent to the average of all possible split-half estimates. In both cases, the stronger the correlation, the greater is the internal consistency and thus internal reliability. Internal consistency coefficients are normally expected to be high, for example, around 0.7 (e.g., Cox & Ferguson, 1994). There are also some subtly different statistical manipulations that can be used as estimators of internal consistency, such as average inter-item and average intertotal correlations. Of the 13 measures evaluated by Coffield et al. (2004a, 2004b), five failed to demonstrate acceptable internal consistency and a further three had insufficient evidence to draw any conclusions on the issue. If we accept the proposition that intellectual style is in fact a composite of several distinct constructs (e.g., Curry, 1983, 1987; Zhang & Sternberg, 2005, 2006), but that many of the style instruments were developed on

the basis of a single-construct theory, then this may provide a partial explanation for their failure to support acceptable levels of internal consistency. Items representing alternative constructs are clearly likely to show lower inter-item correlation.

Construct Validity

In developing a psychometric scale, the objective is to operationalize an underlying concept into a psychological construct. Thus, the construct validity of a scale reflects the degree to which the concept has been captured by the scale, and is evidence that the scale is measuring what it is supposed to be or purports to be measuring. The construct validity of a scale is normally represented by the degree to which it correlates with measures of related constructs (convergent validity) or fails to correlate with measures of unrelated constructs (divergent validity). Internal (or within) construct validity can also be measured through exploratory and confirmatory factor analysis procedures to assess the degree to which the construct measure conforms in terms of factor structure with anticipated structure according to the underlying theoretical context and associated construct subdomains from which the construct measure has been derived. The profile presented by Coffield et al. (2004a,b) for styles measures meeting this particular criterion is one of the poorest. Seven out of the 13 measures failed outright to demonstrate acceptable construct validity, with a further two failing to present sufficient evidence upon which to draw conclusions. Given the evident lack of consensual theory that has been persistent in the field of intellectual styles, it is unremarkable to discover that the very psychometric index that is perhaps most reliant upon sound conceptualization is producing disappointing results. Demonstrating the construct validity of a measure is informed, more than any of the other psychometric properties included in Coffield et al.'s "minimum criteria," by a clear grasp of the theoretical basis and conceptualization of the construct. Such theoretical clarity must be present not just for the originating authors of a particular measure but also for those researchers utilizing the measure and whose work contributes to the ongoing accumulation of sufficient evidence of construct validity. In this respect, it should be noted that Coffield et al.'s (2000b) review of the evidence of acceptable psychometric properties was based on evidence solely emerging from "external" evaluation, that is, research, evaluation, or practice not managed by or supervised by the originating authors of the measures. Originating authors may well argue against the exclusive nature of such a stringent criterion, perhaps with some justification. Other suggested limitations of Coffield et al.'s (2004a) review include a less than convincing basis for the selection of models for review, the effect that the overly negative tone in which the review is presented has on the objectivity with which the report is considered, and flawed methodology related to an inconsistent implementation of rigor within the review (Rayner, 2007). Nonetheless, Rayner (2007) does concede that the review provides a useful description of a wide selection of models, and, while the evidence provided may fall into question, the approach examining reliability and validity as critical concerns for self-report measures, and consequently for intellectual styles measurement, remains important for research and practice in the field.

Predictive Validity

The final psychometric property considered by Coffield et al. (2000b, 2004a) is predictive validity. This is a form of criterion validity in that the score obtained on a measure of a particular psychological construct, in this case one of the intellectual styles constructs, is correlated with the score on a relevant criterion measure, such as academic achievement, measured at some point in the future. Thus, predictive validity is indicative of the potential of a particular measure to predict future relevant outcomes, and therefore adds value to the relevance of and utility of the measure and its associated construct in applied or "real-world" contexts. Again, it is quantified according to the strength of the correlation between scores obtained on the construct measure and scores obtained on the criterion measure, although coefficients are not normally expected to be as high as with reliability testing, given the nature of the relationship between the two measures, where the criterion measure is often multifaceted, as in the case of academic achievement. Coffield et al.'s (2000b, 2004a) assessment of the predictive validity of styles measures is comparable to that of their assessment of construct validity, with only four out of 13 models reviewed demonstrating acceptable validity. Seven failed to meet the predictive validity criterion and two presented insufficient evidence for conclusions to be drawn. It is this particular shortcoming that contributes to one criticism of the style approach, that is, its apparent lack of utility. Coffield et al. (2004b) discussed this in the context of pedagogy, believing that these minimum standards must be met by any instrument intended for use in the redesign of pedagogy or change of practice. Of course there must be justification for making decisions based on the utilization of any psychometric instrument, and the absence of satisfactory predictive power renders any such justification difficult. However, as with some of the other psychometric properties already considered, this needs to be interpreted in the context of a multidimensional styles model.

For example, instruments purporting to measure those aspects of intellectual styles commonly accepted as reasonably stable such as cognitive style (e.g., Sadler-Smith, 1998) may be expected to achieve minimum standards for predictive validity, whereas those aspects of styles that appear to be context-bound and therefore less stable, such as approaches to learning (e.g., Entwistle & Tait, 1990), may fail to achieve acceptable predictive validity because they are much more sensitive to the context of the criterion measure. Approaches to learning measured in first-year undergraduates are unlikely to predict final grade-point average with the same accuracy as for instance, students' cognitive style given the evidence that approaches to learning change in accordance with the students' perceived demands of the learning environment (Entwistle, 1991; Entwistle & Tait, 1990). In fact, Coffield et al.'s (2004a) findings are consistent with such an argument, reporting acceptable predictive validity for Allinson and Hayes's (1996) Cognitive Styles Index measuring cognitive style along analytical-intuitive dimension, but not for either Entwistle and Tait's (1996) Approaches and Study Skills Inventory for Students or Vermunt's (1994) Inventory of Learning Styles measuring approaches to learning according to depth of processing. There is also Kozhevnikov's (2007) argument for a mobility–fixity dimension to styles and Zhang and Sternberg's (2006) assertion that intellectual

styles can be taught, both of which also impinge on the veracity of predictive validity in the context of psychometric measures of styles.

The suggestion is not that psychometric properties are unimportant. On the contrary, given the limitations associated with self-report measures, the psychometric properties of self-report measures should be contextualized. Razavi (2001) noted that the advantages of self-report measures are largely dependent upon their psychometric properties, which are both fundamental to classic psychometric theory (e.g., Nunnally, 1994) and critical to the interpretation of data collected using such instruments. However, Razavi also argued that the potential for variations in construct stability, and the fact that not all constructs are expected (according to their underlying theory) to exhibit perfect homogeneity (Silva, 1993) may negatively affect reliability coefficients, and that it is the validity of the measure that should therefore take priority over reliability. Finally, Razavi (2001) suggested that it is *construct* validity that should take precedence in line with the view that it encompasses all other forms of validity (Anastasi & Urbina, 1997).

Thus, existing construct measures may fare better according to Coffield et al.'s (2000b, 2004a) "minimum criteria," provided future reliability and validity testing is conducted in line with a conceptualization of style that recognizes distinct style constructs, and this should be borne in mind when considering any limitations of the evidence presented in Coffield et al.'s (2000b, 2004a) review. In their account of psychological testing, Kaplan and Saccuzzo (1997) discuss, under "theoretical concerns," the assumption made by psychologists that they are measuring a stable entity that is absolute and that exists independent of environmental and situational factors. Kaplan and Saccuzzo suggest that such an assumption is flawed and cite empirical evidence provided by Cacioppo, Bernston, and Anderson (1991), and Rowe (1987) indicating that "... even the best tests have yet to achieve such temporal stability ..." (Kaplan & Saccuzzo, 1997, p. 607). Hence, the future utilization or development of style instruments should be construct specific, and their application or use should be context specific. That is, measurement of style should be firmly bound by both the precise purpose of the study and the context of the study, as discussed in the sections "Deconstruction of Styles", "Self-report measures of styles and psychometrics", and "Why measure styles and which style construct to measure?". In fact, construct specificity and context specificity should be central concerns for the future research direction and associated research design in the field of intellectual styles.

Why Measure Styles and Which Style Construct to Measure?

The first major issue that must be addressed prior to selecting an instrument to measure style or considering it against minimum standards of reliability and validity is to decide why styles are being measured and which intellectual style construct it is that you intend to or *need* to measure in order to achieve the aims of the study or project. In general, interest in the measurement of intellectual styles continues because of styles' relevance to understanding and explaining individual functioning in a range of both educational and work-based settings and applications. The

following sections present examples illustrating the relevance of each of the proposed intellectual style constructs and may guide decisions regarding which construct to measure and why.

Cognitive Styles

A key finding reported by Hayes and Allinson (1996) in their review of studies involving cognitive styles in education is that accommodating individual differences in style had a beneficial effect on learning and performance. This is an exciting finding when combined with those of Riding and Pearson (1994) and Riding and Agrell (1997), who found that cognitive style (holist–analytic/verbal–imager) was not related to measures of general intelligence. Riding (2000), in his review of cognitive styles, cited a whole range of areas in which cognitive styles have been shown to play an important role to varying degrees. These include instructional preference and mode of presentation, subject preference and educational achievement, motor skills, social behavior, and behavior problems and decisiveness. Both extreme analytics and extreme holists were shown to be the least decisive, perhaps because of their tendency to consider all the possible outcomes (analytics) or consider all relevant aspects in a broad perspective (holists) (Riding & Wigley, 1997). Sadler-Smith and Riding (1999) demonstrated an association between cognitive style and learning preferences, with analytics preferring internal control when questioned about instructional preferences. In terms of individual achievement, studies have indicated the impact of cognitive style on academic achievement, with verbalizers performing better (according to teacher ratings) than imagers for learning a second language (Riding, Rayner, & Banner, 1999), while Riding and Agrell (1997) reported an interaction effect between intelligence and cognitive style, where style proved more important for low-ability pupils than high-ability pupils in school achievement.

Information Processing Styles

Examining approaches to learning and depth of processing models (e.g., Entwistle & Tait, 1996), Cassidy and Eachus (2000), Cassidy (2006), and Cassidy (2008) reported positive associations between deep (meaningful) and strategic (achieving) approaches and students' perceived academic proficiency, academic achievement, positive academic self-efficacy beliefs, and internal academic locus of control. Surface (reproducing) approach was negatively associated with students' perceived academic proficiency (Cassidy & Eachus, 2000) and academic achievement (Cassidy & Eachus, 2000; Diseth, 2002; Richardson, 2003), and positively associated with external academic locus of control (Cassidy & Eachus, 2000). A deep approach has also been found to be positively associated with student self-assessment skill or accuracy (Cassidy, 2006), and there is some evidence that a deep approach is associated with competitive attitude in undergraduates (Cassidy, 2008). Marton and Saljo (1997) asserted that students are aware of, and sensitive to, the demand characteristics of the assessment. According to Entwistle and Tait (1990), students showed a preference for assessments that they perceived to reflect their dominant approach to learning. Hay and Kinchin (2006) also presented examples of how the deep-surface model has been used to successfully distinguish between grasp of meaning and acquisition

of additional knowledge by rote, providing evidence of how approach to learning and learning outcomes are related, and thus demonstrating the relevance of at least this model of style to pedagogy.

Learner Preferences Styles

There is evidence indicating that individuals show particular learner preferences around issues such as time of day (Callan, 2003), physical environment (Burke, 2003), perceptual modality (Raupers, 2003; Roberts, 2003), structure of teaching approach (Minotti, 2003), and level of interaction with peers and tutors (De Paula, 2003). The critical point of most of the work in this area of styles is not that one preference (style) is better or worse than another, but that there are benefits in accommodating learner preferences and costs in failing to accommodate learner preferences. For instance, Virostko (1983) reported significantly higher standardized test scores for academic subjects taught at the preferred time of day when compared with subjects taught at nonpreferred time of day. While Callan (1999) reported a "statistical advantage" for students with morning as their preferred time of day, concluding that traditionally this is when core subjects such as mathematics are taught and tested. Raupers (2003) claimed that research on perceptual preferences (auditory, visual, tactual, and kinesthetic) demonstrated both improved academic achievement and improved attitude to learning when instructional approach was congruent with perceptual preference. Roberts (2003) considered perceptual preference in a developmental context, suggesting that younger child learners are almost exclusively tactual/kinesthetic learners and that observing and accommodating perceptual preferences leads to significantly higher academic achievement. Similarly, Zenakou, Kouvava, Antonopoulou, & Stampoltzis (2007) identified a preference for kinesthetic learning in dyslexic students compared with nondyslexic students, and presented evidence suggesting that the approach may hinder achievement in school where mainly visual, auditory, and verbal processing approaches are required, but that the kinesthetic approach is better accommodated in a university environment.

The sections "Cognitive Styles," "Information Processing Styles," and "Learner Preferences Styles" provide examples of construct-specific intellectual styles research and practice that are intended to help illustrate distinctions *within* the field, and to emphasize the relevance of *context* in selecting construct measures. Thus, measuring learner preferences styles may have great relevance to a study exploring curriculum design, but be of little value in a study exploring how intellectual styles relate to how police officers respond in emergency situations. Equally, given evidence suggesting differences in decisiveness between holists and analytics (Riding & Wigley, 1997), measuring cognitive style in police officers would be relevant in a study of how police officers respond in emergency situations, but perhaps of less value in a study exploring curriculum design.

So, the two issues central to the measurement of intellectual styles are: (1) what functional aspect of styles is to be measured (guided by suggested style domains and construct labels; see Table 4.1) and (2) does the chosen measure meet minimum standards of psychometrics (which may be interpreted in the context

of both the particular aspect of style functioning being measured and the intended context of the study; see the section "Self-Report Measures of Styles and Psychometrics")?

PART III: RUDIMENTS FOR THE FUTURE DEVELOPMENT OF INTELLECTUAL STYLES RESEARCH AND PRACTICE

There are perhaps two discernible tiers or levels of activity currently present in styles work. The first is the *superordinate* tier, where activity is concerned with conceptualizing styles and is conducted by, or is the responsibility of, those authors central to the debate and who have already provided a major influence in the area. It is their responsibility to focus on the sustainability and future development of the field. The second *subordinate* tier focuses on the application of styles in real-world contexts and provides evidence regarding the continued relevance of styles in practice. Activity at this level is conducted by researchers and practitioners concerned with certain aspects of styles, and not necessarily concerned with contributing to the debate regarding conceptualizing styles. Whereas previously these two tiers may have operated independently with little regard for developments in the other tier, the future of the field requires that they now recognize a responsibility for potential impact outside their own tier. Thus, the superordinate tier has a responsibility to develop a consensual theory of styles and the subordinate tier has an equal responsibility to observe any such theory and develop research and practice that *explicitly* observes these theoretical parameters. On this basis then, there may be two separate rubrics that apply separately according to the tier of activity, but together they enhance the sustainability and development of styles research and practice. Both Riding (2000) and Curry (1983, 1987, 2006) pointed to specific criteria that need to be met for the future development of style research and that clearly span the two tiers (see Table 4.2).

TABLE 4.2
Illustrative Examples of Superordinate and Subordinate Tiers of Style Research

Superordinate Tier	• Conceptual clarification (Curry, 1983, 1987, 2006) • Identifying the fundamental dimensions of styles (Riding, 2000) • Situating styles in the context of other individual difference constructs and modeling their interaction and impact on behavior (Grigorenko & Sternberg, 1995; Miller, 1987; Riding, 2000; Zhang & Sternberg, 2005)
Subordinate Tier	• Development of simple, valid, and direct measures of styles (Riding, 2000) • Establishing reliability and validity evidence of style measures against minimum standards (Curry, 2006) • Establishing clear relationships between measures of styles and objectively observable behavior in diverse settings (Riding, 2000) • Continuous attention to the relevance of styles for practice (Curry, 2006)

In a synthesis of recent developments in the styles field, Cools (2009) presented a proposed agenda for future development of the field. The proposed agenda closely addressed those issues raised by Riding (2000) and Curry (2006), outlining specific requirements for advancement of styles research and practice. These included the need to establish the link between style and ability, personality and affect; the need to develop and empirically test an integrated (including styles) model of individual differences; the need for longitudinal, contextual, and cross-sectional research designs to add to knowledge of the origins and determining factors of style; the need to endeavor to establish fundamental dimensions of style through comparison of style models; the need to adopt a pragmatic approach to research design, focusing on and thereby enhancing the practical relevance of styles; and the need to draw evidence from multiple sources of data using both quantitative and qualitative methodologies.

In the context of a discussion on measurement, it is Cool's final agenda issue regarding sources of data and research approach that rightly form the basis of concluding comments for this chapter. Research in the field has been dominated by single-source self-report styles data. The field is dogged by criticisms regarding reliability and validity, and the limitations of self-report psychometric measures discussed by Razavi (2001) and Riding (1997) have already been considered. In addition, Razavi (2001) also noted the effect of monomethod bias (employing only a single construct measure) as a threat to construct validity and how weaknesses in self-report methodologies can be countered, limited, and compensated for through stronger research designs. It therefore seems an obvious progression, which is long overdue, that multi-source/multimethod/mixed methods approaches should form the order of the day for future research and practice-focused style studies. Gathering data from multiple sources and using multiple methods which are still likely to include self-report psychometric measures as well as more direct measures of styles and style-related behavior will serve not only to validate study-specific data and enhance interpretation, but also to provide much-needed evidence contributing to the validation of existing measures of styles. Some of the advantages of a mixed-method approach suggested by Greene and Caracelli (1997) include testing consistency of findings across data sources or challenging the findings from one method with those from another; enabling findings from one method to be further clarified or illustrated by findings from a complementary method, adding richness and detail, deepening understanding of findings, and providing new directions or research questions. Mixed method approaches that combine traditional quantitative approaches to styles measurement with qualitative approaches can exploit the strengths of each approach. That using multiple approaches can overcome the limitations of a single-method approach (Spratt, Walker, & Robinson, 2004) is highly pertinent in the context of styles research, and will enhance interpretation and application of findings, improving, particularly, the practice-based relevance of styles (Cools, 2009).

Minimum standards in terms of psychometrics have been emphasized in this chapter and it would be remiss not to refer to the existence of accounts that provide a more critical assessment of the approach. Both Howe (1997) and Richardson (1999) are examples of such accounts, each presenting highly negative appraisals of the psychometric approach albeit in the context of intelligence research. A

thorough and perhaps more objective and balanced account of psychometrics is provided by Kaplan and Saccuzzo (1997), who consider psychometrics in the broader contexts of psychological testing and research design. Thus, minimum standards of research *design*, in addition to minimum standards of psychometrics, should also be observed and met. Researchers should aim to incorporate an element of cross-referencing and verification in their design, where multiple measures, sources, and methods serve to verify style constructs and protect the integrity of the research and associated findings and implications for practice.

It is probably time to seriously explore alternative, more sophisticated designs in styles research that move away from survey approaches and correlational designs, that is, a paradigm shift (Cools, 2009). In order to reestablish the credentials of the field, it is necessary to return to a "harder-edged" experimental approach that investigates and quantifies the impact of styles on functioning, that explores what interventions (if any) have an effect on styles, and that permit assertions regarding causal direction in styles research. In many respects, it is simply a case of exploiting preexisting alternatives. For example, Witkin's rod-and-frame test has been developed into a computer-based simulation assessing vertical perception and thereby field-dependence, offering a more convenient alternative to the mechanical version of the test (Bagust, 2005). Witkin's Embedded Figures Test is also available as an online assessment (Yoo & Park, 2006). Developments in eye-movement and eye-tracking and functional magnetic resonance imaging (fMRI) technology also offer possibilities to assess potential brain-based and perceptual/cognitive-based indices of styles. Using fMRI, Kraemer, Rosenberg, and Thompson-Schill (2009) found that activity in brain regions associated with pictorial viewing and phonological processing correlated with corresponding self-report measures of visualizer–verbalizer cognitive style, suggesting modality-specific cortical activity underlying visual and verbal cognitive styles. Dong and Lee (2008) found that eye-movement data (indicative of underlying cognitive processing and strategies) supported cross-cultural differences in holistic–analytic cognitive style (proposed by Nisbett, 2003) and web page viewing patterns, and recommend that webpage design be carried out according to the target audience's specific cognitive styles to enhance usability. It is evidence such as this, relating to the *impact* of intellectual styles, that will likely provide the most powerful catalyst for recovery of the field and underpin a renewed credibility.

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5

The Etiology of Intellectual Styles: Contributions From Intelligence and Personality

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Intellectual style is a construct that is rooted in both the literatures on intelligence and personality and, at least partially, is intended to connect these two literatures. In individuals, the connection between intelligence and personality arises and unfolds as a person, possessing both, utilizes them in unique combinations in any given situation. Thus, styles are a type of psychological phenomenon, one that encapsulates the dynamics of the interactions between intelligence and personality in particular situations (for detailed reviews, see Sternberg, 1997; Sternberg & Zhang, 2001; Zhang & Sternberg, 2006).

This general definition of styles suggests that this construct might have both stable and dynamic features. Specifically, because both intelligence and personality form the foundation of styles, they establish the stable features of an individual's styles. However, because styles are manifested in many different situations, dynamic features are necessary for flexible and adaptive reactions to these situations.

Moreover, this general definition of styles also suggests that, etiologically, styles might arise through the recruitment of the etiological factors that contribute to intelligence and personality. In other words, a hypothesis can be formulated that, given that *styles* are constructs that are at least partially derived from intelligence and personality, some insight can be gained into the etiology of styles by looking into the etiologies of intelligence and personality.

In this chapter, we attempt to do just that: Using the literatures on the etiologies of intelligence and personality and the very limited literature on the etiology of styles, we present some comments on the origins of individual differences in intellectual styles. We focus exclusively on the genetic etiology of intelligence, personality, and styles. There is, of course, a need to explore all sources of individual differences, whether primarily genetic or primarily environmental. Yet, here, the accent is made on the genes as sources of individual differences and, therefore, the chapter is not comprehensive. Nevertheless, such a move from genetic sources of variation in intelligence and personality to such sources of variation in intellectual styles can be informative. We argue, in the end, that it is the very fine texture of intellectual styles, the intertwined threads of intelligence and personality, and the merging elements of their etiologies into the etiology of styles that make intellectual styles

so elusive, so "stylish." This elusiveness has been discussed by many, who have questioned the specificity of styles and their uniqueness from both intelligence (e.g., Cronbach & Snow, 1977) and personality (e.g., Allport, 1937). And yet the construct of styles keeps coming back, in different guises and forms, simply because there is something in intellectual styles that cannot be fully explained either by the concept of intelligence or the concept of personality. Regardless of the number of theories on intellectual styles and the voluminous literature on them, there is an underappreciation of the need of such constructs, as well as a lack of understanding of their etiology.

GENETIC BASES OF INTELLIGENCE

Despite its many flaws and limitations as a construct (e.g., Cianciolo & Sternberg, 2004; Sternberg, 1996), IQ has been widely used in studies aimed at exploring the etiology, especially the genetic etiology, of cognition. Results of dozens of heritability studies of IQ, when summarized in a review or meta-analyzed, suggest that IQ's heritability is ~0.50 (Plomin & Spinath, 2004).

Given this level of heritability, researchers have engaged in a search for the specific genes that are behind the genetic component of IQ's etiology. Such searches can unfold in two ways: by means of exploratory whole-genome investigations/screens and by means of hypothesis-driven studies of candidate genes. Both approaches have been used in studies of IQ.

In genome-wide linkage and association studies (often referred to as "scans"), the whole genome is covered, more or less equidistantly, with a large number of genetic markers that might be localized within a gene or in between-gene gaps of DNA. The point of such scans is to identify a particular region of the genome at which, based on specific statistics, there is an indication of the presence of putative candidate genes for the trait of interest. In other words, researchers start their search with the whole genome and then gradually, using statistical approaches, narrow their examination to specific regions of specific chromosomes, excluding the majority of the genome. Once such regions are identified, they are mined for the genes located in them, so that a specific gene or a number of genes in that region, possibly contributing to the signal, can be detected.

Until now, there have been six genome-wide scans for genes contributing to intelligence and cognition; the results of these scans coincided in regions on chromosomes 2q, 6p, and 14q as putatively harboring genes that could explain some of the variance in IQ (Buyske et al., 2006; Dick et al., 2006; Luciano et al., 2006; Posthuma et al., 2005; Wainwright et al., 2006). Note, however, that since the publication of these data, more high-resolution molecular methods have been developed. Specifically, one such method, a whole-genome association study with more than 500,000 single-nucleotide polymorphisms (SNPs), was applied in studies of human memory (Papassotiropoulos et al., 2006). The results revealed potential effects on cognition, in particular on memory, of an SNP in the *KIBRA* gene located at 5q35, which encodes a neuronal protein. Although the *KIBRA* association has not been replicated yet, it is fully anticipated that within a relatively short period of time, many more scans with dense genetic maps will be conducted.

In candidate-gene investigations, the inquiry typically starts with a well-characterized candidate gene (or a set of genes) whose functions have led researchers to believe that it might have a role in forming the genetic foundation for individual differences in IQ. There have been numerous studies of a variety of candidate genes (for reviews, see Deary, Johnson, & Houlihan, 2009; Deary, Spinath, & Bates, 2006; Payton, 2006; Posthuma & de Geus, 2006; Shaw, 2007). Among these genes are (a) neurotransmitters and genes related to their metabolism (e.g., catechol-*O*-methyl transferase, *COMT* located at 22q11; monoamine oxidase A gene, *MAOA* at Xp11; cholinergic muscarinic 2 receptor, *CHRM2* at 7q33 (for a recent study, see Lind et al., 2009); dopamine D2 receptor, *DRD2* at 11q23; serotonin receptor 2A, *HTR2A* at 13q13, metabotrophic glutamate receptor, *GRM3* at 7q21, and the adrenergic alpha 2A receptor gene, *ADRA2A* at 10q25); (b) genes related to developmental processes, broadly defined (e.g., cathepsin D, *CTSD* at 11p15; succinic semialdehyde dehydrogenase, *ALDH5A1* at 6p22; type-I membrane protein related to β-glucosidases, *klotho* at 13q13; brain-derived neurotrophic factor, *BDNF*, at 11p14; muscle segment homeobox 1, *MSX1* at 4p16; synaptosomal-associated protein 25, *SNAP25*, at 20p12); and (c) genes of variable functions (e.g., heat-shock 70 kDa protein 8, *HSPA8* at 11q24; insulin-like growth factor 2 receptor, *IGF2R* at 6q25; prion protein, *PRNP* at 20p13; dystrobrevin binding protein 1, *DTNBP1* at 6p22 (for a meta-analysis, see Zhang, Burdick, Lencz, & Malhotra, 2010); apolipoprotein E, *APOE* at 19q13; cystathionine-β-synthase, *CBS* at 21q22; major histocompatibility complex, class II, DR, *HLA-DRB1* at 6p21). Some recent studies have investigated *ADRB2* (Bochdanovits et al., 2009), *S100B* (Houlihan, Harris, Deary, & Starr, 2010), *NTM* and *NR3C2* (Pan, Wang, & Aragam, 2011), *ATXN1* and *TRIM31* (Rizzi et al., 2011), *ATXN1*, *TRIM31*, and *FACL4* (Zhang, Gao, Qi, Li, Zheng, & Zhang, 2010; Zhang, Zheng, An, Gao, & Zhang, 2010). Clearly, there are too many genes to even try to explain what the function of each of them is. Here we will only point out that, in fact, they differ in function dramatically; this very observation suggests that there is no single gene(s) for intelligence. What transpires through these investigations is that whatever underlies the heritability of IQ appears to be related to the properties of the function of the brain, of which IQ is, perhaps, one of many indicators. It is possible that intellectual styles are also one of many indicators of particular patterns of brain function, which are heritable, but yet are not ascertained and described.

It is important to note, however, that in many of these studies of genes and cognition, the behavioral variables of interest are defined beyond IQ. In fact, they encompass a whole gamut of characteristics of intelligence and even cognition (e.g., executive functioning, working memory, and IQ itself). And, though to many readers of this handbook these details might seem rather technical, establishing these specific associations between genes and intelligence (or cognition, however broadly defined) is a fundamental breakthrough, a switch from the hypothetical decomposition of variance that was characteristic of earlier heritability studies. The hope is that by understanding the functions of these genes and the interactive networks of their proteins, the field will gain some additional understanding of how the general biological (and the specific genetic) machinery of intelligence works.

Along these lines, one other relatively recent development in the literature connects the etiology of intelligence with the etiology of the brain structure. This common

genetic basis has been suggested, in particular with regard to the observation that the correlation between the brain properties of monozygotic twins and their intelligence is higher than in dizygotic twins (Posthuma et al., 2002). Summative interpretations of the literatures on intelligence and the brain (e.g., Hulshoff Pol et al., 2004; Joshi et al., 2011) point to the connection between IQ and the volume and density of the gray and white matter in the brain network that engages the regions of the right medial frontal, occipital and right parahippocampal (gray matter), and the regions of the superior occipito-frontal fascicile and corpus callosum (white matter connecting the corresponding gray matter regions). The *COMT* gene that was mentioned above has also been associated with difference in white matter and a role in intelligence (Deary et al., 2009; Liu et al., 2010).

Developmentally, increases in gray and white matter volume and density (i.e., increases in cortical thickness) are associated with brain (and, correspondingly, cognition) maturation. This maturation is the result of numerous morphological changes, including the formation of new neuronal connections by dendritic spine growth, as well as changes in the strength of existing connections (Chklovskii, Mel, & Svoboda, 2004), and the axonal remodeling and increased soma and nuclei of neurons (Kleim, Lussnig, Schwarz, Comery, & Greenough, 1996). These changes have been attributed to both genetic and environmental effects that are unfolding in a complex systemic fashion (Shaw, 2007). Although the causal hypothesis connecting brain maturation to the development of intelligence has been rooted in and supported primarily by animal literature, there are many correlational human studies that indirectly buttress this hypothesis. Specifically, postmortem studies indicate that the brains of individuals with higher IQ and higher levels of education are characterized by a greater number of dendrites and more dendritic branching (Jacobs, Schall, & Scheibel, 1993; Jacobs & Scheibel, 1993) compared to individuals with very low IQs (Huttenlocher, 1991). Yet, recent evolutionary analyses of the covariation between brain size and intelligence indicate that there is an evolutionary preference for strong stabilizing (average-is-better) selection (Miller & Penke, 2007). Thus, although within a given population there is a tendency for intelligence and brain size to correlate, there is no evidence that evolution systematically promotes big brains and/or high levels of intelligence. One possible hypothesis here might be that this preoccupation with being average in terms of having more stable, biologically controlled traits (e.g., brain size and structure) might explain the greater flexibility and diversity in more dynamic traits such as style. For example, there is a lot of diversity in how people use their average cars (or their average TVs or vacuum cleaners), and those stylistic diversions might be what is encouraged by evolution (metaphorically speaking, of course).

There is some hope that these attempts to bring together genetic studies of the brain and cognition will lead to some insight into what underlies various forms of intellectual functioning, including its stylistic characteristics. To exemplify this line of work, here I present brief comments on research on three particular genes, *APOE*, *COMT*, and *BDNF*, which are clearly relevant to research on both brain structure and intelligence.

The apolipoprotein E gene (*APOE*) is located on chromosome 19q13 and is responsible for the production of an apoprotein that is essential for the normal

catabolism of triglyceride-rich lipoprotein components. This gene has been long studied in the context of research of neuronal development and repair; this research, in turn, is directly related to work on Alzheimer's disease (AD) (Blackman, Worley, & Strittmatter, 2005; Buttini et al., 1999; Rapoport et al., 2008; Teasdale, Murray, & Nicoll, 2005; Teter & Ashford, 2002). The gene is polymorphic, and there are three variants of *APOE* that have been studied extensively: *ApoE2*, *ApoE3*, and *ApoE4.* These variants are responsible for the production of three different isoforms (Apo-ε2, Apo-ε3, and Apo-ε4) of the protein that differ only by single amino acid substitutions, but these substitutions have been shown to be associated with dramatic physiological outcomes. Of these three isoforms, Apo-ε3 is associated with a normal protein, whereas Apo-ε2 and Apo-ε4 are related to abnormal proteins. In the context of this chapter, the *ApoE4* allele is of particular interest because it has been associated with atherosclerosis, AD, reduced neurite outgrowth, and impaired cognitive function. To illustrate, a meta-analysis of dozens of studies combining the data from ~20,000 individuals established that possession of the *ApoE4* allele in older people was associated with poorer performance on tests of global cognitive function, episodic memory, and executive function (Small, Rosnick, Fratiglioni, & Backman, 2004). Moreover, it has been shown that young healthy adults who carry the *ApoE4* allele demonstrate altered patterns of brain activity both at rest and during cognitive challenges (Scarmeas & Stern, 2006). In a pediatric cohort, carrying the *ApoE4* allele was related to having a thinned cortex in the region of the brain, the so-called entorhinal region, where the earliest AD-associated changes are typically registered (Shaw et al., 2007). There is also some evidence that the *ApoE2* allele may be protective; however, the mechanisms of this differential action of the variants in the *APOE* gene are not understood (Deary et al., 2002; Smith, 2002; Sundstrom et al., 2007). Yet, the variation in this gene and its connection to variations in cognition and, subsequently, to the possible acquisition of AD, is of great interest to researchers in a variety of fields.

Similarly, the connection between the protein and its respective isoforms, the brain structure, and cognition is of great interest to researchers studying the gene for catechol-*O*-methyl transferase (COMT). Among polymorphisms in this gene, there is a single-nucleotide substitution (G-to-A), which in turn leads to a valine-to-methionine substitution at codon 158. This polymorphism is typically signified in the literature as the Met158Val variant. The function of this polymorphism is well studied: The Met158 allele results in a fourfold decrease in enzymatic activity in the prefrontal cortex (Lachman et al., 1996). This functional property of the Met158 allele results in slower inactivation of dopamine in the prefrontal cortex (Tunbridge, Bannerman, Sharp, & Harrison, 2004; Winterer & Goldman, 2003). It has been hypothesized, based on a number of findings in the literature, that slower inactivation of dopamine in the prefrontal cortex and, correspondingly, the possession of the Met158 allele, may confer a greater efficiency in prefrontal cortical processing (Winterer & Goldman, 2003) and thus higher IQ (Barnett et al., 2007; Tunbridge, Harrison, & Weinberger, 2006). A meta-analysis conducted by Barnett, Scoriels, and Munafò (2008) found no significant association between the Met158Val variant of the *COMT* gene and cognitive ability. Although, in general, the literature seems to be consistent in supporting the general hypothesis of the link between this variant

of *COMT* and cognitive functioning, it presents many complexities for the field's understanding of the role of this polymorphism in cognition. First, there are other polymorphisms in the *COMT* gene that affect the dopamine metabolism (e.g., Palmatier et al., 2004). Second, the *COMT* is not the only gene that affects this turnover (i.e., metabolism); in fact, there is evidence for the importance of gene–gene interactions in this turnover for example, the role of polymorphisms in the *DRD2*, dopamine receptor D2, gene (Reuter et al., 2005). Third, there are interesting studies showing the differential (in some cases differentially advantageous, in others disadvantageous) impacts of Val and Met on a variety of psychological functions (Stein, Newman, Savitz, & Ramesar, 2006). And, fourth, there are mixed reports regarding the connection between the Met158Val polymorphisms and cognition across the lifespan (Harris et al., 2005). Finally, this gene has also been associated with personality characteristics as well, for example, the extraversion trait (Smillie, Cooper, Proitsi, Powell, & Pickering, 2010).

Another Val-to-Met substitution of interest in our discussion is the Val66Met, G196A (rs6265) in the brain-derived neurotrophic factor gene, *BDNF*, which is located at 11p13. The BDNF protein is involved in both the survival of existing neurons and synapses and the growth and differentiation of new ones. There have been conflicting reports about this polymorphism connection with cognitive functioning and memory. A number of studies have reported the Met allele's impact on long-term memory (Dempster et al., 2005; Echeverria et al., 2005; Egan et al., 2003; Hariri et al., 2003; Tan et al., 2005), whereas others have not been able to reproduce this finding (Strauss et al., 2004). Yet, other studies have shown that the Met allele may be associated with a decrease in short-term memory (Echeverria et al., 2005; Rybakowski, Borkowska, Czerski, Skibinska, & Hauser, 2003; Rybakowski et al., 2006), IQ-related tasks (Tsai, Hong, Yu, & Chen, 2004), and indicators of fluid intelligence and processing speed (Miyajima et al., 2008). To further complicate the matter, other studies have found that those with a Met/Met score higher than those with Val/Met and Val/Val on certain tests of cognitive ability, including the Raven's matrices, a nonverbal measure of IQ (e.g., Harris et al., 2006). The Met allele has also been reported to play a protective role in certain neurological conditions and is associated with improved nonverbal reasoning skills in older adults (Oroszi et al., 2006).

In order to better understand BDNF's role in cognition and cognition-related processes, Mandelman and Grigorenko (2011) conducted a meta-analysis considering all the available published literature on BDNF and cognition with extractable data. The phenotypes that were included in the analysis were general cognitive ability, memory, executive function, visual processing skills, and cognitive fluency. The meta-analysis found no significant associations between the Val66Met polymorphism and any of the phenotypes that were included. It is important to note that the meta-analysis was somewhat limited by the small number of studies published on this polymorphism and it is possible that if more studies were included the results may be different.

How can all this information be related to the question of the etiology of intellectual styles? As per current views of the genetic etiology of intelligence, a substantial portion (~50%) of the population's variation in intelligence is controlled by variation in genes. It appears that many genes are involved in this control and,

although collectively they account for a substantial amount of individual differences in intelligence, individually they appear to exert only small effects. There are multiple candidate genes that might be influencing intelligence, but their roles have not been convincingly and consistently verified.

What might we conclude from this summary that is relevant to the discussion of intellectual styles? First, because intellectual styles, at least partially, overlap with intelligence, it is likely that their etiology is also, at least partially, controlled by genes. Second, because there are no major genes of large effects for intelligence, it is unlikely that there are major genes of large effects for intellectual styles. Finally, it is possible that some of the genes that are considered candidate genes for intelligence might also contribute to the genetic foundation of intellectual styles.

GENETIC BASES OF PERSONALITY

Similar to the field of intelligence, studies on personality are characterized by a variety of different theories and approaches (e.g., for a review, see Caspi, Roberts, & Shiner, 2005). However, lately, the literature has described the convergence of different theorists of personality on either the three- or five-factor model of personality (John & Srivastava, 1999), supporting the traits of extraversion/positive emotionality, neuroticism/negative emotionality, and conscientiousness/constraint (for three-factor solutions), and, in addition, the traits of agreeableness and openness-to-experience (for five-factor solutions).

Of interest is that, regardless of what theoretical platform a particular behavior–genetic study (or a study of heritability) of personality is utilized, the common conclusion in the behavior–genetic literature on personality is that the etiology of nearly all personality traits is characterized by the presence of moderate genetic influence, estimated at ~0.50 (Boomsma, Busjahn, & Peltonen, 2002; Bouchard & Loehlin, 2001). There has also been some recent interest in the genetic underpinnings of a possible general factor of personality (Riemann & Kandler, 2010; Rushton, Bons, & Hur, 2008).

The literature is also replete with studies of correlations between personality traits and psychiatric disorders, such as major depression (Boyce, Parker, Barnett, Cooney, & Smith, 1991) and anxiety (Bienvenu et al., 2004). These correlations appear to be consistent and substantial. Of note also is that there is a rich literature correlating attributional *styles* to mental health (Alloy, Abramson, Metalsky, & Harlage, 1998).

In an attempt to understand these correlations, it has been hypothesized that they are likely to be explained by shared genetic factors (Fanous, Gardner, Prescott, Cancro, & Kendler, 2002; Kendler, Gatz, Garver, & Pedersen, 2006). Thus, the consensus in the literature is that both specific personality traits and attributional styles predispose for negative mental health outcomes, and the basis of this predisposition appears to be genetic. There are few studies examining etiological bases of attributional styles; they suggest the presence of genetic effects in the etiology of these styles (Lau, Rijsdijk, & Eley, 2006; Schulman, Keith, & Seligman, 1993). Similarly, there is evidence that cognitive biases (often called styles) in interpreting life events are also heritable (Eley et al., 2008).

In the first-ever genome-wide association scan (GWAS) of all five of the major personality traits, Terracciano et al. (2010) found a number of strong signals near areas that have been linked to psychiatric illness. These included the association of neuroticism with the variation in the *SNAP25* gene (also mentioned above as it has been implicated as having a role in the genetic foundation of cognitive functioning), extraversion with *BDNF*, *DH13*, and *CDH23*, openness with *CNTNAP2*, agreeableness with *CLOCK*, and conscientiousness with *DYRK1A*. The effect sizes were small and most of these associations did not replicate in independent studies. In another first of its kind GWAS, this time looking at Cloninger's temperament scales, Verweij et al. (2010) also found no significant associations between any of the SNPs and the scales. In a meta-analysis of GWASs, de Moor et al. (2010) found a genome-wide significance for openness to experience near the *RASA1* gene on 5q14.3 and for conscientiousness in the brain-expressed *KATNAL2* gene on 18q21.1. These findings, however, were not replicated when using *in silico* replication.

Among personality factors, neuroticism/negative emotionality appears to be consistently associated with negative mental health outcomes. Correspondingly, there have been multiple attempts to map the genetic basis of neuroticism (Fullerton et al., 2003; Nash et al., 2004; Neale, Sullivan, & Kendler, 2005; Shifman et al., 2008).

Exploring the genetic foundation of neuroticism, two whole-genome studies used an extreme selected sib-pair design, subsampling from general population samples with the intent of increasing the resulting power to detect genetic signals of interest. One study reported the identification of five genetic loci that exceeded a 5% genome-wide significance threshold (Fullerton et al., 2003). Specifically, significant linkage was established to regions on chromosomes 1p, 4q, 7p, 12q, and 13q; suggestive linkage (i.e., an interesting signal, approaching but not crossing levels of significance) was shown at 11q. The second study, however, did not produce any findings at the genome-wide significance level (Nash et al., 2004). Yet, it did report two regions with suggestive linkages, 1p and 6p, replicating previous findings.

Subsequently, Neale et al. (2005) carried out a genome scan for neuroticism on a sample of sib-pair families, ascertained for concordance on nicotine dependence. Similar to the previous work, they pointed to regions on chromosomes 1p, 11p&q, and 12q as possibly linked to neuroticism. Furthermore, in a sib-pair sample from Ireland, evidence for linkage to neuroticism was found on chromosomes 11p, 12q, and 15q (Kuo et al., 2007). Finally, researchers (Shifman et al., 2008) performed a whole-genome association study with ~450,000 genetic markers of neuroticism using pooled DNA from 2,000 individuals from England, selected from a very large sample of about 88,000 people on extremes (very high and very low) of neuroticism scores. The results featured a polymorphism in the *PDE4D* (cAMP-specific 3′,5′-cyclic phosphodiesterase 4D) gene located at 5q11. However, this gene accounted for no more than 1% of the genetic variance in neuroticism. Based on their own data and the data from the other four genome scans, the authors concluded that the heritability of neuroticism is possibly attributable to contributions from many genes, each explaining much less than 1% (Shifman et al., 2008). Calboli et al. (2010) conducted a GWAS that did find support for an association with *PDE4D*. Calboli et al. (2010) also found that *NKAIN2* demonstrated a suggestive association with neuroticism and *GPC6* showed an interaction with age.

Similar to the field of genetic studies of intelligence, there have been numerous attempts to associate specific genes and their variants with various personality traits. For example, variation in the *DRD4* (dopamine receptor D4) gene, specifically a polymorphism in exon III of this gene, was associated with the trait of novelty seeking (Benjamin et al., 1996; Ebstein et al., 1996). Two comments are important to make in the context of the discussion of this finding. First, the original finding has not been consistently replicated (Vandenbergh, Zonderman, Wang, Uhl, & Costa, 1997). Second, since the 1996 report, this polymorphism in *DRD4* has been associated with several personality traits (e.g., adaptability and reward dependence) and neuropsychiatric conditions (e.g., attention deficit hyperactivity disorder, alcoholism, schizophrenia). Such a pattern of results is rather typical for genetic association studies of personality traits.

Munafò, Yalcin, Willis-Owen, and Flint (2008) conducted a meta-analysis where two variants in *DRD4* were considered: variable number of tandem repeats (VNTR) and the C-521T polymorphism. Their meta-analysis findings did not support a relationship between the VNTR and approach-related traits such as novelty seeking, sensation seeking (for a study looking at sensation seeking and other single nucleotide polymorphism (SNP) study within dopamine genes, see Derringer et al., 2010), extraversion, and impulsivity. Munafò et al. (2008) did, however, find an association between C-521T polymorphism and novelty seeking and impulsivity but not for measures of extraversion. In another meta-analysis, Munafò et al. (2009) examined the 5-HTTLPR polymorphism in the promoter region in serotonin transporter 5-HTT gene (*SLC6A4*) and the personality trait of harm avoidance. This polymorphism has been studied widely and there have been mixed results concerning its association with various traits that are related to psychiatric disorders. The result of their meta-analysis suggests no significant association between 5-HTTLPR and harm avoidance, although there is possibly a relationship between the polymorphism and two scales of anxiety-related personality measures. Saiz et al. (2010) reported that different polymorphisms of the *SLC6A4* gene were associated with six out of seven personality dimensions measured by the Cloninger's Temperament and Character Inventory.

Hundreds of genes of potential interest (too numerous for a single list!), given their biological functions, have been investigated for associations with dozens of personality traits and/or psychiatric conditions that are related to personality traits. Of note is that a number of these genes, namely, *COMT*, *MAOA*, and *BDNF*, have also been featured as candidate genes for intelligence and various components of cognition (Terracciano et al., 2010). A mosaic of positive and negative findings has been generated, but little can be said with high degree of certainty. In fact, a recent meta-analysis of studies reporting data on associations between various candidate genes and personality traits concluded that there are few, if any, robustly replicable associations (Munafò et al., 2003). It appears that the early fascination with the idea of identifying the genetic forces acting on the manifestation of personality traits has given way to a more subdued appreciation of the indirect (Benjamin, Ebstein, & Belmaker, 2002) and, probably, small (Shifman et al., 2008) influences of the genome on personality.

Concluding this brief discussion of the literature on the genetic bases of personality, we ask what can be brought to bear on any hypotheses about the genetic bases of intellectual styles.

Similar to the relationships between intelligence and intellectual styles, the relationships between personality and intellectual styles are only partially overlapping. Yet, this partial overlap is substantial enough to hypothesize that at least some of the genetic factors influencing the variation in personality might also be influencing the variation in intellectual styles. Again, similar to the now known mechanics of the genetic influence on intelligence, the mechanisms of genetic influences on personality are probably characterized by the orchestrated efforts of many genes of small effects. It is notable that there are candidate genes that appear to be influencing both intelligence and personality. It is then possible that these overlapping genes contribute to the genetic foundation of intellectual styles and can explain their connections to both intelligence and personality.

ASSOCIATED CONSTRUCTS

In situations where literature on the target construct is limited, one can venture into neighboring literatures, investigating constructs that are related to or overlapping with the construct of interest. Indeed, such an approach is found to be productive in understanding the etiology of intellectual styles.

There are a very limited number of behavior–genetic studies investigating the heritability of intellectual styles. Heritability estimates from these studies report the presence of significant (e.g., different from 0) genetic effects on the manifestation of styles, although their magnitudes are smaller than those of intelligence and personality (e.g., Grigorenko, LaBuda, & Carter, 1992). Specifically, the only set of heritability estimates readily available in the literature is on Witkin's field dependence–independence (Witkin, Oltman, Raskin, & Karp, 1971) and Salkind's reflection–impulsivity (Salkind, 1979). The heritability estimates of the former were ~11% and for the latter they were negative (i.e., correlations for monozygotic twins were higher than that for dizygotic twins). However, these correlations were not different from 0. It appears that this study is the only published, peer-reviewed, quantitative-genetic report of intellectual styles. It is possible, of course, that other reports are available either in chapters of books or in various theses, but they are not at the surface of the literature.

Yet, there are studies of other *styles* that might substantiate the discussion here. For example, there have been a number of behavior–genetic studies on styles of coping. These styles are typically viewed as ways of dealing with stressful situations resulting from the interactions of these situations with the intelligence and personality traits of people in the environment of stress. There are different theoretical frameworks and, correspondingly, different assessment instruments used in these studies, and, thus, a direct comparison of the results is not possible. Yet, forming a general profile of these findings might be of interest.

All these studies were carried out using twin methodologies. For example, in a study by Kendler, Kessler, Heath, Neale, and Eaves (1991), three coping styles were studied: turning to others, problem solving, and denial. The results indicated the presence of genetic influences on turning to others and problem solving, with heritability estimates at around 30%, and no evidence of genetic effect on denial. Yet, another study (Mellins, Gatz, & Baker, 1996) used a different theoretical perspective

on coping, which resulted in the measurement of seven coping scales. Findings from this study showed the presence of genetic influence on five of the seven scales. Specifically, heritability estimates were 0.99 for distraction, 0.55 for use of parents, 0.18 for use of peers, 0.53 for self-soothing, and 0.57 for problem focused; heritability estimates did not differ from 0 for the remaining two scales, problem solving and emotion-focused coping.

Similarly, in a study that utilized 19 coping styles (Busjahn, Faulhaber, Freier, & Luft, 1999), moderate heritabilities were established for some but not all styles. When first-order styles were summarized by four higher-order constructs, the heritability estimates for these constructs were as follows: active coping (0.21), defense (0.52), emotional coping (0.23), and substitution factor (0.41).

In yet a different study (Kozak, Strelau, & Miles, 2005), coping styles were assessed as task oriented, emotion oriented, social diversion, and distraction; their corresponding heritability estimates were 0.35, 0.34, 0.33, and 0.39, respectively. Of interest is that in this study the researchers also estimated genetic and environmental correlations between styles and found that environmental correlations (0.24) were substantially lower than genetic correlations (0.52). Finally, in the most recent study of this type (Wang, Trivedi, Treiber, & Snieder, 2005), coping styles were defined as anger expression (subscales: anger-in, anger-out, and anger-control) and John Henryism (i.e., a strong behavioral disposition to actively handle psychosocial and environmental stresses of daily living). Heritability estimates for anger-in, anger-out, anger-control, the total scale of anger expression, and John Henryism were 0.0, 0.14, 0.34, 0.15, and 0.34, respectively.

Thus, in general, the landscape of published results on styles fit the hypothesis generated at the beginning of this chapter: Although there is evidence for the presence of genetic influences on intellectual styles, these genetic influences appear to be of smaller magnitude than those characteristic of intelligence and personality.

COMMENTS AND CONCLUSIONS

Because the literature on the genetic bases of intellectual styles (or any styles, really) is quite limited, it is impossible to provide a comprehensive review of what is known about the etiological bases of styles. Traditionally, intellectual styles are viewed as emerging interactively, and therefore when intelligence and personality are manifested in particular situations, it is hypothesized that, etiologically, intellectual styles should overlap with both intelligence and personality. Correspondingly, we reviewed the literature on the genetic bases of all three constructs: intelligence, personality, and styles.

In general, as is the case for most complex behavioral traits, the heritability estimates for both intelligence and personality linger somewhere around 50%. In other words, although there is a substantial amount of evidence that both intelligence and personality are shaped by genetic factors, there is a tremendous amount (i.e., 50% or half the variance) of uncertainty and flexibility with regard to how these genetic factors may exert their influence and to what degree such influence will be enhanced or counter-acted by other nongenetic factors.

Such a degree of uncertainty seems to be even greater for intellectual styles. Indeed, although limited in number, when available, heritability estimates for styles are lower, on average, than those for either intelligence or personality (and ranging from 0% to ~30%). This can be explained by two considerations. First, definitions of intellectual styles, typically, include the factor of situations. Because, by definition, situations are not controlled by genes (they are by definition and nature environmentally based), the etiological contribution of situations to styles should diminish the impact of genetic factors and enhance the impact of nongenetic factors. Second, styles are derivative products of intelligence and personality, arising from a mixture of both within situations. As any mixture, intellectual styles resemble to some extent their discrete ingredients and dilute the influence of any particular single ingredient. Thus, the influence of any genes contributing to intellectual styles by means of intelligence and personality is weakened.

Of note also is that heritability estimates of both intelligence and personality appear to fluctuate throughout the course of development. For example, heritability of IQ is reported to be ~20% in infancy and early childhood, with an increase to around 40% in middle childhood, and a subsequent increase to 50% in adulthood, before a subsequent decrease in older age (Payton, 2006; Plomin & Spinath, 2004). Interesting age dynamics of temperament and personality within both constructs across the lifespan have been noted as well (Caspi et al., 2005). In the literature, these dynamics are attributed to presumed changes in gene expression. However, this hypothesis is difficult to verify as there is no comprehensive account of what genes might be involved and how they might be behind these changes. The presence of a developmental dynamic might be characteristic of the etiology of intellectual styles as well, although, at this point, there is no substantial corpus of data attesting to the validity of this hypothesis.

Clearly, the literatures reviewed here indicate a substantial amount of promise for the role of genes in the manifestation of individual differences in intelligence and personality, and, correspondingly, in intellectual styles. Yet, although there are many clues, there is no cohesive picture of how these genetic influences are expressed. One thing is rather clear, however: Many genes of small effects appear to be involved in the formation of these individual differences. And, if the hypothesis presented here is plausible, even more genes, combined into groups of intelligence genes and personality genes, are likely to be involved in the formation of individual differences in styles. And it is anticipated that the effects of these genes should be even smaller.

This is perhaps what makes the concept of styles so alluring it appeals to researchers in both the fields of intelligence and personality, but it cannot be fully explained by either concept. Thus, styles remain popular and hold a tint of a mystery: stylish.

ACKNOWLEDGMENTS

Preparation of this chapter was supported by Grant No. P50 HD052120, as administered by the U.S. National Institutes of Health. Grantees undertaking such projects are encouraged to express freely their professional judgment. This chapter, therefore,

does not necessarily represent the position of U.S. National Institutes of Health; no official endorsement should be inferred. This chapter is an update of a chapter previously published as Grigorenko, E. L. (2009). What is so stylish about styles? Comments on the genetic etiology of intellectual styles. In L.-f. Zhang & R. J. Sternberg (Eds.), *Perspectives on the nature of intellectual styles* (pp. 233–251). New York, NY: Springer Publishing Company. This update is published with permission from Springer Publishing Company. We also express our gratitude to Ms. Mei Tan for her editorial assistance.

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6

Demographic Characteristics and Intellectual Styles

Seval Fer

> Though the roots of style are no doubt to be traced to native temperament, the interaction of mature traits with one another, and their confluent effect upon creative and adaptive acts, are the immediate sources of the stylistic idiom.
>
> *Gordon W. Allport, cited in Morgan, 1997, p. 61*

INTRODUCTION

We use or hear the word "style" generally everywhere because it can be used in many contexts, including in personal life, at school, and in occupational environments. For instance, we often hear, "This is my style; thus, I do not want to change it." It is not strange to hear such expressions from one of the students in a class, a factory person, or our friends. However, does this expression really apply in reality? Is the style of any individual really unchangeable?

In order to identify differences in individuals, the concept of style has been employed widely for many years in psychological and educational literature. Reflections in demographic differences have also indicated that individuals learn, think, and act in different ways. Thus, taking the style of individuals into consideration is important, especially if the styles can be socialized and thus can be changed. According to Sternberg (1997), styles are at least partially modified through socialization variables, such as culture, gender, age, parental style, schooling, and occupation. Similarly, Allinson and Hayes (1996) indicated that styles can be acquired through socialization. Moreover, Hill, Puurula, Sitko-Lutek, and Rakowska (2000) stated that the effects of cultural conditioning are believed to be internalized through both family influences and the educational system. In 2006, Zhang and Sternberg, by presenting evidence suggesting the relationship between styles and socialization variables, have already argued that styles can be changed. They also stated that styles represent states, although they can be relatively stable over a period of time. Other researchers, however, take the opposite view. For instance, Curry (1990) stated that styles are unchangeable. Similarly, for Riding and Rayner (1998), "style" is impossible to switch off. Kirton (1998, cited in Buffinton, Jablokow, & Martin, 2002) also cited longitudinal studies which demonstrate that styles are stable in adults.

However, findings of previous studies have been mixed on whether or not intellectual styles are changeable. Thus, to search for more evidence on this would be a good idea. This chapter addresses the question "Do intellectual styles of individuals vary depending upon their demographic characteristics, and if so, is style changeable?"

THE CONCEPT OF STYLE

Style is defined as a set of individual activities, behaviors, or qualities that are typically sustained over a period of time. Styles are applied without individual awareness (Riding & Rayner, 1998; Sternberg & Grigorenko, 2001). Schmeck (1988) simply described style as a pattern of a person's ways of accomplishing a particular type of task. For Riding and Rayner, style "is used as a term both in popular usage and in a more restricted technical sense" (Riding & Rayner, 1998, p. 5).

Styles are thought to be distinct from abilities and to involve preferences, not necessarily conscious, in the use of whatever abilities one has. It is not connected solely with ability, but rather, is a preferred way of expressing or using one or more abilities (Cano-Garcia & Hughes, 2000; Schmeck, 1988; Sternberg, 1997; Zhang & Sternberg, 1998). While ability is related to the level of performance and is unipolar, styles refer to the manner of performance. Most styles are bipolar, forming a continuum between two poles with specific characteristics (Riding & Rayner, 1998).

In this chapter, intellectual styles are used as Zhang and Sternberg (2005, 2006) suggested. Accordingly, the term "intellectual styles" is used as an umbrella term for all existing style labels, including cognitive, learning, thinking, mind, and perceptual styles. "An intellectual style refers to one's preferred way of processing information and dealing with tasks" (Zhang & Sternberg, 2006, p. 3). In terms of the nature of intellectual styles, style development is one of the major issues. The significant relationships found between them can be used to gain a better understanding of the nature of intellectual styles as it relates to style development.

CRITERIA FOR SELECTING THE MODELS UNDERLYING INTELLECTUAL STYLES

Although many demographic characteristics could have an effect on the development of intellectual styles in the same way as many other variables, a thorough literature search has indicated that four demographic characteristics have been most intensively studied: age, gender, academic discipline, and educational and school class level. In selecting style models and constructs for inclusion in this review, three criteria were applied. First, the model/construct is used in order to assess styles in association with "specific variables" related to the individual solely and not together with other variables (e.g., learning environment, academic achievement). Second, both the theoretical construct/model and the inventory generated from it have proven to be reliable and valid for assessing people's styles in at least several studies. Third, the style constructs defined in the models have been widely used to assess people's styles. Based on the aforementioned three criteria,

12 models were selected: (1) cognitive styles analysis by Riding and Cheema; (2) modes of thinking by Torrance; (3) career personality types by Holland; (4) adaptor–innovator cognitive styles by Kirton; (5) learning styles by Kolb; (6) personality styles as assessed by the Myers-Briggs' Type Indicator by Jung; (7) Witkin's construct of field dependence–independence; (8) divergent–convergent thinking by Guilford; (9) reflective–impulsive styles by Kagan and his colleagues; (10) mind styles by Gregorc; (11) student learning styles by Grasha–Riechmann; and (12) Sternberg's theory on thinking styles.

Data for this review are heavily based on the electronic databases that are available at Yildiz Technical University, Bogazici University, and TUBITAK in Turkey. Among them are EBSCOhost, Academic Search Complete, Full Text, ABI/INFORM, and ERIC databases (for dissertation and thesis materials). Although 823 studies were found initially, this chapter is built upon 123 published studies on variables directly related to demographic characteristics done using various populations under both academic and nonacademic settings across the globe.

RESEARCH FINDINGS AND DISCUSSION

By using relevant headings, findings of the literature review on the relationships between intellectual styles and each of the four demographic characteristics (age, gender, academic discipline, educational and school class level) are explained. Although with both significant and nonsignificant findings, the great majority of the studies suggested significant relationships between each of four demographic characteristics and the styles in the 12 different models (Table 6.1), some articles contained more than one study.

As reported in Table 6.1, most findings that have been reached for in this chapter in terms of demographic characteristics resulted from studies using inventories based on the model by Sternberg, that by Kolb, and that by Torrance.

Age and Intellectual Styles

The earliest study on age reviewed for this chapter was conducted by Stott and Ball (1968). Using Guilford's divergent–convergent thinking construct, the authors revealed that before the age of 5 years, older children tended to score higher on convergent thinking.

In academic settings, although with fairly inconsistent results, significant findings indicated that age has an important role in the development of intellectual styles of students from various populations. Using Kolb's learning style inventory, Titiloye and Scott's (2002) study yielded variation in student's intellectual styles depending upon age. Variations in students' preferred styles were seen from year to year, with a higher percentage of convergers compared with the share of divergers. Moreover, Zhang (2007a), by SOLAT of Torrance, found that older students scored lower than younger students on the analytic mode of thinking. Furthermore, on a very huge

TABLE 6.1
Findings on Demographic Characteristics Considered in the Models of Intellectual Styles

	Age		Gender		Academic Discipline		Educational and School Class Level		
Style Models	**S**	**NS**	**S**	**NS**	**S**	**NS**	**S**	**NS**	**Total**
Cognitive styles analysis of Riding and Cheema	1	0	1	0	0	1	1	0	4
Modes of thinking of Torrance	2	1	1	2	3	0	6	1	16
Career personality types of Holland	0	0	5	0	0	0	0	0	5
Adaptor–innovator cognitive styles by Kirton	0	0	5	0	1	0	2	1	9
Learning styles by Kolb	2	2	3	5	3	0	5	2	22
Type indicator of Myers–Briggs	1	0	1	0	1	0	0	1	4
Field dependence–independence theory of Witkin	2	0	1	0	1	0	1	0	5
Divergent–convergent thinking of Guilford	2	0	1	1	1	0	2	0	7
Reflective–impulsive styles by Kagan	1	0	0	1	0	0	1	0	3
Mind styles by Gregorc	1	1	1	0	1	0	1	1	6
Student learning styles by Grasha–Riechmann	0	1	1	1	1	0	2	0	6
Sternberg's theory on thinking styles	5	4	7	4	6	3	4	3	36
Total	17	9	27	14	18	4	25	9	123

Note. S = significant; NS = nonsignificant.

sample of 4,628 South Korean students in the 9–17 year age range, Lee, Oakland, and Ahn (2010) found that older students scored higher on the extroverted, imaginative, feeling, and flexible styles in terms of the Myers-Briggs's indicator instrument. Lastly, applying Gregorc's mind styles, Ware (2003) investigated 84 undergraduate students and reported that the older the participants, the more they tend to use a concrete sequential style. In terms of Sternberg's thinking styles, some findings had been significant but quite inconsistent. Zhang (1999) revealed that older participants tended to use more hierarchic, judicial, and liberal styles, known as Type I styles. In another study, Zhang (2001b) reported that the age of secondary school Chinese students was negatively correlated with the hierarchical style. In 2004, Zhang also found that university students scored higher than their younger counterparts on the executive, hierarchical, and external styles. Interestingly, Zhang (2007a) also found that in rural areas, older students scored higher on the legislative and global style (both having been classified as Type I styles). Lastly, Basol and Turkoglu (2009), in a study on Turkish elementary student teachers, reported that with age, the score for the local style tended to rise while the score for the anarchic style tended to go down.

In nonacademic settings, findings from adult participants have also been significant but mixed. For instance, using Witkin's field theory, Moir (1986) in a study of 74 adults showed that older participants with higher field independence exhibited more flexibility in thinking than those with lower field independence. Moreover, older participants were better than younger participants at all levels of field independence. Moreover, in a study of 257 trainee operators in the United Kingdom using the integrative model of cognitive styles of Riding and Cheema, Russell (1997) found that older learners were more likely to be analytic. Furthermore, on Kolb's inventory, Truluck and Courtenay (1999) revealed among 172 older participants that age group 55–65 had preferred the accommodator style, which combines feeling and doing; however, age group 66–74 had chosen the diverger style, which involves feeling and watching, and age group 75 and over had preferred the assimilator style, which combines thinking and watching. Lastly, through Torrance's tests of creative thinking, Giampietro and Cavallera (2006) indicated that divergent and creative thinking has remained intact in the cognitive functioning in elderly people.

In a research comparing both young and adult participants in the same study, findings have also been significant but inconsistent. Kim (1996), using Witkin's Group Embedded Figures Test in a sample of 449 Koreans and Korean Americans, declared that adult participants tended to be more field dependent than college and junior or high school participants. Using the reflective–impulsive styles by Kagan and his colleagues, Coyne, Whitbourne, and Glenwick (1978) found that the elderly adults were generally more impulsive than young adults. Moreover, Moir (1986), using the instrument of Guilford, showed that older participants tended to be more variable than younger participants in terms of divergent production.

With the above-mentioned body of research, the common point is that intellectual styles have varied depending upon age, and differences were seen from various populations. However, in contrast, some studies have declared nonsignificant relationship between age and styles among university students; for example, Zimmerman's (1996) research using Gregorc's instrument, Toothman's (2007)

findings through Kolb's inventory, and Novak et al.'s (2006) research by the instrument of Grasha–Riechmann. Other studies also reported no statistically significant variations between age and styles on the thinking styles based on Sternberg's theory (e.g., Saracaloglu, Yenice, & Karasakaloglu, 2008; Zhang, 2001, 2002a, 2006). Some research findings have indicated no significant variations in styles based on age among adults; for example, Truluck & Courtenay's (1999) study done by Kolb's inventory and Roskos-Ewoldsen, Black, & Mccown's (2008) study on Torrance's tests.

In most findings, the style models/constructs that have significant differences in terms of age were by the instruments based on the style models by the following scholars: Sternberg, Kolb, Witkin, Torrance, and Guilford; however, what is noteworthy is that only few studies were conducted under nonacademic settings. In general, this review regarding age shows that 17 research studies reported a significant relationship between age and styles, whereas 9 studies reported the nonsignificant relationship. Although the studies did not directly aim to find out whether the styles are changeable or not, adaptation of styles has led to the notion that intellectual style can be changeable as a function of age, in line with the empirical findings documented in the preceding. Schmeck, commenting on styles, wrote, "Students do not all derive the same conceptions from the same experiences, and this can be explained, in part, by differences" (Schmeck, 1988, p. 2). The findings on age also lent strong support to Zhang and Sternberg's (2006) assertion that intellectual styles are changeable and that they can be developed. However, as Zhang (2002b) explained, differences with regard to age may be attributed to the nature of psychological development of students. Nevertheless, other possible reasons exist for findings regarding age. For instance, Zhang and Sternberg (2006) mentioned that several authors have noted a general change in styles with maturation. This means that participants of most research studies have developed their intellectual styles over time, whereas the younger individuals have focused on trying out new and creative styles.

The above explanation for the study results has been expected. However, the most important point is that as participants get older, they have a tendency to use more creative styles, such as the diverger and global styles. Surprisingly, some older participants showed a preference for creativity-generating styles. Thus, some of the results have shown the opposite of what Truluck and Courtenay had found that "not all older learners are active, hands-on learners as adult education literature suggests, but rather with age there is a tendency to become more reactive and observational in the learning environment" (Truluck & Courtenay, 1999, p. 221).

Gender and Intellectual Styles

This review shows that the earliest study on the relationship between styles and gender was conducted by Gallagher (1965). In a sample of 249 gifted students tested on Guilford's instrument, the author investigated students being either the laboratory school in which programs were designed for academically talented students or regular programs in which programs were designed as public high schools and found that in terms of convergent thinking, regular female students in junior high school were superior compared with senior high male students, and regular female students from junior high school were superior compared with laboratory students.

In academic settings, some studies reported statistically significant but quite inconsistent variations in terms of gender from various populations of school participants; however, these results indicate that gender has an important role in the development of intellectual styles. For instance, Lee, Oakland, and Ahn (2010), using the Myers-Briggs's instrument, found that females scored higher on extroverted, feeling, and judging styles in contrast to males. In 2004, Kilic-Bebek showed that, on Riding and Cheema's instrument, females were more likely to be wholist, intermediate, and analytic styles, while males were likely to use the analytic style. Some studies, applying Torrance's instrument, also indicate fairly consistent results. For instance, in a study by Zhang (2007a) using Torrance's SOLAT, girls scored higher on the analytic mode of thinking scale than boys. Some studies using Kolb's inventory indicate inconsistent results between styles and gender among university students. For instance, a quantitative meta-analysis by Severiens and Ten-Dam (1994) showed that men were more likely than females to prefer abstract conceptualization based on the findings of 26 studies for the period 1980–1994. Similarly, according to Bishop (1985), females scored lower than men on the abstract conceptualization scale. Additionally, Guven and Kurum (2007) found that females were more likely to be assimilators, while males were likely to be both convergers and assimilators.

Some studies on Holland's instrument have indicated that females have a greater tendency to be conventional and social, but males have a greater tendency to be realistic and investigative. Moreover, both gender groups had the lowest scores for conventional interests (e.g., Watson, Foxcroft, & Allen, 2007). On the contrary, other studies, using the same instrument, have indicated that whereas females are realistic, investigative, and artistic, males are conventional, enterprising, and social (e.g., Deng, Armstrong, & Rounds, 2007; Tokar, Thompson, Plaufcan, & Williams, 2007; Turner et al., 2008; Watson et al., 2007). By Gregorc's instrument, Gould and Caswell's (2006) research on university students and program directors revealed that females had tended to prefer abstract random more than males, whereas males had tended to prefer abstract sequential styles more than females. Using the Grasha–Riechmann instrument, Bishop (1985) found that females were significantly more participative and collaborative but less dependent, competitive, and avoidant than men.

Using the thinking styles based on Sternberg's theory, studies have revealed quite inconsistent results among university students. For instance, Zhang (2004, 2007a) reported that girls had scored higher on the executive and conservative styles; however, males were found to be more judicial, global, and liberal than females. Moreover, in Zhang and Sachs' study (1997), males scored higher in global style than females. That is, males tended to score higher on Type I styles, while females tended to score higher on Type II styles. However, Fer (2007) found the opposite: Males scored higher on the monarchic and conservative (Type II) styles than their female counterparts, who scored higher on the legislative and hierarchic (Type I) styles. Additionally, Balkis and Isiker-Bayezid (2005) revealed that males tended to adopt the judicial and external styles more frequently than females, whereas females frequently used the executive style. Lastly, Basol and Turkoglu (2009) reported that males score higher in the conservative styles than their female counterparts. These differential findings might be explained by the effects of culture.

Sternberg (1997) indicated how different dimensions of culture might encourage or inhibit the development of specific styles. Therefore, from gender review, it might be interpreted that different roles could have been assigned to the members of each gender in different society. Thus, individuals in one culture, compared with those in other cultures, might be expected to have a higher or lower preference for certain styles.

Studies conducted under nonacademic settings have also shown significant but mixed findings from adult participants. For instance, by Sternberg's instrument, Zhang (2007b) found that female teachers scored less on the global and conservative styles than their male counterparts. In 1995, using Witkin's test, Beck found females to be more field dependent than males. The most encountered model carried out in nonacademic settings is Kirton's instrument. In general, females have been found to be more adaptive than males in several research studies (Mitchell, 2005; Tuller, 1997). In contrast to these findings, other studies have indicated that females tend to be more innovative than males (see Jablokow, 2003; Tullett, 1995). Some studies have shown mixed findings. For instance, Smith (1995) found that both older females and males to be more adaptive than their younger counterparts; however, men of average age were found to be more innovative than females of average age.

The significant findings of the above-mentioned research have also shown inconsistent results between intellectual styles and gender. This is the case even in studies that reported gender differences, wherein in some, females scored higher but in others, males scored higher. Nevertheless, it is impossible to say what styles or which models/constructs females or males tend to follow because the findings reveal so much variation. Nevertheless, it can be stated that gender clearly plays an important role in people's intellectual styles because a great number of studies have indicated gender differences. In general, females tend to prefer norm-conforming and cognitively simplistic intellectual styles, which Zhang and Sternberg (2006) labeled as Type II styles, whereas males prefer creativity-generating and cognitively complex intellectual styles, which Zhang and Sternberg labeled as Type I styles. However, this male–female pattern is reversed in some results.

In contrast to the significant findings reported above, some studies have declared a nonsignificant relationship between gender and intellectual styles using different instruments: that of Guilford (Stott & Ball, 1968); Grasha–Riechmann (Zelazek, 1986); Kagan and his colleagues (Sommers, 1990); Torrance (Giampietro & Cavallera, 2006; Kim & VanTassel-Baska, 2010); Kolb (Ahadi, Abedsaidi, Arshadi, & Ghorbani, 2009; Jones, Reichard, & Mokhtari, 2003; Kaya, Ozabaci, & Tezel, 2009; Toothman, 2007; Truluck & Courtenay, 1999); Riding and Cheema (Riding & Grimley, 1999; Sadler-Smith & Riding, 1999); and lastly, Sternberg (Grigorenko & Sternberg, 1997; Inweregbu, 2006; Saracaloglu et al., 2008; Zhang, 1999).

The style models/constructs that have been employed the most in studying the relationship between styles and gender are that of Sternberg's, followed by those of Holland's and Kirton's. However, few studies have been conducted under nonacademic settings, except for those by the instrument of Kirton. Review of studies on the relationship between gender and styles showed that, in general, whereas 27 studies reported a significant relationship between the two variables, only 14 studies reported nonsignificant relationship. On one hand, findings have indicated

that gender-based relation was not as greatly significant as had been expected. As Loo and Shiomi (1996) stated, the literature indicates a mix of significant and non-significant gender differences. On the other hand, studies have revealed that gender has an important role in people's intellectual styles in both academic and non-academic settings by indicating that females and males tend to prefer different styles. Therefore, although only a few of the studies were longitudinal, these findings, as some empirical evidence indicated, have led to the notion that intellectual styles can be changeable as a function of gender. Moreover, as Zhang (200b) stated, gender differences can be attributed to the nature of psychological development of students. Nevertheless, overall, findings on gender have shown support for Zhang and Sternberg's position that "styles are malleable and thus represent states" (Zhang & Sternberg, 2006, p. 70). As Schmeck had argued convincingly, "style is quite flexible and really not very stylistic' at all, in the sense that it is not fixed'" (Schmeck, 1988, p. xi).

In keeping with explanation from neurological studies, there is evidence indicating that females and males process information in different ways, in which females of a particular style show a tendency to react to a task in the opposite manner compared with males of a similar style (Grimley & Riding, 2009). Additionally, Truluck and Courtenay revealed that "the sex of an individual generally refers to the biological distinction made between males and females, whilst gender refers to masculinity or femininity, which is thought to be constructed through interactions between biological factors and sociocultural factors" (Truluck & Courtenay, 1999, p. 221). Thus, unsurprisingly, females and males have been found to be differentiated in terms of intellectual styles. An explanation of this finding can also be found in Mitchell's (2005) study, which states that gender differences in the style literature are found because the female and the male differ in their social roles, such as status, power, and expectation within organizations. As Kirton (2000, cited in Mitchell, 2005) had stated, the more boundaries are involved and the more rigidly they are held, the number of innovators tend to decrease. On the other hand, a more plausible explanation comes from the opinion of Halonen and Santrock (1999). According to Halonen and Santrock, the idea that parents are the critical agents in gender role development has come under fire in recent years. Culture, education, schools, media, and family members also influence gender behavior. On the other hand, the world is extremely complex, and the use of stereotypes is one way in which we simplify this complexity.

Academic Discipline and Intellectual Styles

In academic settings, some studies have reported statistically significant but inconsistent variations in various populations of school participants from different academic disciplines. For instance, some studies have reported statistically significant variations in nursing and health students. In 2009, Ahadi et al. found that nursing students tended to score higher on the convergent scale, while allied health students tended to score higher on the divergent scale on Kolb's instrument. In another study, using Gregorc's instrument, Siplon (1990) found that the nursing population

showed its highest preference for the concrete sequential style, whereas the least preferred was the abstract sequential style.

Studies conducted on teacher education in different disciplines have reported significant but inconsistent results. That is, students in teacher education tended to score higher on both Type I and Type II styles. For instance, Guven and Kurum (2007) found that the majority of them had assimilator and converger styles on Kolb's instrument. Similarly, Saracaloglu et al. (2008) indicated that students in elementary school teacher education tended to be more global than students in science and social sciences teacher education, but an absence of conservative thinking has been noted among them on Sternberg's instrument. In 2008, using Torrance's test, Taylor demonstrated a significant difference in creative thinking patterns between pedagogical and special education students.

Several studies on accounting and business students have reported statistically significant but fairly consistent results. Using Grasha–Riechmann's instrument, Yazici (2005) revealed that undergraduate business students tended to be dependent, participant, and collaborative. Similarly, Filbeck and Webb (2000), using the Myers-Briggs's indicator assessment, declared that executive MBA participants' styles differed from those of undergraduate business majors and that traditional MBAs, as executive MBA participants' styles tended to be more intuitive as well as more introverted, "thinking," and "judging" than those of undergraduate business majors and the general public.

Furthermore, some studies conducted in different disciplines have also reported significant but inconsistent results. For instance, Jones et al.'s (2003) findings showed that the diverger style was preferred by students majoring in English. In contrast, the assimilator style was preferred in mathematics, the sciences, and social studies. By Torrance's test, Lavach (1991) demonstrated that natural and social science majors tended to prefer a more integrated or left mode of intellectual functioning. Using the instrument of Torrance, Wang, Kyle, and Chern (2008) also obtained irregular findings, in which the fluency, originality, and elaboration measures of creativity for the art and design discipline students had statistically significant differences, whereas no difference was found for any of the creativity measures in the management discipline. Also, using of Witkin's instrument, Beck (1995), in a sample of 84 selected master's students, found that students majoring in kinesiology tended to be field independent; however, in recreation they did not have a dominant style and in health promotion they tended to be field dependent. Zhang (2004), using Sternberg's instrument, found that more students majoring in social sciences and humanities preferred the executive and external styles compared with students studying in the natural sciences disciplines. In another study, Zhang and Sachs (1997) found that students in the fields of the natural sciences and technology tended to be more globally oriented than those in the social sciences and humanities. In 2007, Fer also discovered that student teachers from the language, science, and mathematics fields of study scored significantly higher on the executive style than those who were from other fields of study. Lastly, Balkis and Isiker-Bayezid (2005), using the instrument of Sternberg, revealed that students in the social sciences tended to use the conservative style more often than students in the natural sciences, fine arts, and foreign language studies. Fine arts students had tended to employ the

oligarchic style more frequently than the students in the social sciences, natural sciences, and foreign language studies.

In studies generally conducted on teachers, results have also indicated significant findings. For instance, Sternberg (1994), using his instrument, found that humanities teachers tended to be more liberal than science teachers, but science teachers tended to be more local than humanities teachers. Using Kirton's instrument, Kirton, Bailey, and Glendinning (1991) found that science, technology, and craft teachers tended to use more of the adaptation style.

The above-mentioned body of research, although having yielded mixed results, shows that academic disciplines clearly play an important role in people's intellectual styles because quite a number of studies have indicated academic discipline differences in various populations of school participants, as well as in nonacademic settings of adult participants. However, a very limited number of studies have found a nonsignificant relationship between academic discipline and styles using Sternberg's instrument (e.g., Inweregbu, 2006; Sternberg & Lubart, 1991; Zhang, 1999), as well as Riding and Cheema's instrument (Kilic-Bebek, 2004).

The style models/constructs in which most studies have found significant differences in terms of academic discipline are that of Torrance, followed by those of Kolb and Torrance. In general, most of the studies that have been reviewed for this chapter regarding academic discipline (18) have reported a significant relationship between them, whereas only four studies did not result in significant relationships. This empirical evidence indicates that individuals develop their particular styles as a result of studying in different academic disciplines. As Zhang and Sternberg (2005) argued convincingly in their book, because students are exposed to different learning environments in different academic disciplines, their predominant styles tend to differ as time goes by. Thus, the nature of an academic discipline modifies people's styles. A more plausible explanation regarding academic discipline comes from the opinion of Jones et al. (2003), who stated that students are able to style-flex from one style quadrant to another. Moreover, they also suggested that "students perceive that different learning strategies are required for various learning situations and students are able to adapt to meet the learning strategy requirements of the different disciplines" (Jones et al., 2003, p. 371).

Educational and School Class Level and Intellectual Styles

The relationships of intellectual styles to educational and school class level have also been studied. Educational level refers to different institutional levels, including elementary, junior, high, college, university, and graduate schools, while school class level refers to the actual grade or school class, school year of within each of these educational levels (e.g., first grade in an elementary school).

Under academic settings, although with fairly inconsistent results, the significant research findings from various populations explored indicate that both educational and school level have an important role in the development of the intellectual styles of students. Some studies have reported statistically significant results among the elementary school students. For instance, Kim, and VanTassel-Baska's (2010)

research revealed that through a measure of creative potential by Torrance's test, elementary school students may have more chances to show their creative potential than high school students.

Several studies using Torrance's instrument have yielded significant findings regarding school class level in elementary and junior high school. For instance, Goldin (1983) found that children in the fifth and sixth grades had revealed more intraindividual variability across creative thinking tasks compared with children in the lower grades. Moreover, problem-solving skills tended to grow steadily from the second through the sixth grades, whereas divergent thinking increases from second through fourth grades. Furthermore, Kim, Cramond, and Bandalos's (2006) study revealed that scores for all the subscales were higher for the third graders than those for the sixth graders. In another research, Craig (1983) found that students had produced greater figural gains in the fourth grade and greater verbal gains in the fifth grade. Similarly, McKay (1981) revealed that the observed creativity, fluency, and elaboration decreased with grade level. Moreover, school grade appeared to be a better indicator of creativity than teacher ratings among first- and second-grade students.

Additionally, several studies using several models have also indicated significant findings based on school class level in elementary and junior high school. For instance, using Kagan's instrument, Lovano (1969) found that the analytical scores of boys from grades two through six advanced in school class level. This finding suggests that a developmental trend from an initial global processing of information to a more differentiated or analytical mode occurs as participants advance in school class level. Lastly, using Kolb's instrument, Guven and Kurum (2007) revealed that the assimilator style tended to be prevalent in the first, second, and fourth grades, whereas the converger style tended to be common in the third grade. However, the percentage of accommodators was the smallest in all class level levels. In 2009, Kaya et al. revealed that the highest average scores among sixth and seventh graders were in active experimentation, whereas those for eighth graders were in abstract conceptualization and reflective observation style. The lowest scores were in concrete experience for all class levels.

Some studies have reported significant but quite inconsistent results among college or university students. Using Sternberg's instrument, Fer (2007) found that participants who were pursuing graduate studies scored higher on the executive style than the rest of the participants. Moreover, participants who were in their fourth year undergraduate studies and those who had undergraduate degrees scored significantly higher on the liberal style than those who were in graduate studies programs. In another research, Galphin, Sanders, and Chen (2007), using Kolb's instrument, found students to be predominantly abstract in their learning, showing no strong preference on the reflective/active dimension; hence, they were either convergers or assimilators. But across the 3 years of undergraduate study, styles were observed to have become more balanced in terms of the reflective/active dimension, which is associated with organization, planning, and decision making.

Some other studies have reported statistically significant variations by educational level. Using Torrance's test, Taylor (2008) discovered significant difference

between arts high school students and arts major university students. Using Guilford's instrument, Engelmann and Gettys (1985) found that divergent thinking was twice as high for graduate participants compared with the undergraduates. In 2005, using Grasha–Riechmann's instrument, Yazici found that graduate students had tended to be collaborative and independent learners. Lastly, Mitchell's study (2005) showed similar results: the higher the educational level of participants, the higher the score for the innovator style on Kirton's instrument.

Some studies have reported significant variations by class level in college or university. Using Riding and Cheema's instrument, Roberts (2005) revealed that students were more likely to be analytic in the first and second year of architectural education. Nevertheless, by the end of students' third year, this was no longer the case. Additionally, through Kolb's instrument, Titiloye and Scott's (2002) research revealed variations in each class from year to year, with more convergers and with fewer divergers. On Gregorc's instrument, Ware (2003) reported a significant relationship between the class level (freshman, sophomore, junior, senior, and vocational) and abstract sequential styles. On Grasha–Riechmann's instrument, Hick-Rheault (1989) found that after entrance to a physical therapy college, fewer students scored in the competitive style. Moreover, during internship, their numbers decreased in the collaboration and participation styles as these styles were less available to them. On average, students were more independent than dependent.

One study comparing young and adult participants revealed a significant finding by educational level. By applying Witkin's Group Embedded Figures Test, Kim (1996) found that adults were more field dependent in thinking compared with students in college, high school, and junior high school.

In nonacademic settings, a number of studies regarding education level conducted on adult participants have revealed significant and fairly consistent findings. Smith (1995), on Kirton's instrument, found in a sample of school principals and teachers that those with master's and specialists degrees as well most of the PhD holders tended to be innovators, whereas BA and BS degree holders tended to be predominantly adaptors. Applying Sternberg's instrument, Zhang and Higgins (2008) reported that higher educational level was related to higher scores in the executive style. Zhang (2006) also showed that parents of secondary school students with higher educational levels scored higher on the judicial, global, and liberal styles (all being Type I styles). In another research, Zhang (2007b) indicated that teachers with higher educational degrees tended to be significantly more creative in their teaching (Type I styles) and significantly less conservative in their teaching (Type II styles) compared with teachers who reported lower levels of education.

Moreover, in contrast to the significant results documented above, a very limited number of studies have declared a nonsignificant relationship between educational and school class level and styles using the inventory of Kolb (e.g., Demir & Sen, 2009; Truluck & Courtenay, 1999), Torrance (Marshall, 1985), Myers-Briggs (e.g., Werth, 1986), Kirton (Monavvarrian, 2002), Grasha–Riechmann (e.g., Gould & Caswell, 2006), and Sternberg (Grigorenko & Sternberg, 1997; Inweregbu, 2006; Zhang, 1999).

In terms of educational and school class level, the style models/constructs in which most studies have presented significant differences were those by Torrance's instrument, followed by instruments of Kolb and Sternberg. In general, most of the

studies reviewed for this chapter regarding educational and school class levels and styles have reported a significant relationship (26) between the two variables, whereas six studies reported nonsignificant relationships. These research findings suggest that people with different educational and school class levels differ in their intellectual styles. In other words, individuals may develop their particular styles as a function of educational and school class levels.

One possible explanation for these results may be that the longer people are socialized in educational settings, the more they differ in their intellectual styles. Additionally, in accordance with the view of Cano-Garcia and Hughes (2000), it might be possible in educational setting that students adapt their styles according to the context of education, teaching methods, and assessment format. As Kolb (1984) has suggested, the learning preferences of students may change on the basis of the demands of teachers, instructional structure of the course, the environment of the classroom, as well as the evaluations and assessment of the instructions.

Another possible explanation for these results may also be that the styles people choose correspond more to the nature of the education and school class level. Moreover, the styles required may be associated with the tasks particular to different types of courses or educational level. Even though evidence is not clear on what the overriding reason might be, education and school level may influence students' styles as people with different educational levels are exposed to different learning and teaching environments (Fer, 2003, 2007).

A more plausible explanation comes from an early study by Gallagher (1965) who posited that different school environments and values influence people greater than changes in cognitive abilities. Additionally, Zhang (1999) had also found that many students tend to use the executive and local styles that will be ineffective in terms of students' future career survival. That the students had a preference for using the executive and local students was not an accident, but rather, they are more likely to be a result of socialization. Being in an environment of quantitative assessment tradition, these students are merely trying to meet course requirements. For the same reason, in order to meet highly structured objectives, students with high academic achievement tend to be dependent on convergent thinking rather than on divergent thinking. As also had been explained by Mitchell (2005), style is consistent with the fundamental values and culture of the school. As a result, as outlined by Sternberg (1997), styles might be not innate but can be developed; that is, they reflect task or situational demands, as well as individual dispositions.

CONCLUSION AND IMPLICATIONS

Whereas some studies have not yielded significant findings, the great majority of the studies based on 12 different models and constructs of intellectual styles in both academic and nonacademic settings indicated significant relationships between intellectual styles and demographic characteristics, which include age, gender, academic discipline, and educational and school class level.

What is noteworthy is that in terms of age, surprisingly, older people tend to use Type I styles (characterized by creativity and cognitive complexity according to

Zhang & Sternberg, 2006). The finding that older adults are as creative as younger adults may be important for two reasons, which Roskos-Ewoldsen et al. (2008) has explained on the basis of the life span developmental approach. One, this finding increases the opportunity for older adults to make contributions to society. Second, this denotes the potential for enhancing the quality of life of older adults who view themselves as creative people.

On the effect of gender on intellectual styles by the different models and constructs, studies have yielded contradictory or irregular results. Yet, the majority of the studies supported the notion, in general, that females tend to prefer norm-conforming and cognitively simplistic intellectual styles (known as Type II styles), whereas males prefer creativity-generating and cognitively complex intellectual styles (known as Type I styles). Although the male–female pattern is reversed in some results. These could be explained in terms of demographic characteristics (as explained in this chapter via age, academic discipline, and educational and school class level), environmental factors, and characteristics associated with particular samples of participants. Gender differences in styles have great implications for education. As inferred from the explanation of Gould and Caswell (2006), as the number of female students who enter schools and the professions increases, educators may benefit by designing curricula and selecting instructional methods that are sensitive to females.

Because there is much variation among findings, it is very difficult to state which discipline has the most significant effects on the different intellectual styles or based on which models/constructs. Nevertheless, in keeping with the research findings documented above, it is possible to say that participants in social sciences and humanities as well as in language studies tended to score higher on Type II styles, while participants in mathematics, the natural sciences, and technology tended to score higher on Type I styles. Thus, it can be stated that academic discipline clearly has played an important role in people's intellectual styles because several studies indicate academic discipline differences in various populations of academic participants, as well as in nonacademic settings of adult participants. Findings have suggested that styles are academic discipline sensitive, which means that students from different subject areas require different styles to meet the necessities of the task of the discipline. Moreover, these findings have indicated that students are able to style-flex from one style to another, which means that students may adapt their styles to meet the different task requirements of a particular discipline.

In terms of educational and school class level, it can be stated that people who have higher level of education and who are in a higher school class level tend to be more innovative than those who have a reverse pattern. The results of the documented research above demonstrate that intellectual styles do not remain stable during school years. That is to say, people continue to develop their styles in the course of their education. This finding is especially important for educators, which means that if educators value a certain style, they can provide opportunities so that students can use that style. Thus, accordingly, it can be inferred that in terms of the level of education attended, the educational system places a higher priority on some styles.

In summary, the conclusions for this chapter are as follows. First, people's styles vary depending upon the variables of age, gender, academic discipline, and educational and school class level. Second, the findings suggest that styles can arise out of

socialization and thus, they are changeable. The documented findings support Zhang and Sternberg's idea that "styles represent states and that they are malleable. . . . To some extent, society structures tasks along lines that benefit one style or another in a given situation. We therefore need to learn when to be what if we wish to adapt" (Zhang & Sternberg, 2006, p. 118). An important notion comes from Zhang (1999) who stated that if styles are partially socialized, then they are teachable. At this point and to serve as an example, the writer of this chapter would like to state that as a function of changing demographic characteristics and circumstances, she had a global style until the age of 35; however, her style has varied from the global to the local and at some point has been an intermediate between the local and the global.

Although the difference in findings may have resulted from the manner of sampling of the studies, they can also be attributed to different demographic characteristics. However, as Watkins stated, "these results must be treated with caution because of the danger of combining statistics based on non-comparable measures" (Watkins, 2001, p. 185). Additionally, the role of biological, psychological, and cognitive development, as well as demographic differences, may also encourage or inhibit the development of specific styles in individuals. Therefore, the above-mentioned results need to be verified by future studies. As Deng et al. asserted, "additional factors are necessary to capture the full range of individual differences" (Deng et al., 2007, p. 19).

For a bigger and clearer picture, we need research on more than just a single variable such as age or gender. We can combine more demographic characteristics in the same research by using more sophisticated statistical procedures (e.g., path analysis, multivariate analysis of variance MANOVA) to find out which characteristics exert more impact on the development of intellectual styles. Thus, whether intellectual styles are constantly changed or not needs to be clarified by new findings. For instance, Mitchell by using multiple regression analysis found that "the combination of educational level, position in the organization, and gender predicted leadership style more accurately than any variable alone" (Mitchell, 2005, p. 93). Additionally, Borchard (1984, cited in Giampietro & Cavallera, 2006) asserted 16 years ago that one of the factors in shaping careers is brain capabilities. This assertion is more important today. Thus, changeable or not, style is a very important factor today, and it will be more so in the future.

How can these findings regarding intellectual styles and demographic characteristics be translated into action? While no generally accepted type of answer exists for this question, some reasonable assumptions can be formulated if findings from different traditions can be integrated into a common framework. The changeable nature of intellectual styles is important especially for children and the young in both academic and nonacademic settings because people tend to be more successful when they can adapt to the changing nature of schools, work, academic disciplines, and even lifestyle. As outlined by Cano-Garcia and Hughes (2000), schools should bring about the creation of learners who know how to learn. However, because educational systems reward through "good grades," students adapt their styles within the context of teaching methods, evaluation, etc. According to cognitive theorists (see Feldman, 2000; Halonen & Santrock, 1999; Morgan, 1997; Rayner & Riding, 1997; Sternberg & Williams, 2002), effective learning occurs through interaction with and support from people and objects in the world. Moreover, learning

is the manipulation of information perceived, learned, and remembered. Therefore, accessing the styles used by people not only in school but also in every phase of life is necessary to motivate individuals to analyze and adopt their own styles. In terms of academic settings, when necessary, as stated by Sternberg (1997), teachers should design a way of teaching that takes the diversity of individual styles into account. This must be done to enrich and favor all students. As Zhang (2002a) stated, educators should consider the development of styles of students to produce students who are going to be capable of adapting themselves to the ever-changing world. Educators must cultivate the creative styles of students.

In terms of academic and nonacademic settings, in practice, revealing the relationship between styles and demographic characteristics can encourage individuals to be aware of their styles, which thereby make them realize the reason why they prefer using certain styles than others. This would enable them to adapt themselves to diverse environments, which may improve individuals' autonomy and enhance their positive attitudes toward whatever environment they are in.

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7

Culture and Intellectual Styles

Li-fang Zhang and Robert J. Sternberg

INTRODUCTION

In the field of intellectual styles, one of the long-standing controversial issues has been over whether styles are traits (and thus stable) or states (and thus malleable). In their Threefold Model of Intellectual Styles, Zhang and Sternberg (2005, 2006) argued that styles are malleable. In this chapter, we argue for the same position through integrating some of the major existing conceptualizations and empirical investigations of the relationships between culture and styles. Empirical research on intellectual styles must take culture into account. Are intellectual styles universal, or are they culture specific? How would answers to this question inform the malleability of styles (or lack thereof)? Answers to these questions are important not only because they can inform future research in the field but also because they have implications for education and for the general public.

This chapter is divided into four parts. First, we define the main concepts of the chapter culture and intellectual styles. Second, we introduce models of culture and a guiding hypothesis on the relationships between culture and intellectual styles is proposed. Third, we introduce studies relevant to the hypothesis, based on the nature of intellectual styles and on one of the most prominent theoretical models of culture: Hofstede's (1980) four-cultural systems. Finally, we discuss implications of the reviewed findings in relation to research in the field and to education and beyond.

CULTURE AND INTELLECTUAL STYLES

Definitions of Culture and Cross-Cultural

What is "culture" and what do we mean by "cross-cultural"? There have been many insightful definitions of culture. Following Hofstede, we define culture as "the collective programming of the mind that distinguishes the members of one category of people from another" (Hofstede, 1990, p. 4). In this chapter, we restrict our survey of cross-cultural studies of intellectual styles to cultural distinctions anchored in countries and regions or ethnic groups within countries.

Intellectual Styles

An intellectual style refers to one's preferred way of processing information and dealing with tasks (Zhang & Sternberg, 2005, 2006). The term is used as a generic one that represents the meanings of all "style" constructs postulated in the past several decades, with or without the root word "style." These include, but are not limited to, cognitive style, conceptual tempo, decision making and problem-solving style, learning style, learning approach, mind style, perceptual style, and thinking style (see Chapter 1 in this volume).

In Zhang and Sternberg's (2005, 2006) Threefold Model of Intellectual Styles, styles are grouped into three broad types: Type I, Type II, and Type III styles. Type I intellectual styles denote preferences for tasks that provide low degrees of structure, that require individuals to process information in a more complex way, and that allow originality and high levels of freedom to do things in one's own way. These preferences correspond to those often expressed by highly creative individuals. Type II intellectual styles suggest preferences for tasks that are structured, that allow individuals to process information in a more simplistic way, and that require conformity to traditional ways of doing things and high levels of respect for authority. These preferences are consistent with those frequently observed in people with lower creative potential. Type III styles may manifest the characteristics of either Type I or Type II styles, depending on the stylistic demands of a specific situation.

Largely based on two criteria (popularity and empirical evidence), Zhang and Sternberg (2005, 2006) organized 10 existing style models/constructs in terms of the Threefold Model of Intellectual Styles: field-dependence/independence (FDI) (Witkin, 1962), mode of thinking/brain dominance (Torrance, 1988), reflectivity–impulsivity (Kagan, 1965), adaption–innovation (Kirton, 1976), thinking style (Sternberg, 1988), personality type (Jung, 1923), career interest type (Holland, 1973), divergent–convergent thinking (Guilford, 1967), mind style (Gregorc, 1979), and learning approaches (Biggs, 1978). Within each of these models, some individual styles satisfy the description of Type I styles, some fit in the description of Type II styles, while others meet with the definition of Type III styles.

THEORETICAL MODELS OF CULTURE AND CONCEPTUAL LINKS TO INTELLECTUAL STYLES

Theories of Culture

In the broad cross-cultural literature, cultural theoretical models have been constructed by scholars in different academic fields. For example, in anthropology, Hall (1976) proposed a cultural classification of high-context culture and low-context culture. In psychology, based on their study of the self-construct of different people across cultures, Markus and Kitayama (1991) divided cultures into interdependent-self ones and independent-self ones. Although these models could facilitate a cogent argument in favor of the impact of culture on intellectual styles, the cultural dimensions described in Hofstede's (1980) theoretical model in the field of

management are selected for guiding this chapter because the conceptual links between these cultural dimensions and the intellectual styles under discussion are the most obvious. Moreover, Hofstede's model distinguishes itself from the other models by its dealing with multiple dimensions of culture.

Hofstede's Cultural Dimensions and Their Conceptual Link to Intellectual Styles

Hofstede's cultural dimensions are the result of his analysis of a database established by a multinational corporation (IBM). Of the 71 countries for which survey data were available, the sample sizes of 40 countries were considered to be large enough to allow for reliable comparison. The survey was designed for tapping the employees' basic cultural values. The four basic dimensions are power distance, uncertainty avoidance, individualism (versus collectivism), and masculinity (versus femininity).

Power Distance

The basic issue involved in power distance is human inequality. It refers to the extent to which the less powerful members of a society accept and expect that power is distributed unequally. The level of power distance is socially determined and is endorsed by the followers as much as by the leaders. Jones and Herbert (2000) suggested that a small power-distance society[1] is conducive to creativity because it allows the individuals more freedom. On the contrary, a large power-distance society tends to stifle creativity because it puts much stronger emphasis on hierarchies, rules, and conformance. In cognitive terms, this would mean that in societies of larger power distance, people with less power would tend to accept the ideas of the more powerful players without questioning, and people with less power would rely, to some extent, on the ones with more power to think and make decisions for them. Meanwhile, the opposite of all this would be true in societies of smaller power distance.

Uncertainty Avoidance

Uncertainty avoidance pertains to a society's tolerance for ambiguity. It suggests the levels of comfort (or discomfort) of the members of a society with unstructured situations. People from low uncertainty-avoidance cultures tend to be more tolerant of new ideas and are less rule oriented. In contrast, people from high uncertainty-avoidance cultures tend to be less tolerant of new ideas and they have a propensity for acquiring clarity by seeking rules and regulations. In cognitive terms, this might suggest that people from higher uncertainty-avoidance cultures may reduce uncertainty by, at times, avoiding thinking for themselves and by demanding clear answers and guidance from other people. At the same time, people from low uncertainty-avoidance cultures tend to be more reflective and to think in more relativistic terms. They better tolerate ambiguity.

[1]Within the context of Hofstede's model, a society refers specifically to a country. However, beyond Hofstede's model, society can also refer more broadly to other groups based on dimensions such as cultural and ethnic backgrounds.

Individualism Versus Collectivism

This dimension concerns the relationship between the individual and the collectivity in a given society. Not only does this relationship refer to people's ways of living together (e.g., in families) but also "it is intimately linked with societal norms in the sense of value systems of major groups of the population" (Hofstede, 1980, p. 214). Individualist societies are more tolerant of individual thoughts and behaviors. Thus, individuals residing in such societies are less concerned with doing the "safe" things and are more willing to take risks. On the contrary, collectivist societies are less tolerant of distinctively individual thoughts and behaviors. It follows that people living in such societies are more concerned about doing things in ways that are approved by other members of the society, and such approval is often achieved by avoiding risk-taking. In cognitive terms, people from individualist societies tend to think in ways that defy the crowd, whereas people from collectivist societies are inclined to think in ways that communicate conformity.

Masculinity Versus Femininity

This dimension refers to the distribution of emotional roles between males and females. For males, the predominant socialization pattern is to be more assertive, whereas for females, it is to be more nurturing. Hofstede (1980) contended that the stability of sex-role patterns is more socialized than biologically determined. In masculine societies, assertiveness and decisiveness are more valued. In contrast, rule-following and obedience are much more appreciated in feminine societies. In cognitive terms, people from masculine cultures tend to be engaged in new ways of thinking, whereas people from feminine cultures tend to be engaged in more conventional thinking.[2]

By the year 2001, Hofstede had obtained an index on each of the four cultural dimensions for 66 countries. Although there were some exceptions, a general trend was identified. Broadly speaking, the economically more developed countries usually fall on one end of the four continua (low power distance, L_{PD}; low uncertainty avoidance, L_{UA}; individualism, I; and masculinity, M referred to as $L_{PD}L_{UA}$IM for the sake of brevity), while the economically less developed countries normally fall on the other end of the four continua (higher power distance, H_{PD}; high uncertainty avoidance, H_{UA}; collectivism, C; and femininity, F referred to as $H_{PD}H_{UA}$CF).

Hypothesis

If one cross-examines what Type I intellectual styles entail as described in the previous section and the characteristics of Hofstede's $L_{PD}L_{UA}$IM societies, one observes a resemblance between the two, although the former represent individual characteristics and the latter, societal ones. By the same token, one could easily detect the correspondence between the characteristics of Type II intellectual styles and those of $H_{PD}H_{UA}$CF societies.

[2]These conceptions of *masculine* and *feminine* can be viewed as stereotypical. We wish to make clear that we refer here to Hofstede's use of the terms, not our own.

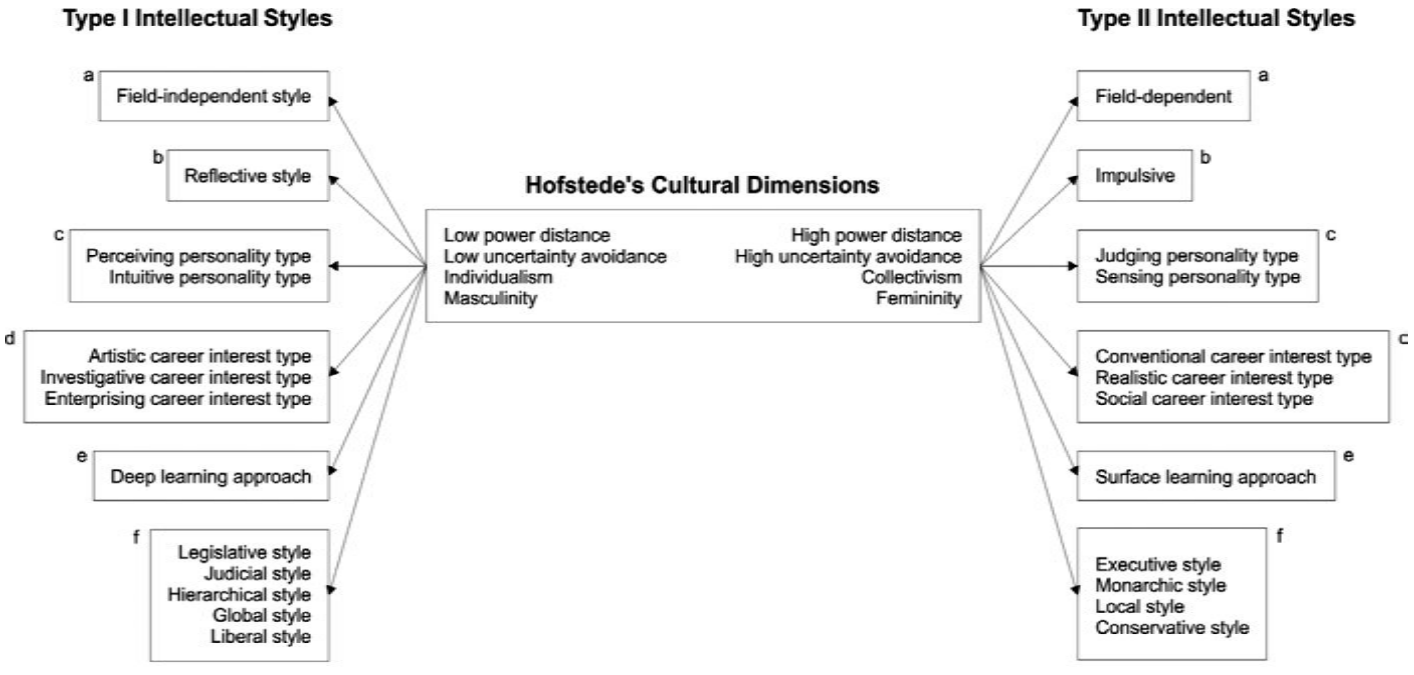
Thus, based on the conceptual similarities between intellectual styles and Hofstede's cultural dimensions, we might expect that people from Hofstede's $L_{PD}L_{UA}IM$ countries (which are usually economically more advanced and with higher levels of what our society defines as *modernity*) tend to employ Type I intellectual styles and that people from Hofstede's $H_{PD}H_{UA}CF$ countries (often economically less developed and with lower levels of modernity) tend to employ Type II intellectual styles (see Figure 7.1).

We extend this hypothesis to ethnic groups within countries. That is, people from Hofstede's $L_{PD}L_{UA}IM$ groups (typically the predominant ethnic group of a country) tend to employ Type I styles and that people from Hofstede's $H_{PD}H_{UA}CF$ groups (typically the ethnic minority groups of a country) tend to employ Type II styles.

However, this hypothesis may not always be true. There are at least four reasons as to why the above hypothesis may not always be supported. First, country/region/ethnic group is not the only dimension along which each of the cultural-dimension indices differs. The indices also differ by other major socialization variables, most notably, age, gender, occupation, and educational level (Hofstede, 1980). Second, within each country/region/ethnic group, people of different social classes and, of course, individuals of the same social class may fall on different points on each of the four continua. Third, with the increasing speed of modernization (as typified by rapid economic growth), those cultures that once tended toward, say, collectivism might begin to manifest more individualism (Matsumoto, 2002). According to Hofstede (1980), a society's economic evolution or modernity is a major determinant of social norms. Finally, people of the same culture may exhibit quite different characteristics on Hofstede's cultural dimensions. For example, Japanese culture is characterized, on average, by its avoidance of conflict and open criticism at the individual level (Westwood & Low, 2003). However, at the group or organizational level, uncertainty is often acknowledged. It is with these caveats that we made the general hypothesis of a relationship between culture and intellectual styles, which of course does not apply to each and every individual within the culture.

CULTURE AND INTELLECTUAL STYLES: EMPIRICAL EVIDENCE

The impact of culture on people's intellectual styles seems likely. However, very few existing studies have made direct comparisons of intellectual styles among people from different cultural settings, as direct comparisons are often associated with several major problems, such as a lack of common understanding of the construct under investigation and incompatibility of samples involved. Nonetheless, existing studies can very well be informative regarding the relationship between culture and intellectual styles. To what degree is the prediction of the relationships between intellectual styles and Hofstede's cultural dimensions supported by existing research? What are some of the challenges to this prediction? This part addresses these questions by presenting empirical findings for 6 of the 10 style constructs currently included in the Threefold Model of Intellectual



Footnotes:
[a] Witkin's construct of field-dependence/independence
[b] Kagan's model of reflectivity-impulsivity conceptual tempo
[c] Jung's theory of personality types
[d] Holland's theory of career interest types
[e] Biggs's theory of student learning
[f] Sternberg's theory of mental self-government

FIGURE 7.1
Hypothesis on culture and intellectual styles.

Styles[3]: field-dependence/independence, reflectivity–impulsivity, personality types, career interest types, learning approaches, and thinking styles (also see Figure 7.1). The selection of these style constructs was based on the availability of cross-cultural studies under investigation.

Field-Dependence/Independence

Alternatively known as psychological differentiation and perceptual style (Witkin, Dyke, Faterson, Goodenough, & Karp, 1962), FDI refers to the extent to which people are dependent upon versus independent of the organization of the surrounding perceptual field. Field-independent individuals are thought to be better at cognitive restructuring because of their propensity for being free from external referents. Field-dependent individuals are considered as being more socially oriented because of their higher levels of sensitivity to external referents.

Based on the definitions of field dependence and field independence and the definition of each of Hofstede's cultural dimensions, one would expect that people from societies (be they on the national level or the within-culture level) that fall on the $L_{PD}L_{UA}IM$ end of Hofstede's cultural continua to be more field independent, whereas people from societies that fall on the $H_{PD}H_{UA}CF$ end to be more field dependent (also see Figure 7.1).

Clearly, among all the existing style constructs, Witkin's FDI construct is the one that has been the most intensively studied in cross-cultural settings. Findings from earlier studies (those conducted in the 1960s and 1970s) generally supported the present hypothesis. However, empirical findings after the 1980s tended to be at odds with this hypothesis.

The earliest study was conducted by Witkin et al. (1962). The researchers provided extensive empirical evidence indicating that, compared with children of other groups, children in the United States were generally more field independent. Subsequent investigations among other cultural groups within the United States (i.e., African Americans, American Indians) have found that children from minority groups tend to be more field dependent than are Caucasian children. Meanwhile, a number of studies were conducted among children from less economically developed countries in Africa. For example, Berry (1966) and Dawson (1966) studied the FDI levels of children of tribal groups in Sierra Leone; Wober (1966) studied Nigerian groups; and MacArthur (1970) and Siann (1970) did their empirical research among Zambian boys and girls. Consistently, these groups fell within the more field-dependent range across several measures of FDI (e.g., Rod and Frame, Block and the Embedded Figures tests).

Meanwhile, Gruenfeld and MacEachron (1975) investigated the FDI differences among managers and technicians in 22 non-Western countries that were at various stages of modernization and development. Results strongly supported the authors'

[3]Notice that the Threefold Model takes an open-system approach. Any individual model can be included in the Threefold Model whenever the former is proved to have met the criteria specified for inclusion in the latter (see Zhang & Sternberg, 2005, for the criteria specified).

hypothesis that the levels of field independence are systematically associated with the levels of economic development of their respective countries.

Earlier studies of people's FDI have also revealed subcultural differences in cognitive styles. For example, when Dawson (1966) studied two of the tribal groups in Sierra Leone, he found that the Mende children (who lived in a culture in which children were given responsibilities at a very young age) were more field independent than were the Temne children (who were brought up in a culture in which strong emphasis was placed on conformity to adult authority).

The support for our hypothesis on the relationship between FDI and Hofstede's cultural dimensions can also be found in some of the more recent studies, although to a much lesser extent. At the national level, Engelbrecht and Natzel (1997) found that African American fourth and fifth graders were significantly more field independent than were South African fourth and fifth graders. At the within-culture level, results from several studies (e.g., Bennett, 2002) also pointed to the field-dependent tendencies of African American students and the field-independent propensity of their Caucasian peers.

However, many more recent studies do not support the present hypothesis. For example, in a review of a series of studies conducted between the mid-1980s and the mid-1990s, Bagley and Mallick (1998) reached the conclusion that students who were from, in Hofstede's terms, cultures known for their high individualism and smaller power distances (in this case, students from Canada, the United Kingdom, and the United States) were more field dependent, whereas students from cultures that have been generally agreed by anthropologists to be collectivist cultures that value conformity (in this case, Chinese and Japanese cultures) were more field independent. In searching for explanations to these unexpected findings, Bagley and Mallick made two convincing points, both communicating the dynamic nature of styles. First, because cognitive abilities are rising significantly in each decade in American children (and in Chinese and Japanese children; Flynn, 2007), American norms for the late 1960s and early 1970s (Witkin, Oltman, Raskin, & Karp, 1971) used for Chinese and Japanese children in the 1990s may not help to establish a fully accurate estimate of the degree of difference between the two groups on the FDI measures. Underlying this explanation is the assumption that children's cognitive styles change as their cognitive abilities do. Second, people can become more field independent as a result of their exposure to new cultural and educational experiences. Indeed, the second explanation should find its empirical support in many acculturation studies. For example, using three different measures of FDI, Buriel (1978) concluded that there was no evidence to support the assumption that Mexican American children were more field dependent than were Anglo Americans.

Reflectivity–Impulsivity

Reflectivity–impulsivity was originally introduced by Kagan and his colleagues (Kagan, 1965). Reflectivity is the tendency to carefully consider alternative solutions. Impulsivity is the tendency to respond rapidly and without sufficient forethought.

Based on the definition of reflectivity and impulsivity and on our earlier hypothesis of the relationship between styles and Hofstede's cultural dimensions, one would expect that people from societies that fall on the $L_{PD}L_{UA}$IM end of Hofstede's cultural continua to be, on average, more reflective, whereas people from societies that fall on the $H_{PD}H_{UA}$CF end to be, on average, more impulsive (also see Figure 7.1).

Like the construct of FDI, reflectivity–impulsivity has also been widely investigated in many countries (e.g., China, Guatemala, Japan, Jerusalem, Poland, North Ireland, and many others). However, unlike studies of FDI that had a greater focus on comparing different cultural groups, studies of reflectivity–impulsivity have been more focused on the validation of the inventory for assessing reflectivity–impulsivity (i.e., the Matching Familiar Figures Test) with respect to its use in the relevant cultures in which the studies were conducted. Of the studies that have taken a comparative approach, some supported the hypothesis that people from economically less developed cultural settings tended to be more impulsive, while others have failed to this hypothesis. Either way, findings from these studies have revealed the dynamic nature of reflectivity–impulsivity.

Studies supporting the hypothesis have been conducted at both the national level and the within-culture level. On the national level, for example, Solis-Cámara and Fox (1985) have concluded that compared with American, Japanese, and Israeli children, Mexican children were, on average, more impulsive. Similarly, after studying children in a small village (known as Wiava) in the Eastern Highlands Province of Papua New Guinea (PNG), Ausburn and Ausburn (1983) asserted that the PNG students' performance level on the Matching Familiar Figures Test was significantly below that expected for peers of their age and education level in developed countries. Ausburn and Ausburn contended that this low-level performance could mainly be attributed to the PNG students' lack of exposure to tasks that require visual analysis. That is to say, students' reflectivity can be enhanced through exposure to visual tasks.

Within the United States, several studies have compared the levels of reflectivity/impulsivity between African American and White research participants and found that the African Americans were, on average, significantly more impulsive than were the Whites. For example, early in 1968, Zucker and Stricker found that lower socioeconomic-class African American preschool children were more impulsive than were their middle-class White peers. Mumbauer and Miller (1970) reached the same conclusion that disadvantaged preschool children (with one half of this group being Black) were more impulsive than were culturally advantaged children from middle-class families.[4]

Among the existing comparative studies, findings that present challenges to the hypothesis on the relationship between impulsivity/reflectivity and culture are abundant. For example, Adejumo (1979) found a lack of evidence to support the commonly held assumption that African Americans are, on average, more impulsive. However, several studies have suggested that the effects of culture on the

[4]Note that these studies are rather old and that the pattern of results may well have changed in the present day.

development of this style dimension may be indirect, through interacting with other variables.

One such variable is educational level. For example, in investigating impulsivity/reflectivity among Chinese and American graduate students in the United States, Huang and Chao (1998) found that Chinese students were significantly more reflective than were their American peers. Of course, there could be many possible explanations to this finding. However, the overseas Chinese students' unique educational background is a likely factor that enhanced their level of reflectivity. By traveling to the United States to pursue their postgraduate education, the overseas Chinese students have crossed a cultural boundary. Tullett (1997) argued that the more boundaries people cross, the more creative they are in their thinking. In addition, it should be noted that the Chinese participants in Huang and Chao's study were a highly selected group of students.

Personality Types

Jung (1923) proposed that people attend selectively to elements in their environments, seeking out the ones compatible with their alleged personality type, and avoiding or leaving incompatible ones. These tendencies, according to Jung, lie along three dimensions: extroversion–introversion, sensing–intuition, and thinking–feeling. Myers and McCaulley (1985) extended Jung's work by adding a fourth dimension judging–perceiving. An extraverted person leans toward the outer world of objects, people, and actions, whereas an introverted person prefers the inner world of concepts and ideas. A sensing person has a predilection for seeking the fullest possible experience of what is immediate and real, whereas an intuitive person seeks the broadest view of what is possible and insightful. A thinking person likes to make decisions based on rational and logical planning, whereas a feeling person likes to make decisions based on harmony among subjective values. A judging person tends to be concerned with seeking closure, sometimes without sufficient exploratory activities, whereas a perceiving person tends to be attuned to incoming information and open to new events and changes.

Jung (1958) argued that psychological functions apply not only to individuals (types) but also to civilizations, nationalities, and cultures. The Myers-Briggs's Type Indicator (MBTI), first published in 1943 and currently in its 19th printing (Myers, McCaulley, Quenk, & Hammer, 1998), has been translated into many languages and has been widely used around the world for assessing the aforementioned four dimensions of preferences.

In Zhang and Sternberg's (2005) Threefold Model of Intellectual Styles, the intuitive and perceiving personality styles are classified as Type I styles, the sensing and judging personality styles as Type II, and the remaining as Type III styles. Along with our understanding of Hofstede's cultural dimensions, this classification of the MBTI personality types enabled us to predict that individuals from societies that fall on the $L_{PD}L_{UA}$IM end of Hofstede's cultural continua would be more intuitive and perceiving, whereas people from societies that fall on the $H_{PD}H_{UA}$CF end would be more sensing and judging (also see Figure 7.1). This prediction was confirmed by

findings in the majority of empirical studies (e.g., Hammer & Mitchell, 1996; Hedegard & Brown, 1969), although it was challenged by findings of some other studies (e.g., Shade, 1986).

Nearly all studies supporting the hypothesis have been conducted at the within-culture level. Researchers of these studies primarily aimed at identifying the predominant MBTI types of their research participants from different ethnic groups. As early as in 1969, Hedegard and Brown reported that, compared with their White counterparts, African-descent students tended to use more concrete and tangible ways (i.e., more sensing) rather than abstract and intellectual ways (i.e., less intuitive) in dealing with their environments. Hammer and Mitchell (1996) examined the MBTI types of a national sample (1,267 adults aged 18–94 years) matched on ethnicity to the 1990 census. The authors found that African Americans had a significantly higher proportion of sensing type when compared with the overall sample, which was highly dominated by the White Americans.

In one of his earliest publications, Jung (1958) turned his attention to the possible personality styles differences between Eastern and Western civilizations, suggesting a preference for introversion in the former and for extraversion in the latter. Empirically, among Chinese nationals, the sensing and judging types tended to be overrepresented (Broer & McCarley, 1999).

Yet, the hypothesis on the differences in the MBTI types based on cultural groups has also been challenged. A case in point is the research findings on the differences between African Americans and European Americans. Given the social and economic disadvantages that African Americans have had, on average, when compared with their European American counterparts within the United States, one would anticipate that African Americans would be more sensing and judging and that European Americans would be more intuitive and perceiving, on average. However, Shade's (1986) review of the literature did not support such a prediction. Instead, Shade's own research on ninth-grade students has repeatedly found that African-descent students are, on average, more perceiving, whereas European Americans are more judging (Shade, 1986).

Career Interest Types

Holland (1973) proposed that people can be classified into six types corresponding to six occupational environments: realistic, investigative, artistic, social, enterprising, and conventional. People of the realistic type like to work on concrete tasks and enjoy outdoor activities. People with an investigative type of career interest like to be engaged in scientific kinds of work. People of the artistic type like to deal with tasks that provide them with the opportunities to use their imagination. Socially interested people like to work in situations in which they can interact and cooperate with other people. People of the enterprising type like to take on leadership roles (that requires innovative thinking) when working with others. Finally, people of the conventional type like to work with data under well-structured situations.

The Self-Directed Search (SDS, Holland, 1994) has been the most widely used measure of the career interest types based on Holland's theory. First published in

1971 and having been translated into about 30 languages, the SDS has generated thousands of empirical studies worldwide.

Cross-cultural studies of career interests based on Holland's model typically have one of the following three objectives: (a) to test the criterion-related validity of the SDS, (b) to examine the structure underlying the interests of racial–ethnic groups within the United States or of other national groups, and (c) to identify differential patterns of interests. This research has, in general, lent great support to Holland's model, although the model has not gone unchallenged.

In Zhang and Sternberg's (2005) Threefold Model of Intellectual Styles, the artistic career interest is classified as a Type I style, the conventional interest as a Type II style, and the remaining ones as Type III styles. Considering Hofstede's cultural dimensions and the definition of each of the six types of career interests, we anticipated that individuals from societies that fall on the $L_{PD}L_{UA}$IM end of Hofstede's cultural continua would tend to express stronger interest in artistic, investigative, and enterprising careers, whereas people from societies that fall on the $H_{PD}H_{UA}$CF end would tend to be more interested in the conventional, realistic, and social types of careers (also see Figure 7.1).

Regarding both the criterion-related validity of the SDS and the degree to which data from various cultures fit Holland's circular order model, we predicted that data sets from Hofstede's $L_{PD}L_{UA}$IM cultures would yield better prediction and better fit than those from Hofstede's $H_{PD}H_{UA}$CF cultures. Hofstede's cultural dimensions (and their often associated factors economic development and level of modernization) could be related to a nation's (or ethnic group's) occupational structure, in particular, to its distribution of the kinds of career interests (Rounds & Tracey, 1996). Cultures falling on Hofstede's $H_{PD}H_{UA}$CF end would necessarily place constraints on individuals' vocational interests, such as by depriving individuals of the opportunities to be exposed to certain types of occupations and to develop the career interests they might have developed had they been socialized elsewhere in a society that falls on the L_{PD}-L_{UA}IM end of Hofstede's cultural system. Following this logic, one would stand on a solid ground for predicting that such restrictions would lead to poorer prediction and poorer model fits for the $H_{PD}H_{UA}$CF cultures. Likewise, one would predict that data from $L_{PD}L_{UA}$IM cultures would demonstrate stronger construct validity of Holland's model than would those from $H_{PD}H_{UA}$CF cultures.

These hypotheses, while not without their challenges (e.g., Fouad & Daucer, 1992; Swanson, 1992), have received empirical support from many studies (e.g., Gade, Fuqua, & Hurlburt, 1984; Leung & Hou, 2001; Payne & Sabaroche, 1985; Rounds & Tracey, 1996). Again however, these mixed findings have collectively supported the notion of style malleability.

Support for our hypothesis can be found in studies that aimed at achieving all three objectives mentioned earlier. First, criterion-related studies lent support to our hypothesis. That is, the SDS's predictive validity is relatively lower for samples from Hofstede's $H_{PD}H_{UA}$CF cultures. For example, among 777 Hong Kong high school students, Leung and Hou (2001) found that the correspondence between students' high-point interest code on Holland's SDS and tentative choices of university majors and careers was generally lower than that obtained in previous studies in the United States. These lower predictive validities could have been attributable to

educational systems (educational systems being part of cultural practices) that tend to exercise more power and control, putting constraints on students' development of career interests. For example, in Hong Kong, students are required to choose, at the end of junior high school (i.e., ninth grade in the United States), either a science stream or an arts stream. Such early commitment may have inhibited students' development of career interests they would have developed otherwise. As a result, what shows on their SDS test may not correspond very well with their choices of university majors or of actual careers. Thus, examining this inhibition of development from a different perspective, one could argue that intellectual styles, as represented by career interests in this context, are malleable.

Second, we anticipated that data from $L_{PD}L_{UA}$IM cultures would have a better structural fit with Holland's model than would those from $H_{PD}H_{UA}$CF cultures. Support for this hypothesis is strong, although somewhat mixed. For example, incorporating the notion of economic development (as assessed by the gross domestic product per capita, GDPPC) and two of the four Hofstede's value systems (masculinity–femininity and individualism–collectivism), Rounds and Tracey (1996) conducted a meta-analysis of data sets from 20 U.S. ethnic samples, 76 international samples (representing 18 countries), and 73 U.S. benchmark samples. Although the degree of fit of data with Holland's model had no significant relationship to GDPPC and masculinity–femininity, countries with more individualistic values fit the model better than countries with more collective values. Nonetheless, our hypothesis on the relationships between career interests and culture also failed to receive support from data of some countries. For example, in contrast to our prediction (and indeed, the prediction of Rounds and Tracey as well), data from Australia and Canada showed a significantly poorer model fit when compared with the U.S. benchmark data sets.

Further challenges to our hypothesis were found in other studies. For example, Swanson (1992) concluded that the structure of interests among African American college students was similar to that of White American college students. Cross-nationally, holding gender and occupation constant, Fouad and Daucer (1992) found strikingly similar structures of career interests among engineers in Mexico and in the United States. Similar research findings had been obtained as early as in the 1960s. For example, Lonner (1968) concluded that U.S., German, Swiss, and Austrian psychologists were more similar to one another than to accountants within the same country. Given such evidence, one could argue that it is not ethnic or national cultures that shape people's career interests, but rather, occupations. However, such an argument is not well grounded because there is also substantial evidence revealing differences that ethnic and national cultures have made in people's career interests. Furthermore, going back to the nature of intellectual styles with regard to style malleability, one could argue that whether it is occupation or ethnic and national cultures that matter more in people's intellectual styles, intellectual styles are dynamic.

Finally, the hypothesis regarding the patterns of career interests expressed by people of different cultural groups has also found support in studies conducted in the mid-1980s. In a first study, Payne and Sabaroche (1985) administered the SDS and the Vocational Preference Inventory (VPI) to 101 14- to 16-year-old school children in Dominica, an economically relatively underdeveloped Caribbean nation.

Although data suggested that Dominican adolescents can be fairly reliably classified into Holland's six career interest types, the significantly positive relationship found between the social and realistic types in their study was not consistent with Holland's theory. According to Holland's model, the social and realistic types should be opposite to each other, with the former being "people-oriented" and the latter being "things-oriented." Such a finding, albeit contrary to the prediction of Holland's model, makes good sense in the context of Dominica. As Payne and Sabaroche have cogently argued, "many Realistic or things-oriented' occupations in a country such as Dominica involve a significant Social' component. Auto mechanics, for example, would not normally work mostly out of sight of the public, but be self-employed and rely for custom on their ability to have good interpersonal rapport with clients" (Payne & Sabaroche, 1985, p. 154).

Our hypothesis was further supported by the finding that, compared with the normative White American samples, the Native American samples scored significantly higher on the social, conventional, and realistic scales. For example, within the United States, a larger percentage of the conventional type was reported among such ethnic groups as African Americans, Hispanics, and Native Americans, when compared with that among the White Americans (Holland, Fritzsche, & Powell, 1994).

Learning Approaches

Based on quantitative research evidence, Biggs (1978; see also Entwistle, 1981) concluded that there are three common approaches to learning: surface, deep, and achieving. The surface approach to learning involves a reproduction of what is taught to meet the minimum requirements. The deep approach to learning involves a profound understanding of what is learned. The achieving approach focuses on maximizing one's grades. Each approach has two components: motive (i.e., why one learns) and strategy (i.e., how one learns).

The two most commonly used research tools for assessing the three learning approaches are Biggs's (1987) Learning Process Questionnaire (LPQ) for school students and the Study Process Questionnaire (SPQ) for university students. Originally constructed to measure Australian and Canadian students' learning approaches, the inventories have been translated into several languages and proved to be valid in many cultures. Cross-cultural studies focused on either examining the internal structure of the inventories in different cultural contexts or testing the relationships between students' learning approaches and their academic achievement.

In Zhang and Sternberg's (2005) Threefold Model of Intellectual Styles, the deep learning approach is classified as a Type I style, the surface approach as a Type II style, and the achieving approach as a Type III style. In this chapter, we anticipated that individuals from societies that normally fall on the $L_{PD}L_{UA}$IM end of Hofstede's cultural continua would tend to adopt the deep approach to learning, whereas people from societies that usually fall on the $H_{PD}H_{UA}$CF end would tend to use the surface approach to learning (i.e., first hypothesis, also see Figure 7.1). Our second hypothesis was: The $L_{PD}L_{UA}$IM societies tend to reward the deep approach to learning, in that deep-approach learners would perform better academically. Likewise, the

$H_{PD}H_{UA}CF$ societies tend to reward surface learners, in that surface-approach learners would obtain significantly better academic achievement.

To what extent have these predictions on the relationship between learning approaches and Hofstede's cultural systems been supported or disconfirmed? The answer is, of the hypotheses on the relationships of cultural dimensions to all the style constructs discussed in this chapter, those relating to learning approaches have been the most seriously challenged by empirical data.

In line with our first hypothesis, two popular claims are often made in cross-cultural studies of learning approaches: (a) that African-descent and Hispanic-descent students have a greater preference for the surface learning approach than do European-descent students and (b) that Asian-descent students tend to be rote learners, adopting the surface approach to learning. Some earlier works supported these assertions (e.g., Ballard & Clanchy, 1984). However, some of the more recent findings are in opposition to both notions.

Comparative studies on the learning approaches of African-descent (and Hispanic-descent) and White students in several cultures (e.g., Mpofu & Oakland, 2001) have failed to reveal significant difference. Similarly, some research comparing the learning approaches of Asian students with those of Caucasian students also is in disagreement with the stereotypical view that Asian-descent students are rote learners (e.g., Brand, 2001). Moreover, there is evidence indicating that White American and Australian students showed a greater tendency to rely on the surface approach to learning than do their Asian peers, including students from Hong Kong, the Philippines, and Nepal (e.g., Brand, 2001).

Nonetheless, since the time the stereotypical view about Asian students' being rote learners was challenged, some scholars have put caveats on this challenge. For example, Niles (1995) argued that as there is also some evidence indicating that Asian students are examination oriented, stronger evidence is needed to refute such a long-held view about Asian students.

From yet a different perspective, one could also see the dynamic nature of learning approaches as they relate to culture. For example, Volet, Renshaw, and Tietzel (1994) examined the change in students' learning approaches between the beginning and the end of a semester. Research participants were a group of local Australian students and a group of Southeast Asian students enrolled in a Western Australian university. Results indicated that, by the end of the semester, the differences in learning approaches between the two cultural groups found at the beginning of the semester had disappeared. The authors concluded that the similarity in learning approaches between the two groups found at the end of the semester was attributable to the adaptation of the Southeast Asian students to the demands of the academic course and the learning environments.

Finally, findings on the relationship between learning approaches and academic achievement have lent strong support to our second hypothesis. For example, Watkins (2001) reviewed studies conducted between the late 1980s and the late 1990s on this topic. Consistent with our hypothesis, using the deep approach to learning is not associated with better academic achievement in India, Fiji, and Japan. Also in line with our hypothesis, the surface approach to learning was encouraged in Hong Kong, Nepal, Nigeria, and South Africa. A more recent study conducted in

Zimbabwe (Mpofu & Oakland, 2001) also indicated that although European-descent deep learners achieved better academically, African-descent students who reportedly adopted the deep approach to learning had lower academic achievement. Apparently, all these cultures tend to be on Hofstede's $H_{PD}H_{UA}CF$ end, and some with lower levels of modernity.

Thinking Styles

Using "government" metaphorically, Sternberg (1988, 1997) contended that, just as there are many ways of governing a society, there are many ways of managing our activities. These ways of managing are thinking styles. In managing our activities, we choose styles with which we feel comfortable. Moreover, we are at least somewhat flexible in our use of styles and try with varying degrees of success to adapt ourselves to the stylistic demands of a given situation. For example, an individual using the legislative style when designing a research project may prefer to use the executive style when installing information in an iPod according to written instructions.

The theory of mental self-government describes 13 thinking styles (see Sternberg, 1997 for definition of each style) that fall along five dimensions: functions, forms, levels, scopes, and leanings. Based on both empirical data and conceptual arguments, Zhang and Sternberg (2005, 2006) classified the 13 thinking styles into three types, corresponding to the three types of intellectual styles (also see Figure 7.1).

The theory of mental self-government has been operationalized through several instruments, including the Thinking Styles Inventory (TSI, Sternberg & Wagner, 1992) and its revised versions the TSI-R (Sternberg, Wagner, & Zhang, 2003) and the TSI-R2 (Sternberg, Wagner, & Zhang, 2007). The three versions of the inventory have been validated in many studies conducted in several cultures (see Higgins & Zhang, 2009).

In this chapter, based on the definition of Hofstede's cultural systems and that of the three types of thinking styles, we anticipated that individuals from societies that fall on the $L_{PD}L_{UA}IM$ end of Hofstede's cultural continua would tend to use Type I styles and the internal style, whereas people from societies that usually fall on the $H_{PD}H_{UA}CF$ end would tend to use Type II styles and the external style. Furthermore, the $L_{PD}L_{UA}IM$ societies tend to reward the Type I and internal styles and thus, in these societies, these styles would have a positive relationship with better academic performance. Likewise, the $H_{PD}H_{UA}CF$ societies tend to reward the Type II and external styles and thus, in these societies, these styles would be significantly related to better academic achievement.

Research supports both hypotheses. For example, on studying a sample of Chinese Canadians, Tang (2004) concluded that her research participants' thinking styles differed significantly from those of the Hong Kong samples, with the former scoring significantly higher on two of the Type I styles as well as on two of the Type II styles than did the latter. As another example, in a comparative study of thinking styles, Zhang, Fu, and Jiao (2008) found that their Tibetan research participants, both university students and faculty members, tended to use Type II styles more frequently than did their counterparts from the Han majority culture.

Furthermore, research on the relationship between thinking styles and academic achievement also shed light on the roles of culture in thinking styles. Results from the second line of investigations (i.e., the contributions of thinking styles to academic achievement) also largely affirm our current hypothesis. It has been consistently found that, in secondary school settings of Hong Kong and Israel and in university settings of Hong Kong, the Philippines, and Spain, students with Type II thinking styles tended to be higher academic achievers, whereas those who scored higher on Type I thinking styles tended to be lower academic achievers (Bernardo, Zhang, & Callueng, 2002; Nachmias & Shany, 2002). As expected, university students in the United States tended to be rewarded academically for their Type I thinking styles (Zhang, 2002). However, in contrast to the conventional view that mainland Chinese students are conservative in their thinking styles, there is research evidence indicating that Type II thinking styles are penalized in the context of university students' academic achievement (Zhang, 2001).

One should always keep in mind the many caveats in drawing any conclusion about any research findings. For example, apart from the widely acknowledged possibility that the same assessment tool used in different cultures may very well result in scores that are not comparable, the relationships between thinking styles and achievement may also differ, based on variables such as school grade levels and subject matters. Nonetheless, existing research on thinking styles in different cultures suggests that culture does play a role in people's thinking styles.

LIMITATIONS, IMPLICATIONS, AND FUTURE DIRECTIONS

In this chapter, we have been discussing the roles of culture in intellectual styles. We made and tested a hypothesis that is based on the nature of intellectual styles as well as on one of the most prominent theories of culture that of Hofstede's cultural dimensions. It should be acknowledged that making and testing such a hypothesis has several limitations. First, one may argue that making and testing such a hypothesis could be flawed because Hofstede's model has been criticized as using a dichotomized method of showing cultural differences, resulting in related problems such as unjustifiable generalizations and ignoring of subtleties (Clark, 2003). Second, making and testing such a hypothesis can tend to promote stereotypical views about the intellectual styles of people from different cultures. Third, as has been repeatedly pointed out, there are many caveats that have to be kept in mind when considering the findings obtained in cross-cultural studies of intellectual styles, including macroissues such as measurement tools used, the meaning of a particular style construct, comparability of samples, the dynamic nature of culture, and process of modernization, as well as microissues such as research participants' age, educational level, gender, motivation, occupation, and socioeconomic status.

Yet, none of these above limitations should prevent scholars from making inquiries into the general role of culture (and its strong correlate economy) in the development of intellectual styles. On the contrary, these limitations point to the future directions to which this area of research should go. This review shows clearly that although scholars' research interest in identifying the role of culture in intellectual

styles can be traced back to almost half a century ago, existing research in this area can be said to have only uncovered the tip of the iceberg. Most noticeably, serious cross-cultural research has been conducted based on only one style construct that of FDI. More vigorous cross-cultural studies of intellectual styles need to be designed and carried out. These studies should be systematic ones characterized by using sound research tools, taking into a fuller account of variables that may moderate or mediate the relationships between styles and culture, integrating multiple research methodologies, and involving research participants from as many cultural settings as possible. In particular, we call for experimental studies that delve into the process of people's development of styles that can be claimed to be largely the consequences of culture. Yet, research on such a scale cannot be carried out without the concerted efforts from scholars across the world, which are needed to enrich this field of investigation.

Naturally, one would want to know the practical significance of the findings from a review such as this. Due to the lack of statistics necessary for conducting a meta-analysis research and for reporting the effect sizes of the results in the studies discussed here, we have only been able to conduct a general review of the literature. Nonetheless, because of the strong and consistent evidence presented here, some implications of the present findings for education and for the general public may be proposed.

The notion of intellectual styles is becoming increasingly known to the education arena. However, almost all parties (including students, teachers, counselors, and senior managers) are left to wonder what they could do in applying the notion of styles to their efforts of enhancing student learning and development because there is not enough clear articulation on what affects styles. This chapter shows that culture is an important factor in the formation of styles. An awareness of the relationship between culture and styles could be beneficial to all parties in educational institutions. For example, teachers could benefit from such an awareness. Increasingly, teachers teaching at various levels (from kindergartens to universities) are dealing with students from diverse cultures. An understanding of the possible impact of culture on styles may raise teachers' levels of cultural sensitivity in dealing with students with diverse cultural backgrounds. Teachers' sensitivity to students' diverse intellectual styles associated with culture can be manifested in a wide variety of teaching practices, ranging from teachers' expectations toward students to their interpersonal interactions with students, and from teaching styles to assessment methods.

A good understanding of the present findings should also be of assistance to senior managers of educational institutions who are perhaps in the best position to make policies that affect the degree to which the relationship between culture and intellectual styles is taken into account in the learning environment. In contemporary educational institutions, senior managers are dealing with not only an increasingly diverse student population but also a progressively more diverse staff population. Such diversification of student and staff populations calls for educational environments (including environments for administration as well as teaching and learning environments) that allow for multiple intellectual styles, in particular, creativity-generating styles. It calls for educational environments that accommodate cultural

diversity. One way of creating such educational environments is to take into consideration the complex relationships between culture and styles when making and implementing educational policies.

By the same token, the present findings have implications for the general public. For example, instead of holding on to stereotypical views about the intellectual styles of different cultural groups, one should realize that styles are malleable. People who experience cultural shock should be confident that it is a matter of time before their ways of thinking become more effective in their new host culture.

The same applies to those who believe in their own cultural superiority. People in Hofstede's $L_{PD}L_{UA}IM$ value systems (and often economically advantaged societies) should realize that their counterparts on the other end of Hofstede's continua may be just as creative in their thinking if they were in environments that encourage creativity-generating intellectual styles.

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8

Metacognition and Styles

Eugene Sadler-Smith

Developing a repertoire of intellectual styles in order that individuals may learn, problem-solve, and take decisions in increasingly dynamic, complex, and time-pressured personal and professional contexts is a vital capability, and one that is more important now than ever before (Zhang & Sternberg, 2009). Developing a wider repertoire of thinking and learning styles and strategies involves "thinking about thinking" and "learning how to learn," that is, it is essentially a metacognitive process (cf. Type III styles, Zhang & Sternberg, 2005). Indeed, much of the educational utility (and unrealized potential) of intellectual styles research rests upon: first, translating scientific findings into practical action via improved instructional processes and designs that acknowledge and accommodate styles; and second, empowering learners with scientifically validated styles-related metacognitive self-knowledge. In this chapter, I will explore the concept of metacognition from the perspective of intellectual styles and offer a framework that may contribute to the advancement of this important area of styles research.

METACOGNITION

Metacognition has long held considerable allure and appeal for psychologists and educationalists alike; for example, in the 1990s metacognition was judged one of the "top 100" topics in cognitive and developmental psychology (Nelson, 1992), and was seen as "one of the most important developments in the contemporary study of cognition" (Roberts & Erdos, 1993, p. 259). Despite this and its apparent natural affinity with styles, its relationship to styles appears to be either underexplored or taken for granted.

Styles and strategies are related to metacognition for several reasons: First, metacognition involves information processing, for example, metacognition is "the active monitoring and consequent regulation and orchestration" of information processing activities in "in the services of some concrete goal [such as learning]" (Flavell, 1976, p. 232); second, self-awareness of one's habitual and stable preferences for particular learning and thinking processes is a necessary precondition for metacognition; third, instructor awareness of style increases the likelihood of the incorporation of style-related factors into the design of educational programs. In terms of styles of

learning and thinking, metacognition is a self-aware and intentional orientation to the representation and processing of information during learning, thinking, problem solving, and decision making. And although the precise nature of the construct is the subject of debate (Dinsmore, Alexander, & Loughlin, 2008) from the perspective of styles, metacognition is comprised of the following (see Brown, 1987; Bruning et al., 1995; Kluwe, 1987; Kolb & Kolb, 2009):

1. *Knowledge of cognition*: declarative knowledge about ourselves as learners (e.g., what intellectual style preferences we are likely to exhibit when averaged out over tasks); procedural knowledge about strategies (e.g., whether and how to use a verbal or visual cognitive strategy to solve a problem); conditional knowledge about when or why to use a strategy (e.g., by recognizing the salient and style-relevant features of a problem or task; e.g., whole-view vs. part-view).
2. *Regulation of cognition*: planning (e.g., the selection of necessary strategies, such as deep processing, and the allocation of appropriate cognitive resources to support this); information management (e.g., skills and strategies used "on-line" to process information); monitoring (e.g., the assessment of one's own strategy use); "debugging" (e.g., strategies used to correct performance errors, such as those accruing as a result of inappropriate use of stylistic preferences); evaluation (e.g., appraising the outcomes and processes of thinking and learning in terms of one's mental models of the learning process and of oneself as a learner).

These regulatory processes may be highly automated, and therefore introspection and articulation may sometimes be difficult or impossible to achieve directly; nonetheless, metacognitive knowledge and regulation not only improve with domain knowledge and expertise but they are also trainable (Schleifer & Dull, 2009).

A large body of research exists in relation to metacognition, and readers are referred to Alexander (2008), Maruno (2007), Otani and Widner (2005), Perfect and Schwartz (2002), Schraw and Moshman (2005), and Schunk (2008) for comprehensive overviews and more general evaluations of the field. Zohar and Ben-David (2009) called for an in-depth theoretical clarification of a number of possible sources of confusion surrounding the concept of metacognition, for example, "cognitive" versus "metacognitive," imprecise use of the term "metacognitive" (using it to denote very different concepts, or using different terms to denote the same concept, cf. styles), and lack of clarity regarding the relationships between the various components of metacognition. In a similar vein, Kaplan (2008) made a plea for some form of clarifying conceptual framework, and suggested that metacognition, self-regulation, and self-regulated learning should be considered as subtypes of the general, abstract, phenomenon of "self-regulated action." In their attempt to resolve some of these questions, Zohar and Ben-David proposed a subconcept of metastrategic knowledge (MSK) defined as "general, explicit knowledge about higher-order thinking strategies" (Zohar & Ben-David, 2009, p. 191) consisting of the abilities to: first, make generalizations and draw out rules regarding thinking strategies; second, explain when, how, and why such a strategy should be

used (or not used); third, know the disadvantages of not using an appropriate strategy; and finally, be aware of task characteristics that call for the use of a particular strategy.

Clearly, the use of the term "metacognition" has broadened considerably beyond Flavell's original conceptualization, and it has developed linkages to other related concepts, models, and theories such as organizational metalearning (see Visser, 2007). Perhaps the trend identified by Papaleontiou-Louca for the term "metacognition" to include "almost anything psychological, rather than just anything cognitive" (Papaleontiou-Louca, 2003, p. 10) parallels problems that have dogged cognitive styles research (for a review of the development of the latter field and its attendant problems, see Kozhevnikov, 2007). An unrestrained broadening of Flavell's original idea runs the risk of diluting it to the extent that it can come to mean all things to all people who have an interest in phenomena that exist at the nexus of cognition and learning.

Hence, from our perspective to be useful as a theoretical resource for styles researchers, metacognition needs to be commensurable with current theories of intellectual styles. Moreover, to be useful as a practical resource for educators and instructors, there should be evidence that metacognition can be operationalized in real-world settings and that its application yields useful outcomes.

INTELLECTUAL STYLES AND STRATEGIES

Many different labels and definitions are used for and applied to the concept of "style" (for comprehensive reviews, see Coffield, Moseley, Hall, & Ecclestone, 2004; Kozhevnikov, 2007; Riding & Rayner, 1998; Zhang & Sternberg, 2009). The term "intellectual style" provides an "umbrella term" for constructs such as learning styles and thinking (cognitive) styles (Zhang & Sternberg, 2009, p. xi). From the perspective of this chapter, "style" will be used to refer to the relatively stable states with respect to learning and thinking that people have a proclivity to enter into and which are more or less adaptive under different sets of circumstances (Zhang & Sternberg, 2005). Styles as "relatively stable states" are nonetheless malleable to the extent that they can be adapted to changing environmental demands and modified by life experiences (Kozhevnikov, 2007). They serve as "high level heuristics" that organize the deployment of strategies, operations, and propensities (including abilities) in complex processes such as "problem solving and learning" (Messick, 1976, p. 9).

Several authors have offered a variety of conceptual frameworks within which styles may be classified, for example, Curry's (1983) onion model; Miller's (1987) model of cognitive processes and styles; the duplex model (Sadler-Smith, 2009); styles as modes of organizing, processing, and representing information (Sadler-Smith, 2011); and the integrative models of Riding and Cheema (1991), Sternberg and Grigorenko (1997), and Zhang and Sternberg (2005).

Zhang and Sternberg (2005) proposed a three-level model of intellectual styles, which integrated a number of important style and style-related constructs (e.g., learning approach, personality and career personality type, mode of thinking and "mind"

and thinking style, decision-making style, conceptual tempo, perceptual style, and structure of intellect). Zhang and Sternberg (2005, 2009) posited three intellectual style types:

1. Type I styles, involving preference for low-structure tasks, requiring complex information processing, allowing scope for originality and freedom.
2. Type II styles, involving preference for structured tasks, allowing more straightforward information processing, with conformance and respect for authority.
3. Type III styles, an amalgam that may manifest Type I or II characteristics, depending upon the demands of the situation.

Zhang and Sternberg (2005, 2009) argued that "deliberately fostering Type I styles can be effective in preparing people to meet the challenges of a fast-moving world" on the assumption that "intellectual styles are value-laden (with Type I on average more adaptive)" (2009, p. 64). Hence, from the perspective of Zhang and Sternberg's (2005) threefold model of intellectual styles applied to the business management context, for example, Type I styles (e.g., field independent, innovative, and intuitive) are "strongly associated" with desirable leadership behaviors (Zhang & Sternberg, 2009, p. 80). Therefore, one instrumental purpose of metacognitive interventions might be to facilitate a shift from Type II mode of thinking to Type I mode of thinking in order to improve leadership and various other types of behavior and performance in occupational settings.

At the level of information processing (corresponding to mode of thinking, personality type, "mind style," and decision style in Zhang and Sternberg's conceptualization of intellectual type), there have been several attempts to unify styles, for example, efforts to bring a number of related styles together under a superordinate analytical–holistic dimension (e.g., Allinson & Hayes, 1996). However, recent findings cast doubt upon the view of style as unitary, and suggest a more complex hierarchical organization of style consisting of at least two subordinate dimensions and quite possibly more (Blazhenkova & Kozhevnikov, 2009; Hodgkinson & Sadler-Smith, 2003; Kozhevnikov, 2007). Several researchers have concluded that dimensions previously conceptualized as polar opposites are in reality interdependent and integrated aspects of information processing that are contextually appropriate, and that have each evolved in the human organism for particular purposes (a view, incidentally, which is commensurable with the intellectual style model) (see Epstein, 1994).

Zhang and Sternberg argued that "most styles are value-laden rather than value-free" (Zhang & Sternberg, 2009, p. 64). From the dual-process perspective, styles are value-free in that each has its own utility under particular sets of circumstances (Epstein, Pacini, Denes-Raj, & Heier, 1996), and are value-laden (i.e., "better") under those learning, problem-solving, and decision-making situations for which they are appropriate; for example, more of an intuitive style is better in complex, time-pressured, and dynamic situations in which the decision-maker has domain-relevant expertise (see Kahneman & Klein, 2009). The conceptualization of styles as orthogonal, unipolar dimensions (measured high to low with a "preferred end") is quite at odds with the view of styles as bipolar (with "no preferred end")

(Jablokow & Kirton, 2009, p. 137). Whether style is conceptualized as a unitary or a more complex construct is an important distinction as far as metacognition is concerned (see below).

Whereas styles are habitual and automatic, strategies are effortful and deliberative. Thinking (cognitive) strategies may be defined as consciously deployed executive control mechanisms exercised over the monitoring and regulation of the representation, organization, and processing of information during learning, thinking, problem solving, and decision making. At a higher level, metacognitive strategies "help one to assess the success [or otherwise] of cognitive strategies" (Schleifer & Dull, 2009, p. 340). Thinking styles are manifestations of dispositions that themselves may be correlates of personality sources and cognitive history (Riding & Rayner, 1998). Left to operate without help or hindrance, styles may give rise to dispositional approaches to learning, which in themselves are neither good nor bad, but which in certain tasks may be dysfunctional (Riding & Cheema, 1991).

METACOGNITION AND STYLES: A REVIEW OF SELECTED STUDIES

The foci of this chapter are metacognition and intellectual styles in the context of higher and postcompulsory education and training. In order to review the current state of knowledge in this composite domain, a literature search was conducted.[1] The search of author-supplied abstracts covering the domains of metacognition *and* styles in the 25 years from 1985 to 2010 and within the strictures of the parameters set out in the footnote yielded 54 articles, which were categorized subjectively into three groups: (1) review, theoretical, and prescriptive; (2) measurement and construct validity pertaining largely to self-report measures; and (3) empirical studies (i.e., based on observations or experiments) of the effects of metacognition. Main findings within each of these areas are discussed in the following.

Review, Theoretical, and Prescriptive Articles on Metacognition and Styles

Moran (1991), in a review of learning styles in relation to recent developments in cognitive psychology, at that time commented that styles research could benefit from consideration of a growing interest in metacognition. This assertion was made on the basis that eliciting self-perceptions of learning style preferences may be viewed as an attempt to "induce" metacognitive awareness in the learner, and that this

[1]The search as selection criteria were: (1) databases: *Business Source Complete*, *PsycARTICLES*, *PsycBOOKS*, *PsycINFO*, and *Psychology and Behavioral Sciences Collection*; (2) search terms: "metacognition/meta-cognition" or "metacognitive/meta-cognitive" (in a second wave "self-regulation" with and without hyphen was also used in place of "metacognition" and its variants), and "style(s)" (i.e., cognitive, learning, intellectual and thinking) in abstract (with related words applied); (3) delimiters: scholarly peer-reviewed articles (review, theoretical, empirical, and book reviews), normal (i.e., non-clinical or non-therapeutic settings) adult samples (18 years of age or older), published between 1985 and 2010.

may be especially useful with more difficult learning tasks. Riding and Powell (1993) argued that by designing learning materials that suit particular learning styles (i.e., "matching"), the net result might be to make learners more dependent than ever on a narrow range of information processing styles, behaviors, and strategies; that is, education may become limiting rather than enhancing. Riding and Powell recommended that design of learning materials should incorporate a metacognitive dimension, for example, by putting learners into problem-solving situations where they can learn how to become more flexible in their choice and use of strategies, thereby enabling them to become skilled in the development, implementation, and modification of learning strategies *before* any learning impasse is reached (i.e., metacognition may have an anticipatory rather than remedial function).

Educational technology researchers were also alert to the promise that metacognition might hold; for example, Burton, Moore, and Holmes (1995), in a review of the then emerging field of "hypermedia," speculated on the gains to be made by applying field-dependence/independent (FDI) styles (which had dominated in styles research for several decades) to metacognition in technology-based learning environments (given that FDI is primarily a perceptual/processing style). However, they did acknowledge that the empirical question " does an individual's cognitive style influence the way he/she will interpret a multimedia presentation?' has largely gone unproven" (Burton et al., 1995, p. 362) but that it is an essential prerequisite for developing the educational technology/metacognition line of inquiry further (Burton et al., 1995).

Winne's (1996) review of research considered metacognition in relation to two specific dimensions of style: first, deep processing, "tactics" relevant to metacognition, including retrieval of relevant information, monitoring relationships between new information and that already in memory, elaboration and transformation of information into meaningful schemata, and metacognitively monitoring tactics to suit the task; and second, Need for Cognition (NfC) (Cacioppo, Petty, Feinstein, & Jarvis, 1996), relevant in that NfC is concerned with the extent to which an individual enjoys situations that require a lot of thinking, and also anticipates situations that are likely to require "deep" thinking. Winne (1996) noted that Cacioppo et al.'s (1996) meta-analysis revealed moderate to large associations of NfC with both outcome measures and self-report measures of task engagement, and also that individuals high on NfC were more likely to engage in metacognitive control to correct misperceptions or biases.

Jans and Leclerq (1997) added further elaboration to the metacognition construct by proposing the concept of "metacognitive realism" based on the extent to which learners are realistic when they make estimates about their own learning (e.g., their capability to perform a specific task), and questioned whether this is an aspect of individual difference, and if it is a variable state or a stable trait. Their questions drew on previous research that suggested individuals are rarely, if ever, infallibly realistic concerning metamemory (defined as "processes by which we monitor our memory"). In considering metacognitive realism as a content-linked metacognitive style, Jans and Leclerq noted that it affects the way people think about information and situations, and that people have tendencies to over- or underestimate themselves and that this varies among domains (i.e., as a function of domain

familiarity or expertise). They left a number of issues unresolved with regard to metacognitive realism, and recently researchers have tended to focus on accuracy and calibrations of self-judgment and actual performance rather than metacognitive realism per se (see Krätzig et al., 2009).

Looman (2003) argued, though not explicitly from a dual-process perspective, that leaders need to be able to integrate cognitive and emotional "mental processing" systems in order to function metacognitively. Looman connected his proposals to the notion of style by suggesting that by using their emotional and cognitive skills, leaders can evaluate respectively both internal "data" (e.g., affect) and external data (e.g., attributes of an external stimulus), and may thereby be able to exercise a "reflective" style. Looman also speculated that the metacognitive system acts to alert other subsystems when something does not "feel right" (cf. intuition).

In a wide-ranging, authoritative, and critical review of the styles literature, Kozhevnikov (2007) examined what previous researchers had to say about the relationship between cognitive styles and metacognitive functioning. She concluded that metacognition may be a dimension of cognitive functioning that exists in addition to style (i.e., it may be a "metastyle"), a proposal that could explain why the effect of style often fails to generalize across tasks, making meaningful patterns of correlations difficult to find:

> [I]ndividuals' positions on the metastyle dimension will define their flexibility to choose the most appropriate cognitive style; flexible individuals might exhibit a variety of styles depending on situational requirements, causing "elusive" correlations among their preferences for a particular style and performance on different cognitive tasks.
>
> *Kozhevnikov, 2007, p. 472*

Constructs that are potential candidates for being "metastyles" include rigidity–flexibility of control and internal–external locus of control (Nosal, 1990).

Kolb and Kolb (2009), refocusing on the work of William James and others, applied a metacognitive model to experiential learning theory (ELT) (Kolb, 1984) to describe how the concepts of learning self-identity, the learning spiral, learning style, and learning spaces can guide monitoring and control of learning and personal development and transformation. Building on Nelson's (1996) elaboration of Flavell (i.e., learning is monitored at the *object level*, and observations of learning are connected to a mental model of learning processes at the *meta level*), Kolb and Kolb suggested that the ELT cycle (concrete experience, CE; reflective observation, RO; abstract conceptualization, AC; active experimentation, AE) can operate at the two levels suggested by Nelson: ELT operates (1) at the object level when applied to the learning experience itself and (2) at the meta level when applied to the learning model itself (i.e., comparison of what is happening at the object level within an idealized (CE, RO, AC, AE) cycle, and also in terms of the way in which the learner's style fits with what is happening at the object level.

In this model, the levels are connected by *monitoring* of the object level at the meta level, and by *control* from the meta level to the object level (the meta level contains an inbuilt mental model of what learning *is* and who the learner *is*, and serves an executive control function). Kolb and Kolb argue that *becoming* a learner ultimately

involves a redressing of the balance between a "fixed-view" of the self (e.g., negative self-talk, avoidance of failure, and feeling threatened by other's success) toward a "learning-view" of the self (e.g., trusting the process of ELT, seeking new challenges, persisting and learning from mistakes, and learning from others' successes). Therefore, from the ELT perspective, metacognition has transformative implications (cf. Mezirow, 1991). The implications of the issues raised by Kolb and Kolb's theorizing for styles and metacognition will be returned to in a later section of this chapter.

Measurement and Construct Validation of Metacognition in Relation to Styles

Vermunt (1996, 1998) used the term "learning style" as a superordinate concept to embrace: cognitive and affective processing of subject matter; conceptions of learning; learning orientations; and metacognitive regulation of learning. He and his colleagues developed the Inventory of Learning Styles (ILS), a 120-item instrument to assess the above components of student learning. The ILS has shown acceptable levels of reliability and validity (for a review, see Vermunt & Vermetten, 2004). In relation to relevant ILS subscales, students who use deep processing demonstrate good metacognitive skills usage compared to those whose approach to studying is surface or disorganized (Coutinho & Neuman, 2008; Vermunt, 1998). Coffield et al. (2004) examined 13 models of style and independent research evidence for internal consistency, test–retest reliability, and construct and predictive validity of style instruments. The ILS was one of three instruments to meet minimal requirements. An additional strength of the ILS was that it integrated cognitive, affective, conative, and metacognitive processes, and recognized the latter as a function of the overall system in which learning takes place. Coffield et al. (2004) concluded that the ILS can "be safely used in higher education, both to assess approaches to learning reliably and validly, and to discuss with students changes in learning and teaching [i.e., strategic and metacognitive aspects of learning and thinking]" but may require additional development work to extend its usage beyond that for which it was designed (Coffield et al., 2004, p. 56). On a less positive note, Minneart and Janssen (1997) compared the ILS with a locally developed measure (the Leuven Executive Regulation Questionnaire, LERQ) and argued that the ILS was less discriminative and predictive than the LERQ; metacognitive skills are domain independent but situation bounded; and a higher level of metacognitive regulation skill can compensate for a lower level of general thinking skill (i.e., metacognition may have a compensatory function).

Feldhusen and Goh (1995) reviewed creativity from the perspectives of both assessing (e.g., adaption vs. innovation) and accessing the construct (including via metacognition). They concluded that as far as assessment of creativity was concerned, the Kirton Adaptation–Innovation (KAI) cognitive style inventory had a sound factorial structure and was a valid and reliable measure. As far as assessing creativity was concerned they concluded that important cognitive factors included field independence and intuition; planning, monitoring, and evaluating were

important metacognitive attributes that were trainable. They also concluded that students might be taught basic theories of creative thinking to enhance their metacognitive awareness of creative processes. They further noted that specific problem-solving techniques for facilitating divergent thinking were likely to be important; for example, brainstorming, attribute listing, synectics, and free association described as "action-oriented metacognitive guides" (Feldhusen & Goh, 1995, p. 242).

Duff (2004), in a construct validity study of the Revised Approaches to Studying Inventory (RASI) (Tait & Entwistle, 1996), found the "metacognitive awareness of studying" scale (which was a later addition by the test's developers to supplement the original five scales, that is, deep, surface, strategic, academic self-confidence, and lack of direction) to have a marginally acceptable level of internal consistency (Cronbach alpha = 0.62). Duff also found metacognitive awareness to be correlated with a deep approach ($r = 0.60$), strategic approach ($r = 0.60$), academic self-confidence ($r = 0.60$), and lack of direction ($r = -0.30$) ($p < 0.01$). Backhaus and Liff (2007) used the RASI and the Cognitive Styles Index (CSI) (Allinson & Hayes, 1996) to explore the relationships between cognitive style and approaches to studying. The correlations between the RASI scales and CSI were deep, $r = 0.22$**; surface, $r = 0.09$; strategic, $r = 0.36$**; lack of direction, $r = -0.05$; academic self-confidence, $r = 0.07$; and metacognitive awareness, $r = 0.19$** (*$p < 0.05$; **$p < 0.01$). These data suggest a weak positive relationship between CSI analysis and metacognition (and vice versa for CSI intuition, since for the purposes of their correlational analysis, Backhaus and Liff scored the CSI in the conventional unitary manner and contrary to recent recommendations; see Coffield et al., 2004). There were no gender differences for metacognitive awareness (as an aside, females were more analytical/less intuitive than males, $t = -3.87$, $p < 0.001$). Backhaus and Liff interpreted their overall findings as evidence that analytics tend "to be more aware of their own learning process, as well as adopting a systematic, organized method of studying, and an elaborative approach to studying material" and that "analytics tend to adopt more success-oriented study approaches than their intuitive counterparts" (Backhaus & Liff, 2007, p. 461). Backhaus and Liff recommended that students be taught the techniques of metacognitive awareness (e.g., metacognitive knowledge and regulation) in order that they may better manage the acquisition, retention, and recall of material, and that it might be beneficial to pair intuitive and analytical students to work together.

Kolb's (1984) model of learning style (assessed using the LSI) was used by Metallidou and Platsidou (2008) to explore possible relationships between students' learning styles and their metacognitive knowledge about frequency of use of various problem-solving strategies (i.e., brainstorming, analogy, step-by-step analysis, visualization, and combining). Correlations between learning styles (AE, AC, CE, and RO) were either nonsignificant or low (-0.16** $\leq r \leq 0.14$*). (It is somewhat puzzling that the authors did not compute scores for each of the two LSI bipolar dimensions, i.e., active experimentation–reflective observation [AE–RO] and abstract conceptualization–concrete experience [AC–CE], as recommended by Kolb.) The claim made by these researchers that their results add to the "critique regarding the soundness of the instrument [LSI]" (Metallidou & Platsidou, 2008, p. 117) is premature and open to question.

Empirical Studies (i.e., Based on Observation and Experimentation) of Metacognition and Style

In this section, the various studies reviewed were categorized as quantitative or qualitative, and will be discussed accordingly.

Quantitative Studies

In a study of learning from textual materials, Beishuizen, Stoutjesdijk & van Putten (1994) found that students who combined self-regulation with a deep processing style and those who combined external regulation with a surface processing style outperformed students with complementary combinations of regulation style and processing style (e.g., self-regulation/surface style or external regulation/deep style). These data suggest that the regulatory aspects of metacognition may have a compensatory function (a finding commensurate with other research, see the preceding discussion). Vermunt (1995) examined the effects of a learning process-oriented study program for university students (learning style diagnosis, learning guide, and tutorials). Participants reported significant effects on learning, typified more by integrating and making usable the metacognitive knowledge that was already present rather than by increases in new knowledge (the program appeared to serve to activate latent metacognition); moreover, participants in the program scored better than nonparticipants on examinations in other courses (i.e., metacognition appeared to transfer). Vermunt concluded that "linking of a thorough diagnosis of personal learning styles to individually tailored instructional measures turned out to be a powerful way to activate students to reflect on their learning and develop mental models of their learning" (Vermunt, 1995, p. 325; see the following).

In a study of realism in confidence judgments on answers to word knowledge and logical/spatial ability problems, Jonsson and Allwood (2003) found that high Need for Cognition (NfC) was not associated with better realism in confidence judgments and an NfC style of thinking (broadly equivalent to a rational/analytical style, see Epstein et al., 1996) was not therefore beneficial for metacognitive realism. They concluded that the latter is unlikely to be explained satisfactorily by one- or few-factor theories; rather, it is much more likely that factors such as the individual, the knowledge domain, as well as gender and cognitive style are important in combination.

The concept of "cognitive maturity" (defined in terms of cognitive operating level) was used by Rosencwajg and Corroyer (2005) as a criterion variable in a study that included reflective–impulsive style and a metacognitive control index. They found that: First, reflective individuals who implemented analytical processing were cognitively mature, whereas impulsive individuals who used holistic processing were cognitively immature; second, fast-accurate individuals capable of analytical and holistic processing exhibited cognitive maturity, while slow-inaccurate individuals exhibited good metacognitive control but had trouble implementing both types of processing. Styles of processing were more important as far as performance was concerned than was metacognitive control, and fast-accurate individuals were able to benefit from equal accessibility to analytical and global processing styles.

Klinger (2006), in a study of styles of learning in an online psychology course, found that students' online dialogues revealed richer and deeper conceptual understandings than did their self-reported behaviors; the author concluded that students should be encouraged to develop an explicit "metacognitive understanding" of how cooperative online discussions, rather than being an added burden, are an important means of constructing deeper and more meaningful approaches. Klinger's data suggest that self-report inventories should not be relied upon exclusively to access metacognition and capture levels of metacognitive awareness and behaviors.

Coutinho and Neuman (2008) adopted an integrative approach in a study that tested the relationships between achievement goal orientation, learning style (deep, surface, and disorganization), self-efficacy, metacognition, and learning performance (grade point average, GPA). Using structural equation modeling, they found self-efficacy to be the strongest predictor of performance, while metacognition was a weak predictor of performance (correlations with GPA were low, $0.07 \leq r \leq 0.13$). Metacognitive awareness (Schraw & Dennison, 1994) correlated positively with deep *and* surface approaches (the latter is contrary to expectations), and negatively with disorganization (the strongest correlation was with self-efficacy, $r = 0.66$). Coutinho and Neuman noted that a comprehensive model that tested the range of variables in their study (and which included metacognition and style) has not been tested previously but that their findings were "inconsistent with a large body of research that has shown the utility of metacognition in task performance" (Coutinho & Neuman, 2008, p. 146). They speculated that this may have been because metacognition could be useful for learning but not for academic performance (in which rote memorization played an important role) and/or because metacognition improves with age (mean age was 19.22 years, standard deviation 1.69) and hence participants may have had little useable metacognitive experience to draw on. They concluded that metacognition may not be critical in the learning environment they studied, but that evidence suggested clearly that teachers and learners should work together to develop learners' sense of self-efficacy.

Coutinho (2008) found that students who had command of effective metacognitive strategies also had strong beliefs in their capabilities to perform a task (i.e., self-efficacy) ($r = 0.63$, $p < 0.01$), and suggested that these findings support the use of training programs for students to enhance self-efficacy through metacognitive strategies and skills (in the same study self-efficacy correlated with GPA, $r = 0.37$, $p < 0.01$, and metacognition correlated with GPA, $r = 0.21$, $p < 0.01$). Coutinho's views are consistent with previous studies showing positive relationships between metacognitive awareness and academic self-confidence (see the preceding, but it should be noted that the relationship is causally ambiguous). This is also consistent with Bostrom and Lassen (2006), who argued that awareness of learning styles has the potential to influence metacognition, the choice of relevant learning strategies, and awareness of improvements not only in terms of learning performance but in the efficacy of the learning process itself. This may therefore have a synergistic and compounding effect on the enhancement of learners' self-efficacy (Bostrom & Lassen, 2006).

In a series of experimental studies, Krätzig and Arbuthnott (2009) examined the claim that metacognition can be improved with experience (item-specific experience

and lifetime experience, the latter indexed by age). Results indicated that calibration (the correlation between recall prediction and recall performance; cf. Nelson & Narens, 1994, see above) improved with item-specific experience for both younger and older adults, whereas lifetime experience did not influence calibration (i.e., metacognitive accuracy). A novel finding was that calibration of difficult items improved with experience, suggesting that with experience "our knowledge of what we don't know increases" (Krätzig & Arbuthnott, 2009, p. 140). The implications of these findings are that individuals can identify quickly what they know, and to a lesser extent what they do not know, but putting this awareness into practice to improve memory performance does not automatically follow (even more so for older adults); hence, metacognitive training programs for older adults may need to be more carefully structured.

In a study of consistency of response styles across different cognitive tasks, Nietfeld and Bosma (2003) found that learners who do not exhibit high impulsive or high reflective styles showed the greatest flexibility in self-regulating their response styles when asked to respond more quickly or more accurately. An implication of these findings is that extreme impulsive or reflective styles "may hinder the ability to self-regulate strategy use" (Nietfeld & Bosma, 2003, p. 136) (i.e., metacognition may have a moderating function by reducing the deleterious effects of extreme stylistic preferences).

Krätzig and Arbuthnott (2006) examined the extent to which people are able to make accurate self-reports and self-assessments of their preferred mode of information processing (i.e., style). In a self-report (SR) questionnaire (of visual, auditory, and kinesthetic styles) and single-item self-assessments (SA) (what word would best describe you as a learner: "verbal," "visual," or "kinesthetic"?), 40% (SR) and 60% (SA) of participants indicated that they were visual learners, whereas 16% (SR) and 8% (SA) indicated kinesthetic learning preference. However, using a standardized memory test, 23% of participants performed best with the visual test and 52% performed best with a tactile test. Krätzig and Arbuthnott argued this indicated "as with other metacognitive judgments" (Krätzig & Arbuthnott, 2006, p. 241), people are not especially accurate in making predictions about factors (e.g., preferred processing modes) that actually influence memory performance. This research highlighted important disjunctures and contradictions between what type of learner people believed themselves to be (of which they appeared quite sure) and their performance in their preferred modality (i.e., inaccurate metacognitive judgments may bias learners' self-assessments).

Qualitative Studies

Rivers (2001) studied the self-directed learning behaviors of adult third-language learners using ethnographic observational and self-reported qualitative data analyzed using a grounded method. River's results indicated that the experienced learners in his sample assessed regularly their learning progress, styles, and strategy preferences, as well as conflicts with teaching styles, and they monitored themselves in relation to other learners' behaviors. Based on this information, the majority of learners attempted self-directed learning behaviors focused mainly on changes to course materials, classroom activities, and aspects of the learning process (including

type and mode of input, workload, and course structure). In a similar vein, Carson and Longhini (2002) used an ethnographic/case study method to study second-language learning styles and strategies, and from an analysis of diary entries found that the learners' style remained relatively constant but that learning strategies, while being consistent with style, were more variable, with the most frequently used strategies being those in the metacognitive group.

Brown (2005), using techniques of neuro-linguistic programming (NLP), found that NLP "meta programs" (an NLP technical term for ways of indicating unconscious thinking style preferences that influence perception, behavior and interpersonal communication, for example, "detail" vs. "general," "internal" vs. "external," and "away" vs. "toward") affect the capability of students to manage their educational processes and cope with the demands of higher education. Brown argued that an increased understanding on the part of students and faculty of such programs offers the potential for better communication and feedback, and more effective teaching (this study highlights the underresearched overlaps between NLP and styles; for a review of NLP, see Tosey & Mathison, 2009).

Masikunas, Panayiotidis, and Burke (2007) adopted a case study approach to evaluate the usefulness of electronic voting systems (EVS) in university lectures. From a thematic analysis of data collected by means of questionnaire and focus groups, their findings suggested that EVS-style lectures promoted deep and active learning commensurate with a metacognitive paradigm in which teaching involves explaining, modeling, supporting, helping and providing evaluation criteria, and learning based on mindful engagement, managing learning tasks strategically, reflecting and monitoring reflection, adapting and transferring information between contexts, and self-evaluating.

Beddoes-Jones and Miller (2007) used thinking styles' diagnosis as a means to "scaffold" an occupationally focused coaching session with a small sample of working adults. Beddoes-Jones and Miller reported that by the end of the intervention, participants reported a greater understanding of themselves and others as part of the coaching process, and where participants had chosen to focus on specific thinking styles, their self-reported thinking styles scores did change, although sometimes by a reduction in their dispreferences rather than an increase in their positive preference scores. This study highlights the potential that metacognition holds for making learners aware not only of the positive aspects of their styles of learning and thinking but also of how their styles may be holding them back from learning and developing further.

Learners' analytical thinking processes may be activated by metacognitive experiences of difficulty or disfluency (Alter, Oppenheimer, Epley, & Eyre, 2007), serving as an "alarm" that activates analytical forms of reasoning that monitor and sometimes correct potentially faulty intuitions. With respect to intuition and analysis, although not concerned explicitly with styles, Sadler-Smith and Shefy (2007) reported an intervention-based study that aimed to develop managers' intuitive awareness. Following a program of intuitive awareness (mindfulness) training, Sadler-Smith and Shefy used thematic content analysis of managers' diarized accounts to understand the program's impact. One outcome was the role that reflection (as a form of metacognitive monitoring) played in developing metacognitive awareness: reflection

was not only " on experience' but is a form of experience itself (a metacognitive process) in which the chain of habitual thought patterns can be cut" (Sadler-Smith & Shefy, 2007, p. 203).

CONCLUSION

From the perspective of styles, this review suggests that metacognition has the following attributes and functions shown in Table 8.1. Building on Nelson (1996) and colleagues' hierarchical model of metacognition and following Kolb and Kolb's (2009) modification of Nelson's model to include the experiential learning cycle (ELC) and learning styles, an experiential learning *and* information processing model of metacognition will now be discussed (i.e., including learning styles and cognitive styles). As noted earlier, Nelson (1996) and colleagues distinguished between object and meta levels, and drew attention to the significance of monitoring and control in metacognition: (1) "monitoring," flow of information from the object level to meta level; (2) "regulating," flow of information from the meta level to object level; and (3) meta level contains a model pertaining to the goal and the ways in which the goal can be accomplished, hence the meta level contributes critically to the accomplishment of the goal by "communicating back and forth with the object level" (Nelson, 1996, p. 106).

Kolb and Kolb (2009) introduced the ELC at both the object level (i.e., the object of monitoring is a specific instance of the learning process) and the meta level (i.e., the model by which the object [learning] is monitored and controlled is itself in terms of the model of learning). Given that intellectual styles encompass both learning styles and cognitive (information processing) styles, this approach may be further extended by augmenting Kolb and Kolb's elaboration of Nelson (1996) by the

TABLE 8.1
Attributes and Functions of Metacognition

Attribute/Function	Example
Compensatory	Metacognitive skills can compensate for lack of appropriate intellectual skills for a given task that result from stylistic preferences
Anticipatory	Anticipating the likely outcome of learning as a result of one's stylistic preferences, and taking actions in advance to avoid learning impasses
Moderating	Reducing the potential effects of extremes of stylistic dispositions by introducing ameliorating strategies
Transferable	Although aspects of metacognition may be domain-specific, the skills of monitoring and controlling learning and information processing on the basis of knowledge of styles are domain-general
Integrative	Enabling learners to develop an holistic mental model of themselves in terms of their habitual approaches to learning and thinking
Imperfect	Individuals may be subject to errors in metacognitive judgment as a result of biases accruing from preferred modes of thinking and learning

inclusion of cognitive (i.e., information processing) style. Moreover, these two elements of the model are complementary in that each draws on different theoretical and methodological resources, that is, experiential (Kolb, 1984) and dual-process (i.e., Epstein, 1994) theories and measures; see Figure 8.1.

The objects are learning and information processing, overlapping to the extent that learning style and cognitive style interact. The models at the meta level are the individual's subjective mental models of the ways in which they learn and process information. Ordinarily, individuals are likely to construct such models of their own learning and thinking. In the absence of theories, mental models will be developed on the basis of naïve ("lay") understandings of the "learning self"; for example, "I'm the kind of person who learns best from pictures," or "To solve a math problem I have to think out loud." Alternatively, a mental model of the learning self may be informed by theory (e.g., Kolb's ELT/ELC, Epstein's Cognitive-Experiential Self-Theory, and CEST) and relevant psychometric assessments (e.g., the LSI or the Rational Experiential Inventory; Epstein et al., 1996).

The mental model at the meta level is dynamic over the life span as a result of learning, experiences, and feedback, and the model itself (as Kolb and Kolb indicated) may be better represented as a series of cycles wherein the inclusion of time as an additional dimension gives the learning self a spiral and dynamic trajectory (cf. spiral dynamics; see Beck & Cowan 1996). The trajectory is toward the integrative level at which the learner, through the resolution of dialectics (e.g., between abstract conceptualization (AC) and active experimentation (AE), or between intuition and analysis) becomes versatile with respect to learning and information processing, for example, "cognitively ambidextrous" (see Hodgkinson & Clarke, 2007; Sadler-Smith, 2009). The learner overcomes the dispositional constraints of learning and

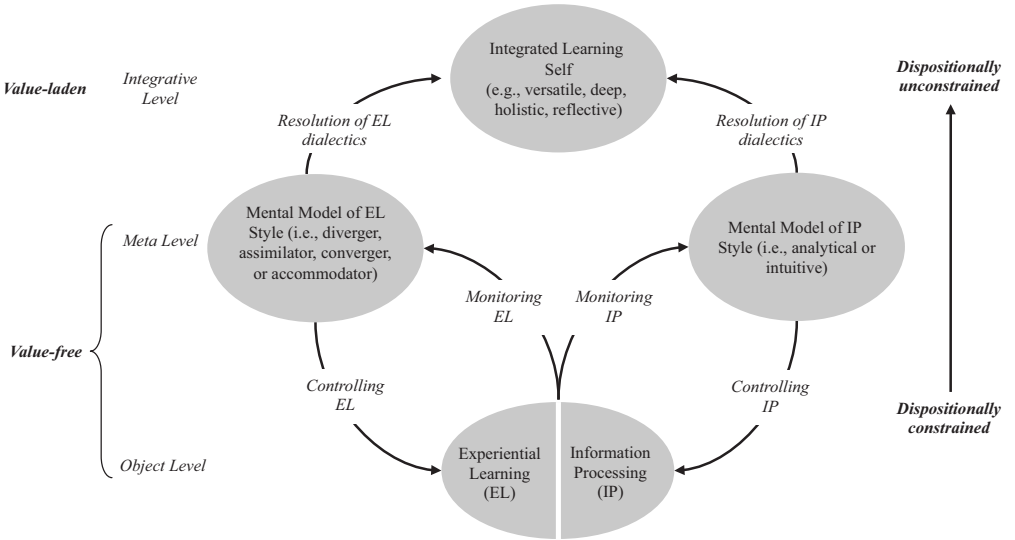

FIGURE 8.1
Nelson's (1996) and Kolb and Kolb's (2009) metacognitive model modified to include dual-process theory and intellectual styles.

information processing styles. At the object and meta levels, the elements are value free; at the integrative level they are value laden, and likely to include some of the attributes of a Type I intellectual style identified by Zhang and Sternberg (2005); for example, reflective, deep and holistic. The shift toward the integrated level is effortful and takes time (see Zhang & Sternberg, 2005, p. 42). Predictions may also be made on the basis of these relationships; for example, that individuals high on analysis and intuition would be deep learners (cf. Backhaus & Liff, 2007). Nelson's (1996) hierarchical model of object/meta levels is a generic template for metacognition into which other models of learning and styles might be incorporated or substituted.

Winne (1996) concluded his review of metacognition and self-regulation of learning with the observation that the number of studies on the use of metacognition was small, but even smaller was the number of studies that probed metacognitively based individual differences. In the intervening one-and one half decades, it appears that the situation has not changed markedly. There has not been any surge in studies of metacognition by styles researchers in spite of rhetoric expounded by a number of them regarding its importance (e.g., Riding & Sadler-Smith, 1997). Metacognition, the meaningful study of which requires more than self-report and cross-sectional research designs, has been a subject of comparative neglect by styles' researchers. Coffield et al., in the conclusion to their critical review of styles, threw down a gauntlet to styles researchers when they remarked that:

> One of the main aims of encouraging a metacognitive approach is to enable learners to choose the most appropriate learning strategy from a wide range of options to fit the particular task in hand; but it remains an unanswered question as to how far learning styles need to be incorporated into metacognitive approaches.
>
> *Cof"eld et al., 2004, p. 50*

If styles exist and are important, it is impossible to foster metacognitive approaches without an informed awareness of habitual learning and information processing preferences (styles), that is, *there can be no learner-focused and practically useful metacognition without styles*. The challenge is for metacognition and styles researchers to work collaboratively in ways that are both theoretically and methodologically rigorous and practitioner relevant, and to realize the synergies of combining these complementary and vital approaches for understanding and enhancing human learning and cognition.

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9

Intelligence and Intellectual Styles

Adrian Furnham

At the heart of differential psychology, there is a fundamental rift between those who study *abilities* and those who study *preferences*. Many of the world's most famous differential psychologists Raymond Cattell, Hans Eysenck, Robert Sternberg have worked in *both* areas, but they have been comparatively exceptional as most researchers think of themselves as either personality/style theorists *or* intelligence researchers. This chapter will look at the relationship between intelligence or intellectual ability and intellectual styles (a general term for constructs such as cognitive, learning, and thinking styles). Researchers have been interested in this issue for a very long time. For instance, Goldstein and Blackman (1978) considered the relationship between five cognitive styles, including field dependence and cognitive complexity and intelligence all of which were very low. Similarly, Shouksmith (1970) examined the relationship among creativity, reasoning, cognitive style, and intelligence and argued that the relationships differed as a function of the particular test used.

The central problem for researchers in this area is agreeing how to operationalize and measure both intelligence (cognitive ability) and styles (Sternberg, 1994). The proliferation of style measures has made the whole endeavor more problematic and there seems to be no programmatic approach to research in the area. Some style concepts like field dependence/independence have attracted a great deal of attention over the years, but interest appears to be declining.

This chapter has five sections. It will first consider the power versus preference approach to measuring individual differences. Second, it looks at the debate about the unitary versus multidimensional nature of intelligence/cognitive ability. Third, it briefly reviews three concepts that straddle the ability/style divide. Fourth, it looks specifically at the concept of *intellectual style.* Finally, it reviews the evidence for the relationship between intelligence and intellectual style.

THE TWO DIFFERENTIAL PSYCHOLOGIES

Those interested in intelligence tend to use "objective," timed, power tests to assess personality, while those interested in styles tend to use untimed preference tests to measure personality traits, types, styles, and disorders. However, there have been

many attempts over the years to derive *power* tests of personality as well as *preference* measures of intelligence. Indeed, there have also been attempts to integrate the two approaches, including Chamorro-Premuzic and Furnham's (2003a, 2003b, 2006a, 2006b, 2010) work on specifying the "intelligent personality." Despite this, the literatures on abilities and styles remain resolutely separate.

However, it should also be noted that those psychologists who use, and are interested in, preference measures also differ among themselves. Thus, *clinical* psychologists tend to be interested in "normal" and "abnormal" personality traits as well as personality disorders, while *social* psychologists are interested in values and belief systems and *educational* psychologists (and to a lesser extent, cognitive psychologists) seem interested in cognitive and learning styles. It can, however, be difficult trying to distinguish between different self-report measures, sometimes called measures of traits, types, styles, or beliefs, which may overlap a great deal (Furnham, 2008).

For a very long time, researchers in these two areas have virtually ignored each other. Top journals in intelligence tended to not publish preference-test (i.e., personality trait) research while top journals in personality seemed more interested in social–psychological rather than educational correlates of traits or power-test measures.

The 1960–1985 quarter century period saw a decline and lack of confidence in both personality and intelligence research. Mischel's (1968) attack on personality set the field back for decades as social psychologists pursued the so-called *person situation debate*. Similarly, sociopolitical changes in the Western world resulted in many attacks on intelligence testing. Some researchers have been accused of faking their data and of having an ideology that supported discriminatory, eugenic, and racist ideas (Deary, 2001).

However, the past two decades (on either side of the millennium) have seen renewal of interest in both intelligence and personality. More than this, there has been something of a rapprochement between these two areas. Some intelligence researchers were inspired by those like Gardner (1983, 1999) and Sternberg (1997b), who proposed new theories of multiple intelligences, as well as more "orthodox" researchers, who began to mine rich "data" sources that demonstrated the power of conventional intelligence test scores to predict everything from work success to longevity (Deary, 2001). The area has also experienced considerable interest after the publication of various "popular" books that offered contradictory and highly controversial conclusions and implications from the data (Brand, 1996).

The field of personality also showed a great renaissance mainly due to the acceptance by many, but certainly not all, researchers of the *Five Factor Model* (*FFM*). This acceptance has allowed the field to move forward in all areas from the behavior genetics of personality to the predictive power of tests.

The same consensus, however, has not been seen in the "style" area, which has been most clearly linked to personality research. There have been those who for nearly 100 years have chosen to look not at traits or abilities but at styles. The earliest work in this area was concentrated on *cognitive* styles, while later work was focused on *learning* styles. More recently, researchers have talked about *thinking* styles. One attempt to integrate the work on cognitive, learning, and thinking styles has been

the notion of *intellectual styles.* It remains to be seen if this attempt successfully moves the field forward (Zhang & Sternberg, 2005).

There is no agreed definition of style. Clearly the concept implies "volition" in the sense that one can adopt and change a style. Styles seem less fixed and biologically based than traits or cognitive ability, although they seem to have equally important behavioral consequences. Zhang and Sternberg suggested that *intellectual style* "refers to one's preferred way of processing information and dealing with tasks. To varying degrees, an intellectual style is cognitive, affective, physiological, psychological and sociological" (Zhang & Sternberg, 2005, p. 2).

There are (too) many style concepts: field dependence and independence, leveling and sharpening, impulsivity and reflexivity, divergent and convergent thinking, holistic and serial thinking, explorers and assimilators, innovators and adaptors, and intuitive and analytic thinking. Some cognitive styles have traditionally been measured by maximum performance power tests, although most have traditionally been measured by preference tests. There are literally dozens of tests in this area. Certainly, some styles concepts have attracted more research than others. This is true of those working in styles that originate in the cognitive (i.e., field dependence) or learning (i.e., approaches to learning) tradition.

Indeed, as we shall see, it seems that there has been less consensus about the fundamental dimensions of styles or indeed the very definition of styles (Furnham, 2010). The area remains for many a depressing and chaotic area with "conceptual confusion, contested definitions, poor measurement and lack of validity ... while there is also strong awareness of criticisms and concerns over terminology and measurement there appears to be little resolve to address them" (Peterson, Rayner, & Armstrong, 2009, p. 1). The styles literature continues to attract highly critical reviews like the recent one on learning styles (Riding & Rayner, 2007). However the emergence of the intellectual styles concept has provided hope for the field to move on (Zhang & Sternberg, 2005).

This chapter will concentrate on styles, particularly *thinking* and *intellectual* styles and their relationship to cognitive ability. In an important book titled *Thinking Styles*, Sternberg (1997a) set out 15 axioms or principles for researchers in the area, although he noted that not all styles researchers would accept them. They warrant repeating:

1. Styles are preferences in the use of abilities, not abilities themselves.
2. A match between styles and abilities creates a synergy that is more than the sum of its parts.
3. Life choices need to fit styles as well as abilities.
4. People have profiles (or patterns) of styles, not just a single style.
5. Styles are variable across tasks and situations.
6. People differ in the strength of their preferences.
7. People differ in their stylistic flexibility.
8. Styles are socialized.
9. Styles vary across the life span.
10. Styles are measurable.
11. Styles are teachable.

12. Styles valued at one time may not be valued at another.
13. Styles valued in one place may not be valued in another.
14. Styles are not, on average, good or bad it is a question of fit.
15. We confuse stylistic fit with levels of abilities.

There has always been a great debate as to the distinction between cognitive style and ability. Various attempts have been made to draw distinctions between the two (Messick, 1984; Tiedemann, 1989). These include the following:

First, ability questions refer to *how much* and *what*; style questions to *how*. Ability refers to what kind of information is being processed, by what operation, in what form, how efficiently, and so forth. Style refers to the manner or mode of cognition.

Second, ability implies *maximal* performance; style implies *typical* propensities. Ability is measured in terms of accuracy, correctness, and speed of response, whereas style emphasizes the predominant or customary processing model.

Third, abilities are *unipolar*; style is *bipolar*. Ability levels range from none to a great deal, whereas styles usually have two different poles with quite different implications for cognitive functioning.

Fourth, abilities are *value directional*; styles are *value differentiated*. Usually, having more of an ability is considered better than having less, whereas supposed stylistic extreme poles have adaptive value but in different circumstances.

Fifth, abilities are often *domain speci"c*; styles cut across domains. Abilities are often specific to various domains (e.g., verbal, numerical, or spatial areas), whereas styles often serve as high-level heuristics.

Sixth, abilities are *enabling* variables because they facilitate task performance; styles are *organizing* and controlling variables. Abilities dictate level of performance, whereas styles contribute to the selection, combination, and sequencing of both topic and process.

A more simple way of conceiving this difference is that a person's performance on (virtually) all tasks improves with higher intelligence scores, while the effect of style on performance is highly dependent upon the nature of the task. Nearly all researchers see styles as being at the interface between personality and intelligence.

However, important questions in a number of areas have not been satisfactorily answered (Furnham, 2008). These areas include the following: The first is the *etiology of cognitive/learning style*. This is the question that addresses the origin of styles: Are they biologically based, the result of early learning, neither, or both? The second is the *variance accounted for*. This issue refers to whether the amount of variance accounted for by this factor is so small as to be trivial or indeed a major and central factor. The third concerns *the nature of style as a variable*. If cognitive/learning style is a moderator variable among intelligence, personality, and learning, the precise nature of this relationship needs to be spelled out. The fourth is the *processes underlying styles*. So far, a great deal of research in this field has been descriptive and taxonomic, aiming at identifying various styles and their consequences. Less work has gone into describing the mechanism or process whereby the styles operate.

Indeed, with noticeable exceptions, people interested in one of the two areas seem to have very little interest in the other. Thus, if one searches the entire content of the journal *Intelligence*, since its inception nearly 30 years ago, there are

very few papers on the topic of styles. Certainly, it seems that those interested in thinking or intelligence style (predominantly originally educational psychologists) tend to be more interested in intelligence than vice versa.

However, this problem goes back to the very origins of differential psychology. Table 9.1 is modified from Most and Zeidner (1995), who tried to contrast the two approaches.

Thus, the literature on intelligence is divided between the more conventional and traditional researchers, who advocate power tests to measure general intelligence and are turning more and more to biological and genetic research paradigms, and the more socially oriented and applied psychologists, who are interested in preference measures of "intelligence" and styles and use preference measures. The former insist that the word "intelligence" be put in inverted commas when referring to the multiple "intelligences." The conventional general intelligence (g) theorists also maintain that the evidence for g is on their side (Visser et al., 2006a, 2006b). Indeed, Almeida et al. (2010) recently provided results that challenge Gardner's original position on refusing a general factor of intelligence.

It should also be noted that many, but not all, of the multiple intelligences are measured by self-report, preference, and questionnaire methods (Haselbauer, 2005). Indeed, one recent study looked at the relationship between (self-reported) multiple intelligences, approaches to learning, and general knowledge (Furnham, 2009). Intelligence was only modestly correlated with two (of the eight) multiple intelligences. The deep-learning approach was, however, significantly correlated with five of the eight multiple intelligences.

TABLE 9.1
Distinguishing Between Intelligence and Style

Dimension	Intelligence	Style
Trait	Unidirectional ("little of" to "much of")	Bidirectional (polar extremes)
Trait to item relationship	Strictly monotonic	Not necessarily monotonic
Goals and optimal assessment situation	Test situation requiring maximal performance	Real-life situation
Motivation in taking the instrument	High motivation	Tends to vary
Instructions	To do one's best	To provide a candid response
Criteria for evaluating responses	Veridical criterion	Direction/intensity (no correct response)
Stability of the instrument	Relatively stable	Tends to fluctuate
Reliability of the instrument	Generally high	Varies from high to low
Research on popular tests	Extensive	Very variable
Agreement on "facets"/types	High	Low
Timing of tests	Timed	Not timed

However, there is a dispersed literature going back many years on preference measures of intellectual activities. They are not supposed to be tests of intelligence but tests of intellectual preferences, investment and thinking style. These will be considered before the styles literature is considered in detail.

INTELLIGENCE AND "INTELLIGENCES": UNITARY *g* OR MULTIPLE INTELLIGENCES

There are many long-standing, unresolved issues and debates in the field of intelligence. Deary (2001) posed a number of questions that he attempted to answer: What happens to mental abilities as we grow older; why are some people cleverer than others; are intelligence differences a result of genes or the environment; does intelligence matter; and is intelligence increasing generation after generation?

Indeed, as a response to a book dealing with one of the hottest of all topics in intelligence, namely, group differences (race, sex, class), the leading psychological researchers drafted a co-signed document that set out where they stand on the issue today (Gottfredson, 1994).

The "experts" make a good case for the predictive power of IQ tests. Researchers in the area appear to have settled early disputes and have become particularly interested in two increasingly sophisticated areas of research. *First*, they have been exploring processes underlying intelligence with the rise of interest in cognitive neuropsychology and behavior genetics. *Second*, they have been exploring large, rich data banks, often held by military or educational institutions, examining the predictive power of intelligence theory tests over time.

However, the intelligence research world has been split down the middle by the general versus multiple-intelligence theorists. While there are differences between the main protagonists of multiple-intelligences theory themselves, they have a much closer affinity with preference researchers and those interested in styles. This is certainly more true of researchers aligning themselves with Gardner than those who have followed Sternberg's model.

This view has been disputed starting off by Gardner's work on multiple intelligences. This has led to an explosion of discovered, found, or labeled intelligences. The question, however, is what is the evidence in favor of the multiple-intelligence theories and, just as important, how are the concepts measured? This is clearly relevant to the issue of the relationship between intelligence and intellectual styles as the question has to be asked which definition and measure(s) of intelligence should be used.

There are many critiques of multiple intelligences but perhaps one of the most thorough and devastating is that of Waterhouse (2006a, 2006b), suggesting that the theory lacks any empirical support. Waterhouse reviewed the evidence for multiple intelligences, the Mozart effect, and emotional intelligence and concluded "... that despite their wide currency in education these theories lack the adequate empirical support and should not be the basis for educational practice" (Waterhouse, 2006a, p. 207). She noted that cognitive psychology and neuroscience are *not* exploring multiple-intelligence theory, nor are there any papers in that tradition that support the theory.

This dispute can perhaps be most clearly seen in the work of research groups interested in the now well-known concept of emotional intelligence (EI), also hotly disputed. On the one side are those who measure EI as an ability by using power tests and on the other are those who measure EI as a trait and use preference tests.

There is a basic distinction between measures of *maximum* performance (e.g., IQ tests) and measures of *typical* response (e.g., personality questionnaires) with far-reaching implications for construct operationalization. In essence, this is what distinguishes the ability and styles literature because most intelligence (cognitive ability) researchers use exclusively power or maximum performance tests, while most style researchers use preference tests.

Self-report measurement leads to the operationalization of the construct as a personality trait ("trait EI" or "emotional self-efficacy"), whereas potential maximum performance measurement would lead to the operationalization of the construct as a cognitive ability ("ability EI" or "cognitive-emotional ability"). Trait EI and ability EI are two *different constructs* because the procedures used in their operational definitions are fundamentally different, even though their theoretical domains might overlap.

The primary basis for discriminating between trait EI and ability EI is to be found in the type of measurement approach one chooses to employ and not in the element of the sampling domains of the various conceptualizations (Table 9.2). Many dispute the more fundamental point that EI could ever be actually measured by cognitive ability tests.

TABLE 9.2
Trait Emotional Intelligence (EI) Versus Ability EI

	Trait EI	Ability EI
Measurement	Self-report	Performance based
Conceptualization	Personality trait	Cognitive ability
Expected relationship to *g*	Orthogonal (i.e., uncorrelated)	Moderate-to-strong correlations
Construct validity evidence	Good discriminant and incremental validity vis-à-vis personality	Limited concurrent and predictive validity
	Good concurrent and predictive validity with many criteria	Lower than expected correlations with IQ measures
Number of measures	Many	Few
Popularity	High	Few
Properties of measures	Easy to administer	Difficult to administer
	Susceptible to faking	Resistant to faking
	Standard scoring procedures	Atypical scoring procedures
	Good psychometric properties	Weak psychometric properties

Brody (2005) has delivered a cogent attack on the single ability measure of EI: the Mayer–Salovey–Caruso Emotional Intelligence Test (MSCEIT). He objected to the scoring method because he noted that the test measured emotional knowledge, not emotional management as claimed. "A person who has expert knowledge of emotions may or may not be expert in the actual ability that is allegedly assessed by the test" (Brody, 2005, p. 234). The test defines correct answers as those defined by experts but does not indicate the extent to which experts agree (i.e., their consensus).

Brody also doubted that there was sufficient evidence that EI might really be conceived as a latent trait like that of intelligence: "Owing, in part, to the relatively brief history of research on this topic, it is not possible to document a nomological network of laws and relations defining the conceptual and empirical relations that obtain between tests of EI and the latent trait of which they are alleged manifestations" (Brody, 2005, p. 234). Finally, he argued from a characteristically careful analysis of all supposed evidence available that he remained deeply skeptical of the evidence for the predictive validity of the MSCEIT. Others naturally disagree.

At the moment, two "schools" exist: the ability school versus the trait school. They measure, write, and proselytize differently. This issue does not appear to have happened to researchers interested in intelligence versus intellectual styles.

Inevitably there are those who make a strong case for power tests of emotional intelligence (Rivers, Brackett, Salovey, & Mayer, 2007). Indeed, debates of definition and measurement have led to many edited books where enthusiasts and skeptics for different approaches have debated the central issues (Matthews, Zeidner, & Roberts, 2007; Murphy, 2006).

SELF-REPORT MEASURES OF INTELLECTUAL EFFORT, INTERESTS, AND PREFERENCES

The "no-man's land" between power and preferences tests (tests of intellectual ability and style) has been occasionally occupied by preference tests of intellectual processing. Along with what are called "style measures" of cognitive processing, there have been for many years "trait" measures, which are closely related to one another, although they do go under very different names and have different theoretical origins. They are usually conceived as stable traits related to both personality and intelligence, and in many ways similar to style instruments.

Consider the following three:

Need for cognition. One variable that has been shown to relate to both intelligence and personality traits is the need for cognition (NFC), introduced by Cacioppo and Petty (1982) as a stable personality trait relating to the tendency to engage in and enjoy effortful cognitive activity (Day, Espejo, Kowollik, Boatman, & McEntire, 2007; Woo, Harms, & Kuncel, 2007). Originally conceived as an information-processing variable in the study of persuasion (Cacioppo, Petty, & Morris, 1983), NFC has now been found to be a major individual-difference variable affecting behavior in domains as diverse as health, false memory, learning, and problem solving, as well

as being a significant factor in studies of ethnic prejudice, paranormal beliefs, advertising, lucid dreaming and intellectual task performance, and even web site evaluations (Furnham & Thorne, 2010).

NFC is not an *ability* to think, but an *intrinsic motivation* to think and indeed correlates strongly with various measures of intrinsic motivation. Tanaka, Panter, and Winborne (1988), for example, identified *three* factors in the 34-item scale, which they labeled *cognitive persistence* (enjoyment of engaging in cognitive tasks), *cognitive con"dence* (confidence about engaging in cognitive activities), and *cognitive complexity* (preference for complex or simple information processing demands). Davis, Severy, Kraus, and Whitaker (1993), by contrast, identified *two* factors in the short-form scale, relating to enjoyment of cognitive effort and to a preference for problem solving (and in fact this structure was replicated in two recent pilot investigations).

Typical intellectual engagement. Goff and Ackerman (1992) conceptualized the Typical Intellectual Engagement (TIE) scale as a measure of an individual's typical level of intelligence and developed a self-report scale to assess rather than measure an individual's level of intelligence. Higher scores mean stronger inclination to engage in intellectual activities. Ackerman and Goff (1994) suggested a three-factor model of the TIE, where the factors were problem-directed thinking, abstract thinking, and reading, whereas Ferguson (1999) identified a five-factor structure, where the factors were abstract thinking, direct complex problem solving, reading and information seeking, intellectual avoidance, and intellectual pursuits as a primary focus.

Various studies have revealed the incremental and construct validity of the TIE (Chamorro-Premuzic & Furnham, 2006a, 2006b; Chamorro-Premuzic, Furnham, & Ackerman, 2006a, 2006b). Recently, Arteche, Chamorro-Premuzic, Ackerman, and Furnham (2009) have argued that TIE is essentially a by-product of Openness, learning approaches, and self-assessed intelligence.

Openness to experience. Openness is one of the Big Five personality traits (Costa & McCrae, 1992). People who score high on this dimension are said to be artistic, curious, imaginative, insightful, and original, and to have a wide range of interests. They tend to value intellectual matters and can be rather unconventional with possible "unusual thought patterns." Some synonyms for Openness are intellectance or intellectual competence and it is no surprise that, of all the trait variables, it tends to show highest correlations with intelligence, in the region of $r = 0.30$. The high correlations between Openness and Ackerman and Goff's (1994) typical-engagement concept give some insight into the process or mechanism that explains the relationship. This is also related to Cattell's (1987) *investment theory.* This essentially suggests that open, curious individuals read more, explore their environment, and seek out answers to many questions. In doing so, they acquire a large knowledge base, which is related to crystallized intelligence. Thus, open people do well on intelligence tests. Furthermore, this grows as they get older. Openness is associated with intellectual curiosity, a life of the mind, imagination, and artistic sensitivity. It is also related to need for cognition.

Open individuals value intellectual matters and are questioning. Therefore, it is no surprise that the correlations between intelligence tests (both fluid and crystallized) and creativity and measures of Openness are significant and positive and

usually in the range $r = 0.2$ to $r = 0.5$. Of all the personality traits it is Openness that can best serve as a proxy for intelligence, because it is so (relatively) highly correlated with it (Furnham, 2008). Openness is associated with a deep, not surface, learning approach and is a good predictor of creativity.

Overlap and integration. There have been a number of attempts to look at the overlap between these "trait" measures of intellectance. Chamorro-Premuzic and Furnham (2008) found in both a review and a meta-analytic study that learning approaches are basically measuring Openness to experience. Similarly, Woo, Harms, and Kuncel (2007) looked at the overlap among NFC, TIE, and Openness. Correlations exceed $r > 0.50$. They found that NFC and TIE "were quite interchangeable in convergent–discriminant relations with other variables. We argue that these two scales may be measuring essentially the same personality characteristics that are specifically related to intelligence" (Woo et al., 2007, p. 1635).

However, the overlap between personality traits and intelligence has also been addressed. Chamorro-Premuzic and Furnham (2006a, 2006b) conceived of "the intelligent personality." They described a dimension called intellectual competence, which was conceived as "an individual's capacity to acquire and consolidate knowledge throughout the life span." This "trait" relates to a person's self-confidence, personal development, and also his or her academic performance. It is an early attempt to integrate these two areas of differential psychology.

INTELLECTUAL STYLE

As is the case with so many concepts in psychology like EI, there is often a debate as to, first, the origin and then the meaning of the term. One of the earliest papers to use the term "intellectual" in the title was by Cropley and Field (1969). These investigators based their ideas on work by Hudson (1966) that focused on convergent and divergent thinkers. They noted that their study was "concerned with whether high science achievers at senior high school level did differ markedly from low achievers in terms of style as against level of intellect" (Cropley & Field, 1969, p. 132).

Henderson and Gold conceived of intellectual style as essentially "creativity, curiosity and imaginal processes" (Henderson & Gold, 1983, p. 625) and were able to show that their measure was distinct from intellectual power or ability. Duszak (1994) published a paper with the words "intellectual styles" in the title.

Those from a more social science perspective have also written about intellectual style, but they have treated the concept rather differently. In a brilliant essay, Galtung (1981) defined intellectual styles as the approach of intellectuals to their work. It is concerned with how intellectuals go about their job of research and dissemination of ideas, the description and explanation. In doing so, he identified four unique cultural intellectual styles: Saxonic, Teutonic, Gallic, and Nipponic.

However, it has been the work of Li-fang Zhang and Robert Sternberg that have really made the term and the area their own. They have argued that people's intellectual styles fall into three types based on essentially five specific dimensional

preferences: structured versus free of structure; cognitive simplicity versus complexity; conformity versus nonconformity; authority versus autonomy; and group versus individual.

Based on conceptualization and empirical analyses, Zhang and Sternberg (2005, 2006) classified all major style constructs in the styles literature into three types: Type I, Type II, and Type III styles. Type I intellectual styles (e.g., field-independent, reflective, and right-hemispheric styles) were considered creativity-generating and indicate higher levels of cognitive complexity. These styles are often highly associated with generally agreed-upon more desirable human characteristics (such as open-mindedness, clear identity formation). Type II styles (field-dependent, impulsive, and left-hemispheric styles) were seen as suggesting a "norm-favoring tendency" and denote lower levels of cognitive complexity. These styles are considered to be more predictive of attributes that are typically considered less desirable (e.g., pessimism and a poorly integrated sense of self). Type III styles (e.g., internal and external styles) may manifest the characteristics of either Type I or Type II styles, depending on the stylistic demands of a specific task. Type III styles are value-differentiated because the adaptive values of these styles are more context-dependent.

In an important paper, Zhang and Sternberg attempted a definition of intellectual styles thus:

> Intellectual style is used as a general term that encompasses the meanings of all major "style" constructs postulated in the past few decades, such as cognitive styles, conceptual tempo, decision making and problem-solving style, learning style, mind styles, perceptual style, and thinking style. An intellectual style refers to one's preferred way of processing information and of dealing with tasks. To varying degrees, an intellectual style is cognitive, affective, physiological, psychological, and sociological. It is cognitive because whatever styles one uses to process information, one must be engaged in some kind of cognitive process. It is affective because one's way of processing information and of dealing with a task (i.e., employing an intellectual style) is partially determined by how one feels about the task. If one is genuinely interested in the task at hand (assuming that the task does require one to be creative and to have a deep understanding), one may, for example, use the legislative thinking style or the deep-learning approach. On the contrary, if one feels indifferent about the task at hand, one may simply use the executive style of the surface approach to learning. It is partially physiological because the use of a style is partially influenced by the way our senses (e.g., vision, hearing, and touch) take in the information provided to us. It is psychological because the use of a particular style is partially contingent upon how one's personality interacts with one's environment. Finally, it is sociological because the use of a style is affected by the preferences of the society in which one lives for various ways of thinking.
>
> *Zhang and Sternberg, 2005, pp. 1 2*

Earlier research used the now 20-year-old Sternberg and Wagner (1992) Thinking Styles Inventory. Some of the more recent studies were based on two revised versions of the inventory the Thinking Styles Inventory–Revised (Sternberg, Wagner, & Zhang, 2003) and the Think Styles Inventory–Revised II (Sternberg, Wagner, & Zhang, 2007). The *Web of Science* indicates that this measure has been cited over

110 times since it was published. It continues to attract a good deal of attention and recent papers have linked thinking styles with academic achievement (Bernardo et al., 2009), emotional intelligence (Murphy & Janeke, 2009), and anxiety (Zhang, 2009). Recent studies have also looked at things such as the effects of teacher–student congruence in thinking styles on satisfaction and learning (Betoret, 2007). Others have looked at the thinking styles of particular groups (Richmond, Krank, & Cummings, 2006).

Over the years, various studies have examined the psychometric properties of the scale (Cheng, Wang, & Ho, 2009). Gonzalez-Pienda et al. (2004) used confirmatory hierarchical factor analysis to examine the hypothetical structure of the test. They concluded that "the results coincide with those reported by other researchers, providing a thinking-style structure that is substantially different from the one suggested by Sternberg" (Gonzalez-Pienda et al., 2004, p. 139). A more recent study drew a similar conclusion: "Both subscale- and item-level confirmatory factor analysis failed to confirm the theory-proposed 5-factor structure as well as 3 other structural models identified in previous studies" (Black & McCoach, 2008, p. 180).

Zhang and Sternberg (2009) have made a bold effort to integrate the styles literature under the banner of intellectual style, which refers to individualized ways of processing information that are different from intellectual capacity or effort. Research on intellectual styles seems to have concentrated in three areas: first, discriminant and convergent validity with other measures; second, construct and predictive validity of styles scores; and third, the application of styles to the world of education.

Discriminant and Convergent Validity

It appears that all these researchers who develop new instruments in a "crowded marketplace" try to show how the new measure is different from others. This is about uniqueness but also preferably about incremental validity, namely, that the tests account for special or unique additional variance in explaining or predicting relevant behavior. Zhang (2001, 2002, 2004a–c, 2008) has led this impressive research effort. However, she has not only been concerned with correlates of the Thinking/Intellectual Styles Inventory but also the relationship between various other style and learning approach instruments (Zhang, 2003).

The studies have looked at issues such as the relationship of the thinking styles with personality (namely the Big Five), approaches to learning, self-esteem, and cognitive development, as well as self-rated abilities. Some of these studies have very large samples and nearly always correlational and regressional analyses are done. A good example is Zhang (2002), who had 154 Hong Kong students complete the Thinking Style Inventory and the NEO FFI (Costa & McCrae, 1992). Of the 55 correlations, 25 were significant and only 5 were $r \geq 0.30$. Analysis of the traits and 11 styles yielded three factors. She concluded:

> The present study suggested that the Big Five personality traits cannot capture the essential variance in the data. For example, extroversion only explained 29% of the

> variance in thinking styles. This indicates that the Thinking Styles Inventory has its own unique value in educational settings. Therefore, whereas the present study suggested significant relationships between the two constructs, it does not warrant the omission of assessing thinking styles … Finally, a careful inspection of the semantics of the two inventories reveals that whereas the items in the Thinking Styles Inventory are more cognition-orientated, the items in the NEO Five Factor Inventory are more affect-orientated. Items in the TSI elicit participants' responses to situations in which they are required to deal with different tasks. Items in the NEO-FFI elicit participants' feelings about people and situations. Therefore, again, even though the two constructs overlap, they each contribute to the understanding of human individual differences.
>
> *Zhang, 2002, pp. 28 29*

Overall, it is probably fair to say that these studies show that the measures are usually correlated in predictable ways, although the size of the correlations suggests that other than error of measurement, it seems to be the case that they are measuring concepts that are somewhat unique and not totally overlapping. However, what would be more desirable would be to do some discriminant analyses or even better yet to show that these tests had incremental validity over one another in predicting a behavioral outcome.

Construct and Predictive Validity

Some studies have looked at the extent to which thinking/intellectual styles predict actual educational outcomes like academic achievement. For example, Zhang (2002) tested 212 American students from three universities. The students completed both the Thinking Styles Inventory and also a style of learning and thinking inventory, as well as reporting their grade point average. Students also rated their own ability: analytic, creative, and practical. Results showed evidence of incremental validity. That is, some thinking styles could account for 16% additional variance. Zhang (2007) reported a similar study with 452 school children from rural China. She had data from Grades 1, 2, and 3 results for Maths, English, and Chinese. Results showed that thinking styles alone (after sex, age, and self-rated ability) accounted for 2–14% of the variance.

Application of Styles

There are some obvious applications of the style research, particularly to pedagogy. Evans and Waring (2009) have stressed the importance of teachers becoming aware of their own stylistic preferences. They stress the importance of a *personal learning styles pedagogy (PLSP)* to teachers.

It may seem surprising to many that there are comparatively few studies that look at the relationship between cognitive ability (intelligence) and cognitive (intellectual) style and motivation. This in part reflects the mutual distrust and animosity between researchers in these two areas. While there is a thriving literature on the relationship between traits and styles, and another between traits and abilities, there seem comparatively few studies on the relationship between styles and abilities (Furnham, 2008). They are scattered in many different research areas,

most often in educational and differential psychology, and of small scale in number and using a wide variety of instruments.

There are, of course, exceptions but these tend to be piecemeal rather than programmatic studies on comparatively small (student) groups and using rather different measures of both variables. Thus, for instance, in two studies, Furnham et al. (2007, 2008) looked a correlates of approaches to learning and measures of intelligence. The studies showed a modest, predictable, and significant relationship: Surface learning approaches are negatively and deep-learning approaches are positively correlated with intelligence. Various other studies over the years have shown similar predictable relationship; however, there are few of them and it would not be possible to do a good meta-analysis.

Zhang and Sternberg (2006) addressed the central question of the relationship between styles and abilities. They reviewed over a dozen studies, many published in the 1970s and 1980s. Three things emerge from this helpful review. First, while the results are somewhat equivocal, overall the correlations are very low, and mostly nonsignificant. One reason for the variability in the results may occur because different studies used different measures of both styles and abilities in different (often small) samples of students and school children. Second, where styles were considered along with measures of intelligence in predicting (academic) performance, they did account for significant amounts of additional variances. In this sense, it could be argued that the data provide evidence of the incremental validity of styles measures in addition to narrow or general measures of intelligence. Third, a number of studies demonstrated that styles might moderate the relationship between ability and performance. A nice example of this work was shown by Petrides, Frederickson, and Furnham (2004) who showed how EI moderated the effect of low IQ on academic performance. Low-ability pupils are cognitively and emotionally taxed in an intellectually demanding environment, but those pupils with higher emotional intelligence can deal better with stress and widen their social support network that diminishes the pressure.

They concluded, "Then, the question is: if there is evidence that styles and abilities/general intelligence are related, is it still worthwhile to study the role of styles in human performance and behaviours? … We would argue that it makes sense to study intellectual styles as a sources of individual differences in human performance and behaviour, given the ample evidence that (a) styles contribute to human performance over and above abilities, (b) style and abilities are generally orthogonal, and (c) there are fundamental differences between styles and abilities at the conceptual level" (Zhang & Sternberg, 2006, p. 19).

However, to fully understand the nature of the relationship between a style and an ability measure, a number of issues need to be clarified. *First*, although most intelligence researchers would not care too much about which test of intelligence was used as long as it had sufficient evidence of concurrent and predictive validity, they would possibly argue that the results would be rather different for measures of fluid versus crystallized intelligence. Fluid intelligence is efficient in problem solving and is strongly biologically determined while crystallized intelligence is best measured by general knowledge and vocabulary. Fluid intelligence declines with age much more quickly than crystallized intelligence and is less influenced by

education. Good IQ test batteries measure both fluid and crystallized intelligence, which are themselves related. As argued in the investment theory, bright (high fluid intelligence) people are often curious and do well in education and hence develop a wide knowledge base or crystallized intelligence.

Indeed, it may be possible to develop a model that explains a process whereby styles influence intelligence. Thus, for instance, a bright (high fluid intelligent), stable ambivert from a middle-class home that provides and values education may be encouraged to develop a deep approach to learning and an analytic, or Type I, intellectual style. In doing so, the individual acquires a large vocabulary and extensive general knowledge. In this sense, the less *g*-loaded IQ tests may be more strongly correlated with intellectual styles.

Second, and most importantly, much depends upon which measure of style is used. Though they do overlap, it does seem that some style measures are more psychometrically valid than others. Further, most but not all are multidimensional. It is likely that some dimensions would be more closely related to intelligence than others. Thus, for instance, it is possible that convergent–divergent thinking is only modestly correlated with intelligence (though not creativity) while a deep-learning style is more strongly correlated with crystallized intelligence.

Third, the most debatable issue is the effect size. That is, given the many possible sources of error and distortion in a study that looks at the relationship, what size of correlation (effect) should there be for one to conclude that there is a meaning relationship between measures of cognitive ability and cognitive style without it being considered essentially trivial? This differs from one researcher to the next, although one could get some guidelines from the effect size literature. However, significant correlations may be considered unimportant, even undesirable, if there is evidence both of predictive and of incremental validity. Thus, imagine doing a study of academic success with a series of robust outcome measures from a variety of assessments (multitask; multimethod); one important question is the predictive and unique power of cognitive ability tests and intellectual style tests. Of particular interest is the incremental ability of one over the other.

Of particular interest and importance is the issue of the development and change of both variables over time. There appear to be no longitudinal studies of changes in style over time while there are studies of both changes in personality and intelligence over time. Overall it seems the changes are small but predictable. While entity or essentialist researchers would no doubt argue that after adolescence, intelligence (and to some extent personality traits) are fixed and immutable, incremental theorists would argue that it is possible to increase intelligence (and test scores) and no doubt change.

A major question, not as yet addressed, is how the relationship between intellectual ability and style might develop. As Grigorenko (2009) has noted, style has stable and dynamic features. She considered the probability that intellectual styles are in part controlled by genes, in the sense that they are heritable. "It is notable that there are candidate genes that appear to be influencing both intelligence and personality." It is then possible that these overlapping genes contribute to the genetic foundation of intellectual styles and can explain their connections to both intelligence and personality.

CONCLUSION

The issue for those interested in individual differences in learning and thinking is whether they come from a strong general cognitive ability or from multiple intelligence or styles. While most are happy to acknowledge the fact that styles may account for a reasonable amount of variance in explaining learning and school performance, the *g* theorists often imply it is trivial compared to cognitive ability (Deary, 2001). Indeed, most believe *that styles are primarily a function of ability* and personality (Zhang & Sternberg, 2000, 2005). They point to the confused literature on all sorts of styles that has never achieved any theoretical or measurement consensus (Furnham, 2011).

On the other hand, multiple-intelligence and style theorists and researchers are eager to show that narrow cognitive ability is insufficient to understand learning and that the way people approach learning tasks in part accounts for their success at them (Gardner, 1983, 1999). They point to the self-evident fact that people's attempts to comprehend and retain material differ on systematic dimensions, which in turn relates to their learning. They tend not to measure cognitive ability, just as intelligence researchers tend not to measure style or preference.

It is still difficult to find studies that measure *both* abilities and styles and examine their relationship, although they do exist (August & Rychlak, 1978; Kershner & Ledger, 1985; Tucker & Warr, 1996). Most of the papers in this scattered literature have compared different style (i.e., cognitive vs. learning) (Sadler-Smith, 2001) or have looked at self-rated rather than test-derived intelligence/ability test scores and styles (Zhang, 2004d). There seem to be no studies that look at the relationship between test scores on recognized and validated ability (power) tests and style (preference tests) on big samples over time (i.e., longitudinally). To do longitudinal as opposed to cross-sectional work would mean it would be possible to look at the causal influence of ability and style on each other. More interestingly, it would be desirable to understand how styles moderate and mediate the role of ability and personality when considering various types of performance and the extent to which styles account for significant amounts of incremental validity.

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10

Creativity and Intellectual Styles

Kyle A. Hartley and Jonathan A. Plucker

We live in a fast-paced, rapidly changing global society where creativity drives new products, new ways of thinking, and new ways of solving problems. Creativity is essential to all fields, including business, science, technology, and education. If we ignore creativity, we ignore progress.

But how do we define and measure creativity? The answer to this question has a considerable impact on how one studies, supports, and enhances innovation. For example, given the right tools, anyone can create an application for the Apple iPhone. Is this an example of eminent creativity or everyday creativity? Is the fashion-design student who does not follow the professor's directions, yet creates a unique and well-liked outfit, deserving of an A? Both of these examples reflect an individual's creativity focused for a particular product. What these two people have in common is that they clearly went about solving problems and creating new products in unique and personally preferred ways.

When psychologists first began to seriously investigate creativity research, they often focused on the traits of eminently creative people. Over time, creativity researchers have moved away from this focus to one that is more holistic. This focus on creative style has opened the door to exploring new ways of understanding and teaching creativity. For example, Ranjan, Gabora, and O'Connor (2010) examined the extent to which undergraduate students could recognize specific creative styles within and across domains. Their results indicated that undergraduate students were able to not only distinguish between professional and peer work within their domain of interest, but were also able to apply this ability across domains. Likewise, this change in perspective has led to the development of new theories that emphasize individual creative differences, such as the Amusement Park Theory of Creativity (Kaufman & Baer, 2009) and the Four C Model of Creativity (Kaufman & Beghetto, 2009), and it acknowledges the idea that all people have the capacity for creativity but differ in how they prefer to go about being creative. As Richards asserted in her discussion of everyday creativity, "It is not so much what we do as how we do it, whether this is at work or at leisure. With our everyday creativity, we adapt flexibly, we improvise, and we try different options . . ." (Richards, 2007, p. 26).

Many researchers have suggested that an individual who knows their intellectual or problem-solving style may be able to solve problems more efficiently and effectively (Basadur, Graen, & Wakabayashi, 1990; Isaksen & Geuens, 2007; Kirton,

1976, 1989; Selby, Shaw, & Houtz, 2005; Treffinger, Selby, & Isaksen, 2008). They can do so flexibly, moving away from their preferred style if it is not conducive to the situation (Jablokow & Kirton, 2009; Kirton, 1989; Treffinger et al., 2008; Zhang & Sternberg, 2001). As Zhang and Sternberg observed, "Styles make a difference in behavior and performance in diverse domains of our life, ranging from ways of learning and of solving problems to various aspects of development . . . and from academic achievement to job performance . . ." (Zhang & Sternberg, 2009b, p. 292). Clearly, the interaction of creativity and intellectual styles has a place in both research and practice in a variety of fields.

WHAT IS CREATIVITY?

Although all individuals have the capacity to be creative, they differ in how they use it and how they allow it to emerge in everyday life. In essence, people apply their creative faculty to the particular purpose for which they might need it. This can be done through creative problem solving and/or creative thinking. This is a modern conception, one that recognizes the concept of distinctive styles that differ among individuals. Roughly 20 years ago, Sternberg and Lubart saw creativity in this manner:

> We often think of creativity in terms of the discoveries of great scientists, the paintings of great artists, and the novels of great writers . . . creativity is exhibited by more than the rare field fraction of the population who engage in high-level pursuits. Creativity can be found in our daily lives.
>
> *Sternberg & Lubart, 1991, p. 2*

Although researchers have acknowledged that opportunities for creativity surround individuals every day, the field lacks a true operational definition of creativity. What is creativity and who judges something as creative? A variety of definitions have been proposed, but Plucker, Beghetto, and Dow proposed the following definition in an effort to acknowledge both individual and cultural influences: "Creativity is the interaction among aptitude, process, and environment by which an individual or group produces a perceptible product that is both novel and useful as defined within a social context" (Plucker, Beghetto, & Dow, 2004, p. 90). This definition falls in line with Sternberg and Lubart's (1991) as well as Richard's (2007) concepts of creativity, for the Plucker et al. definition suggests creativity is more about how all people are creative instead of the select few who show eminent signs of creativity.

CREATIVITY STYLE RESEARCH

Given the potential importance of creativity styles, we are continually surprised at the lack of intellectual work on this topic. Whereas discussions of intellectual styles could (and do) fill up volumes, theory and research on creativity styles or preferences rarely appear in the major journals. Fortunately, the few scholars who have addressed creativity styles have done so comprehensively, with extensive research programs that are

both theoretical and applied in nature. In this chapter, we primarily review the work of Kirton, Sternberg, and Zhang, and researchers associated with the Creative Problem Solving (CPS) model, although we briefly highlight three new, promising approaches before offering general observations about the future of creativity styles research.

Kirton's Adaptor–Innovator Theory

One of the first attempts to describe creativity styles was Kirton's Adaptor–Innovator theory (Kirton, 1976, 1978, 1989), with the corresponding Kirton Adaption–Innovation (KAI) Inventory. The focus of this work was to describe and assess the degree to which people approached creativity from a stylistic perspective. This theory suggests people fall on a continuum of cognitive style with adaptors on one end people who like to improve on solutions to existing problems by doing things better and innovators on the other those who like to improve on solutions to existing problems by solving them differently. The original subscales were listed as Originality, Methodical Weberianism, and Mertonian Conformist, with a possible score ranging from 32 to 160 (Kirton, 1976). The KAI subscales were quickly revised and (for obvious reasons) renamed to become Originality, Efficiency, and Rule Conformity (Kirton, 1978). A person with a high KAI index score is described as innovative, while a person with a low score is described as adaptive. The official web site for KAI suggests this inventory can be used for many purposes, including individual and leadership development, training, problem solving, and team building. Within Kirton's original sample, the KAI correlated significantly with gender, with women favoring the adaptive style more than men. Regarding age, Kirton found that younger people scored higher on the innovative style than older participants, although the differences were small in the cases of both gender and age. Furthermore, Kirton found no correlation between level of education or occupation status and KAI scores, and the three subscale scores were significantly intercorrelated. More specifically, women were more adaptive than men and individuals over the age of 45 were less innovative than individuals under 30 or between the ages of 30 and 45. The sample's reliability was .88 and its internal consistency was deemed satisfactory (Kirton, 1976).

Kirton (1976, 1989) considers a person's preference for being an adaptor or an innovator to be rather stable and a part of personality. Although adaptors and innovators may not differ in their level of creative output (Brinkman, 1999; Kirton, 1978), they do differ in the type of creative output (Puccio, Treffinger, & Talbot, 1995) they produce. Research suggests that adaptors and innovators can be equally creative. Puccio et al. (1995) found that British employees from two different companies exhibited different types of creative output based on their Adaptor–Innovator orientation. Those who were more oriented toward being adaptive thought that they created products that are best described as logical, adequate, well-crafted, and useful. Meanwhile, those who were more oriented toward being innovative thought that they created products that are best described as original, attractive, transformational, and expressive (Puccio et al., 1995, p. 157). In the research by Houtz et al. (2003), path analysis suggested there was a greater causal relationship between individual's

KAI creative style and self-perceived creativity than between personality style and self-perceived creativity. This suggests that people have a more accurate self-perception of their creative style than their personality style within the context of creativity productivity.

Most recently, Cheng, Kim, and Hull (2010) investigated cultural and gender differences among creative styles of American and Taiwanese college students. Although they did not use the KAI scale, they were able to capture students' creative styles using variables from the Torrance Tests of Creative Thinking (TTCT). Specifically, they used a combination of variables from fluency, originality, and resistance to premature closure to measure innovation and a combination of variables from elaboration, abstractness, and resistance to premature closure to measure adaptation.

Although the literature suggests conflicting results with regard to gender differences in creative style, Cheng et al. (2010) found statistically significant cultural and gender differences among their sample of college students. Specifically, females were found to be more innovative than males, Americans were found to be more adaptive than Taiwanese, and females with adaptive creative styles had significantly higher scores than males with adaptive creative styles. Cheng et al. also investigated the relationship between creative style and personality type and found significant correlations between the Adaptive creative style and Intuition as measured by the Keirsey Temperament Sorter II.

In 2003, Houtz et al. investigated the relationship between creative style and personality type. The authors used the KAI to measure creative styles, the Myers-Briggs Type Indicator (MBTI) to measure personality types, and the What-Kind-of-Person-Are-You (WKOPAY) to measure self-perceived creativity. Although the researchers hypothesized that personality would influence creative style, which in turn would affect self-perceived creativity, the results of their path analysis suggested a greater causal connection between creative style and self-perceived creativity than personality type and creativity self-perception.

A few years earlier, Brinkman (1999) used the KAI inventory to investigate how students with different creative styles would perform on closed versus open musical problems. He hypothesized that research participants with an adaptive creativity style would create a more creative musical product to a closed problem whereas research participants with an innovative creativity style would create a more creative musical product to an open problem. The results indicated there was not significant difference in creativity style, problem type, or interaction between creativity style and problem type. This confirms Kirton's hypothesis that adaptors and innovators do not significantly differ in their levels of creativity, but does not support the researcher's hypothesis. The inconsistency between these researchers' hypotheses and results in these two studies suggests that there is still a lot to be learned about creative style.

The Work of Sternberg and Zhang

Over the past two decades, Robert Sternberg's styles research has gradually moved from a theory of mental self-government to a theory of intellectual styles. Throughout this transition, the importance of individual differences and the interaction of the

environment and the individual have remained constant, and this work has consistently acknowledged the influence of culture, demographics, and environment (Sternberg, 1997; Sternberg & Grigorenko, 1997; Zhang & Sternberg, 2001, 2005, 2009a, 2009b, 2009c).

The theory of mental self-government describes people's thinking styles (Sternberg, 1994) and is intended to bridge our understanding of cognition and personality (Sternberg & Grigorenko, 1997). Sternberg describes this theory as one in which people "organize or govern themselves" in ways that "correspond to the kinds of governments and government branches that exist world-wide" (Sternberg, 1994, p. 37). The model includes five categories: functions, forms, levels, scopes, and leanings. Within each category, individuals traditionally have a preference for one style over another; however, people's preferences may vary according to the task at hand. In this theory, two styles have great implications for creativity: the legislative style and the liberal style. People who prefer the legislative style "like to create their own rules, do things their own way, and build their own structures when deciding how to approach a problem. They prefer tasks that are not prestructured or prefabricated" (Sternberg & Grigorenko, 1997, p. 707). Meanwhile, those who prefer the liberal style "like to go beyond existing rules and procedures and who allow substantial changes. They also seek or are at least comfortable with ambiguous situations, and prefer some degree of unfamiliarity in life and work" (Sternberg, 1997, p. 74). This theory established a framework for Sternberg's subsequent research on thinking styles and intellectual styles, much of it conducted in collaboration with Li-fang Zhang (e.g., Zhang & Sternberg, 2001, 2006, 2009a, 2009b).

In Sternberg's early research on thinking styles (1997), he drew on the idea that people think and process information in a variety of ways. While focusing on schools as a context for creative thinking, he suggested there needs to be more flexibility in schools to include a broader range of thinking styles, especially legislative and liberal thinking styles that are characteristic of creative thinking and problem solving. According to Sternberg,

> it is relatively rare that a great deal of intellectual independence is encouraged [in schools], at least until the very highest levels of schooling, such as advanced graduate or postdoctoral work. Even there, legislative thinking is often not particular encouraged.
>
> *Sternberg, 1997, p. 107*

Recently, Zhang (2007) examined thinking styles and academic achievement in China and found that conservative thinking styles/modes predicted better achievement in earlier grades, but legislative thinking and the holistic modes predicted better achievement in later grades. These results provide convincing evidence that thinking styles are adaptable and likely influenced by social, cultural, and environmental factors.

In 2005, Zhang and Sternberg coined the phrase "intellectual styles" so that all style constructs, with or without the root word "style" (e.g., cognitive styles, learning styles, and thinking styles, learning approaches, personality types) are brought under

one general term. According to Zhang and Sternberg, "intellectual styles" are preferred way of processing information and dealing with tasks (Zhang & Sternberg, 2005, 2006, 2009a, 2009c). These styles have been divided into five malleable dimensions (cognitive, affective, physiological, psychological, and sociological) and split into three different types (Type I, Type II, and Type III). The differences between types depend upon

> . . . people's preferences for each of the underlying concepts (i.e., structured vs. free of structure, cognitive simplicity vs. cognitive complexity, conformity vs. nonconformity, authority vs. autonomy, and group vs. individual).
>
> *Zhang & Sternberg, 2006, p. 164*

Type I styles have low structure and are cognitively complex, nonconforming, and autonomous. These are often thought of as more, in fact, creativity-generating. Type II styles entail high structure and are less cognitively complex and more conforming than Type I styles (Zhang & Sternberg, 2009a, 2009c). Overall, Type I styles are the most important for fostering creativity and Type II styles are the least adaptive. Type III styles may manifest the characteristics of either Type I or Type II styles depending on the specific tasks at hand.

Zhang and Sternberg (2009c) have suggested two ways people can foster creativity through intellectual styles in both schools and business. First, they suggested that school and business leaders need to cultivate Type I styles. Therefore, school and business leaders should act as role models for creative thinking by rewarding creative ideas and products, allowing mistakes, and providing an enriching environment for creative thinking and problem solving. Second, they suggested that school and business leaders need to not only allow but also encourage diverse intellectual styles. In a school setting, this would take form by encouraging teachers to use a variety of teaching methods and strategies that push students to use different intellectual styles in the classroom. In a business setting, this would take form by creating training and management programs that take into account people's individual intellectual styles.

Creative Problem Solving

Creativity is highly related to problem solving (Selby et al., 2005) and decision making. In the context of teaching and education, creative problem solving has been somewhat cast aside as schools have placed very little emphasis on creative questioning and other instructional approaches that are assumed to detract from student performance on standardized tests. It is worth noting, however, that little if any evidence exists that creative teaching strategies have a negative effect on student achievement scores. However, well-researched models exist for the teaching of creative problem solving, with the CPS model first among them.

The CPS framework has been developed over the past five decades, early on through the efforts of Alex Osborne (1953) and Sidney Parnes (1967), who proposed a five-stage model: fact finding (gathering data and examining what participants know), problem finding (clarifying problem), idea finding (generating ideas

through brainstorming), solution finding (evaluating and selecting solutions), and acceptance finding (implementing ideas) (Davis, 2004).

However, the model has been continually refined, with several major revisions over the decades. For example, Isaksen and Treffinger (1985) subsequently added a new first stage, mess finding (later called condition finding), and broadened fact finding to become data finding. They also emphasized the need for both divergent and convergent thinking during CPS and expanded the scope of the solution finding and acceptance finding stages (Treffinger, 1995). Perhaps most importantly, they redefined "problems" as potential opportunities that could foster positive outcomes by allowing students to work through changes and engage in constructive action. As a result, a problem can be defined as any "important, open-ended, and ambiguous situation for which one wants and needs new options and a plan for carrying a solution successfully" (Treffinger, 1995, p. 304). This broadened conceptualization of problems, which is similar to that of Plucker et al.'s definition of creativity (2004), helps debunk stereotypes of creativity mainly being applicable to the arts, literature, and other "creative disciplines" and reinforces that problems and, therefore, creative solutions exist in all domains.

In its most recent form, the CPS framework is described as a flexible circular problem-solving model that can be used by people with a variety of problem-solving styles and, when adapted appropriately, by a broad range of individuals from elementary school students to senior business managers. The model includes a planning component in addition to the three established components: understanding the challenge, generating ideas, and preparing for action, all with individual stages. The researchers suggested that its circular pattern allows a fair amount of flexibility in that people can "enter and exit the process based on their own level of readiness and understanding of the problem situation" (Treffinger et al., 2008, p. 391).

CPS and Creativity Styles

Two current lines of research directly address creativity styles as manifested within the CPS framework: the work with Creative Problem Solving Inventory (CPSI) by Basadur and colleagues, and the development of VIEW: An Assessment of Problem Solving Style by Isaksen and colleagues. Although neither group of researchers explicitly ties the research directly to the model, both teams have a strong theoretical grounding in CPS indeed, many of the model's revisions were made by these researchers and the theoretical connection to the CPS framework is implied in the following studies.

Creative Problem-Solving Inventory

Basadur, Graen, and Wakabayashi (1990) created the CPSI in order to measure an individual's Creative Problem Solving Profile (CPSP). This theory purports that individuals have unique creative problem-solving styles. The Creative Problem Solving Profile is made up of two dimensions, the first consisting of two ways of gaining

knowledge, (1) experiencing and (2) thinking, and the second dimension consisting of two ways of using knowledge, (1) ideation and (2) evaluation.

The profile is based on the idea that in order to solve problems creatively, one must have knowledge about the problem area, be able to transform this knowledge into ideas and options, and be able to make judgments and implement a way to solve the problem. Basadur et al. (1990) conceptualized the possible differences of problem-solving style into quadrants, each quadrant with its own unique way of gaining and using knowledge. These individual differences then flow into an eight-step cyclical problem-solving model (which holds some similarity to later versions of the CPS model). These steps include problem finding, fact finding, problem definition, idea finding, evaluation and selection, planning, gaining acceptance, and action. The corresponding instrument, the CPSP inventory, was developed in order to give research participants an understanding of their dominant problem-solving style (i.e., their place within the four quadrants) (Basadur et al., 1990). Basadur and his colleagues believe that having this information may help individuals and teams solve problems by making each team member more aware of his or her own creative preferences, and team leaders may be better able to assemble and direct teams during creative tasks.

Although each column is unnamed to the respondent, column one represents the respondent's orientation toward gaining knowledge through experiencing (example words include *doing*, *sensing*, and *probing*), column two represents the respondent's orientation toward using ideation in creative problem solving (example words include *intuitive*, *free thinking*, and *projecting*), column three represents the respondent's orientation toward gaining knowledge through abstract thinking (example words include *detached*, *logical*, and *structuring*), and column four represents the respondent's orientation toward using evaluation in creative problem solving (example words include *selective*, *experimenting*, and *examining*). The columns are each totaled and the respondent's problem-solving profile is the combination of these four categories (Basadur et al., 1990).

Reliability was tested using 129 individuals from a variety of businesses and industrial organizations. They took the CPSP inventory twice with a 1-week break in between testing. Correlations for the columns ranged from .58 to .64 and .66 to .67 for bipolar scales. Validity was examined using 181 undergraduate students. The students were trained in creative problem solving and then took the CPSP inventory. After plotting their profiles and discussing them, they were asked to rate how well they believed their profile fit their actual problem-solving style (with 1 representing no fit at all and 10 representing a perfect fit). Their mean score was 7.1 and, overall, 72.4% of the students rated their profile as being a good or better fit. This validity test was repeated with 14 managers. Their mean score was 8.3 and, overall, 92.9% of the managers rated their profile as being a good or better fit (Basadur et al., 1990).

Research with the inventory found that individuals from the four different types of styles, generator, conceptualizer, optimizer, and implementor, benefited from divergent-thinking training in order to decrease premature convergence; however, one specific style, optimizers, responded best to this type of training in regard to improving attitude on active divergence (Basadur et al., 1990). In examining

the similarities and differences between nonmanagers and managers, the researchers found that both groups of workers benefited from divergent-thinking training. After training, both groups showed significant decreases in premature convergence attitudes. Although prior to training, nonmanagers held significantly stronger beliefs about the importance of active divergence than managers, only the increase of managers' attitude in this was significant after training. After completing the training, the differences between the two groups' beliefs about active divergence and premature convergence were not significantly different (Basadur et al., 1990).

Cross-culturally, divergent-thinking training helps improve managers' attitudes about creative thinking and problem solving. Research done in the United States, Japan, and Mexico showed that divergent training improved managers' attitudes of active divergence and premature convergence. In these studies, after divergent-thinking training, managers' attitudes of acceptance of active divergence increased and their attitudes of premature convergence decreased. Interestingly, cross-culturally, managers showed a stronger change for decreasing premature convergence than increasing active divergence (Basadur, Graen, & Scandura, 1986; Basadur, Pringle, & Kirkland, 2002; Basadur, Wakabayashi, & Takai, 1992). This finding may reflect managers' willingness to allocate more time and resources for brainstorming convergent ideas than divergent ideas. Future research in other fields may want to investigate this question in order to examine whether or not these findings extend beyond the business field.

VIEW: An Assessment of Problem-Solving Style

In 2004, Selby, Treffinger, Isaksen, and Lauer developed VIEW, another assessment developed to measure problem solving style. They challenged previous style measures by suggesting it is "difficult to assess the extent to which the measures are truly general styles or merely inventories of interest or preference for specific cognitive strategies or processes" (Isaksen & Geuens, 2007, p. 18). Unlike the CPSI, which measures an individual's problem-solving style according to the CPS model, VIEW specifically examines an individual's styles along three dimensions of problem solving: orientation to change, manner of processing, and ways of deciding. Within each dimension, there are two different styles: the explorer and developer styles within the orientation to change dimension; the external and internal styles within the manner of processing dimension; and the person-focused and task-focused styles within the ways of deciding dimension. Within the orientation to change dimension, an individual who prefers the explorer style enjoys problem solving with little structure, while an individual who prefers the developer style enjoys more structure. Meanwhile, within the manner of processing dimension, an individual who prefers the external style enjoys problem solving with other people while those who prefer the internal style prefer to problem solve individually. Finally, within the ways of deciding dimension, individuals who prefer the people style first consider the ramifications of their decisions based on people's feelings and

support, whereas those who prefer the task style problem solve based on logic (Isaksen & Geuens, 2007).

In 2007, Isaksen and Geuens studied the relationship between VIEW and CPS. Participants had already completed a course based on the most current model of CPS. This course was followed by a survey that aimed at assessing the enjoyment the participants found learning about the different components of CPS and the extent to which they were using the CPS components in their workplace.

The results suggested that within the orientation to change dimension, compared with developers, explorers found more enjoyment in learning the Framing Problems and Generating Ideas stages of CPS. No significant difference was found among the two different styles within the manner of processing dimension and the two CPS categories, generating and focusing tools and guidelines. Within the ways of deciding dimension, people who preferred a task-focused style reported greater enjoyment learning about the generating guidelines and generating ideas aspects of CPS than those who preferred the people-focused style. Those preferring the task-focused style also reported greater use of generating and focusing tools as well as Generating Ideas and Planning Your Approach in CPS. Isaksen and Geuens concluded that the VIEW "is a productive tool to help participants understand their natural preferences for certain aspects of CPS" (Isaksen & Geuens, 2007, p. 20), but one could also conclude that people with different preferences will enjoy different aspects of differentiated instruction which is, after all, a major justification for adapting to student styles in the first place.

Houtz, Matos, Park, Scheinholtz, and Selby (2007) conducted another study that provided some evidence of validity for the VIEW. They examined the creativity styles and attributions for success and failure of female students studying toward their master's degrees, and they found evidence that the participants with higher Developer than Explorer scale scores attributed a higher percentage of their failures to uncontrollable factors, providing evidence in support of the description of Developers being more organized and willing to plan their work.

Business/Management Perspective

Although many business researchers have focused on applying cognitive style research to the workplace (e.g., Allinson, Chell, & Hayes, 2000; Allinson & Hayes, 1996, 2000; Armstrong, Allinson, & Hayes, 2002; Hayes & Allinson, 1997; Hayes, Allinson, & Armstrong, 2004; Vance, Groves, Paik, & Kindler, 2007; Vance, Zell, & Groves, 2008), Min Basadur's research aligns most closely with creative styles. Early research showed creative problem-solving training with business managers to have a positive significant increase in their preferences for ideation (Basadur & Finkbeiner, 1985) and a significant decrease in the tendency to not make premature critical evaluation of ideas (Basadur & Hausdorf, 1996). A more focused divergent thinking training with managers was shown to "decrease the mystery" of creative thinking and increase creative problem solving (Basadur, Taggar, & Pringle, 1999). More specifically, this type of training not only improved managers' attitudes about ideation but also helped relieve some of the stereotypes about creative

individuals and the misconception that new ideas are too time consuming to encourage (Basadur & Hausdorf, 1996; Basadur et al., 1999).

Both of the trainings used followed Basadur, Graen, and Green's (1982) model of creative problem solving. It is possible that these training sessions could be modified for educators in order to help them become more open to creative individuals and creative ideas in their classroom. Likewise, the Item Preference Scale could be modified in order to gauge educator preferences for valuing new ideas, creative individual stereotypes, and ideation (Basadur et al., 1999). Addition research by Basadur et al. (1986) showed after divergent thinking training, attitudes about creative thinking and problem solving are easier to maintain and pass on to others when coworkers have similar beliefs.

OTHER PROMISING APPROACHES

The Amusement Park Theory of Creativity

The Amusement Park Theory (APT), a multilevel model of creative process and production, incorporates the idea of creative styles (Kaufman & Baer, 2004, 2009). The APT emphasizes the importance of environment, intelligence, and motivation for creativity, suggesting that distinct creative opportunities require different amounts of each of these factors for a creative product to be useful and appropriate. For example, both creative journalists and creative poets are incredibly verbal and creative writers, but their intellectual styles are different, and they work in environments that require very different outputs. In line with Zhang and Sternberg (2006, 2009a, 2009c), they believe a person's intellectual style has an impact on creativity; however, as others have suggested, they too believe styles to be flexible and only one factor among many that influence creative productivity. Individuals may have a preferred way of processing information, but they also need to be able to remain flexible in order to create a unique, useful, and appropriate product.

Creativity Styles Questionnaire

In an effort to create a scale to measure creativity style alone, Kumar, Kemmler, and Holman (1997) expanded on a previously developed creativity styles questionnaire (Kumar & Holman, 1989). The original questionnaire, the Creativity Styles Questionnaire (CSQ), was developed by Kumar and Holman (1989) and included 72 questions falling into seven subscales. These subscales included belief in the unconscious processes ("Creative ideas occur to me without even thinking about them"), use of techniques ("I often let my mind wander to come up with new ideas"), use of other people ("I am at my creative best when I work alone"), final product orientation ("I usually have a lot of workable ideas"), environmental control ("I typically have background music when I am engaged in creative work"), superstition, and use of senses ("I tend to use my sense of touch in my creative work"). After initial testing with undergraduates in a psychology course, Kumar,

Kemmler, and Holman developed the 76-item Creativity Styles Questionnaire Revised (CSQ-R) to measure "beliefs about and strategies for going about being creative" (Kumar, Kemmler, & Holman, 1997, p. 51). Students responded to each question on a 5-point Likert scale (ranging from 1 = strongly agree to 5 = strongly disagree). Cronbach alphas estimates for the seven subscales ranged from .45 to .81, with a median of .74. The CSQ-R has been used occasionally by other researchers, suggesting that the instrument is "catching on." For example, Fuchs, Kumar, and Porter (2007) used the CSQ-R alongside three other instruments in order to examine the relationship between emotional and cognitive creativity.

CROSS-CUTTING THEMES AND CONCLUSIONS

Four themes emerge from the major research efforts on creativity styles. First, despite recent research suggesting there is not enough evidence to support tailoring teaching to students' learning or thinking styles (see, e.g., Pashler, McDaniel, Rohrer, & Bjork, 2008), the lack of overwhelming evidence should not be interpreted as meaning that matching styles to one's classroom instruction or work context is not important. Sternberg (1997) did not propose tailoring teaching to a student's specific intellectual style, but he did propose that providing some classroom assignments and assessments that match students' intellectual styles will give the student more opportunity to excel in the classroom (see also Sternberg, 1994; Sternberg, Grigorenko, & Zhang, 2008; Treffinger et al., 2008). Sternberg and Zhang (2005) make a similar argument about the dangers of neglecting leadership styles in schools, asking whether schools can continue to ignore those thinking and leadership styles associated with adult success without causing long-term harm to society. Furthermore, the available research suggests that when a person knows his or her problem-solving style, the person may be able to solve problems more efficiently and effectively both individually and as a team (Basadur et al., 1990; Isaksen & Geuens, 2007; Kirton, 1976, 1989; Selby et al., 2005; Treffinger et al., 2008).

Creativity styles research is also largely in its infancy, with several major, promising lines of research under development. Initial evidence suggests that specific creativity styles tend to be associated with preferences for specific creativity processes and, in some limited cases, creative production (e.g., Martinsen & Kaufman, 1991, 1999; Puccio & Grivas, 2009; Raidl & Lubart, 2001). This evidence appears to be stronger for those lines of research based on strong theoretical foundations and using high-quality measures. As theory and research on creativity styles advance, stronger evidence about the importance of these styles to creative production will likely emerge.

That said, and as a second theme, the major thinkers in this area of inquiry unanimously endorse the value of flexible strategy use and flexible intellectual and creative styles (Jablokow & Kirton, 2009; Kirton, 1989; Sternberg, 1994, 1997; Treffinger et al., 2008; Zhang & Sternberg, 2009c). As Zhang and Sternberg (2001) note, abilities can be viewed as being unconscious, with strategy use being conscious (i.e., under one's control). Midway on this continuum lies styles: People may have a tendency to adopt one style over another, but they also have the ability to adapt their style

to fit the current situation or problem. Treffinger et al. (2008) elaborate on this point by suggesting that teachers should help their students develop flexible problem-solving skills and strategies. The idea of flexible styles is very much in the spirit of divergent thinking. If more ideas lead to better odds of finding a creative solution, then being able to use creativity styles flexibly will lead to better odds of finding a style that fits a given situation or piece of a situation.

The third theme is the strength of the theoretical foundation for the major lines of research on creativity styles. The works of Kirton, Sternberg, and Zhang, and the many researchers involved with creative problem solving all rest on comprehensive theories and models that have been extensively studied and refined. That these lines of research are starting to bear considerable fruit is therefore not surprising, and future researchers interested in creativity styles should invest similarly in the theoretical bases of their work.

Finally, there are holes in the research on creativity styles. First and foremost, more research is needed on the long-term benefits or lack thereof of addressing creativity styles in educational and workplace settings. This recommendation mirrors other recent analyses of general cognitive styles research (Pashler et al., 2008; Riener & Willingham, 2010). In particular, are groups more creative when tasks are structured to appeal to the members' creativity styles versus when these actions are not taken? Are individuals more creative under such conditions? These are the million-dollar questions, and although the research is promising, the questions simply cannot be answered at this time.

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11

Personality and Intellectual Styles

John Roodenburg, Esther Roodenburg, and Stephen Rayner

INTRODUCTION

This chapter examines two major constructs in the psychological structure of the individual: the first is "intellectual styles" and the second "personality." Intellectual styles, an encompassing term for all style labels (e.g., cognitive style, conceptual tempo, decision-making and problem-solving styles, learning style, mind style, perceptual style, and thinking style), are people's preferred ways of processing information and dealing with tasks (Zhang & Sternberg, 2005). According to Sternberg (1988), intellectual styles are at the interface between ability and personality. The concept of style as it is used in this way infers a comprehensive superordinate construct that embodies not only psychological processes but also physiological and sociological aspects of the individual's mind at work. In this chapter, however, a focus is more sharply drawn to examine the contention made by Zhang and Sternberg (2006) that intellectual styles contribute to how an individual's personality interacts with his/her environment.

Personality is understood here to be a well-established yet imprecise concept, purporting to describe a coherent account of an individual's psychology. It is a structure that is thought to be both dynamic and stable, and that uniquely influences a person's individuality in terms of affect, cognition, motivation, and behavior. In the same way as style, its philosophical origins lie in ancient Greek and Roman depiction of humors, temperament, and type (Vernon, 1973). Personality is associated with a number of theories or approaches in psychology, such as dispositional (trait) perspective and models such as the psychodynamic, humanistic, biological, and behaviorist theories. Similar to the style construct, there is no agreed grand theory or consensus for the definition of personality in psychology. The major approaches to personality identified in this chapter, therefore, include empirically driven theories of the construct built around factorial analysis, such as Eysenck & Eysenck (1975) "3 factor model," Cattell's (1989) "16PF model," and the two parallel but not identical models of personality, that is, the Big-Five Model (De Raad & Perugini, 2002) and the Five Factor Model (Costa & McCrae, 2009).

Moreover, it is apparent that ideas of style and personality represent very similar descriptions of individuality and for some, may simply represent

manifestations of one and the same construct (Messick, 1995). The account in this chapter, however, will argue that each construct is in fact independent, thereby satisfying a psychometric requirement for defining a psychological construct (Riding, 2000; Riding & Rayner, 1998), but that the structure and function of the style construct are closely implicated in and dependent upon a system shaping and sustaining an individual's personality. For this reason, it is important to take an overview of the development of style theories in the field, in order to first understand how the intellectual style construct is different to personality, but second, to comprehend why so many may presume, and in our view, erroneously, that intellectual styles are merely aspects of the larger and more encompassing construct of personality.

The key focus in this chapter in response to this question is drawn to how intellectual styles and personality interact as two separate aspects of the individual, what exactly we understand each construct to comprise, and the function and effects of each in turn, as factors and processes affecting individuals' behaviors. The same question poses a problem and at the same time reveals a direction to follow in further developing an understanding and application of the cumulative effects of personality and intellectual styles upon human performance.

The conclusion reached in this appraisal of styles and personality supports the assertion made by Grigorenko and Sternberg (1997) that intellectual styles operate as an interface between cognition and personality. There is, however, clear indication that we need to know more about the way in which personality and intellectual styles work within an individual's psychology. A way forward is proposed, presenting the case for a more focused but eclectic form of research, combining educational philosophy, differential psychology, and psychometrics in the analysis of personality and style as key aspects of a holistic interactive system and/or structure at work in the psychology of the individual.

The structure for this chapter, therefore, comprises a consideration of the meaning of intellectual styles in relation to personality, and historical perspectives including four major influences on its development. We examine personality perspectives on intellectual styles, key relevant personality dimensions, followed by an integration of personality and styles from an ability perspective. We recommend advancing intellectual styles by learning from methods developed in personality illustrated by the psycholexical approach. Finally, we consider design and methodological implications for rethinking intellectual styles research.

THE MEANING OF INTELLECTUAL STYLES AND PERSONALITY

There is an old song that suggests that it is not what you do but the way that you do it that makes all the difference in a performance or task. It is an intriguing suggestion. What we do, it is inferred, is indelibly stamped with a psychological hallmark, leitmotif, signature, or style. What is more, it is this style that shapes and helps us understand the quality and success of our performance in a range of contexts in waking life (Rayner, 2001). This idea of personal style can be seen at work in any number

of human endeavors, for example, sport, art, handwriting, thinking, learning, and even conversation.

It is personality on the other hand, according to accounts from mainstream psychology, that defines how each of us is unique (Allport, 1937; Boekaerts, 1996; De Raad & Perugini, 2002; Eysenck, 1992; Goldberg, 1990), and while some regard personality traits as real and thus causative influences on the way we live and act, others argue for understanding them simply as useful heuristic devices (Slife, Richardson, & Reber, 2005). The concept of personality is succinctly defined as a set of psychological qualities that are stable and enduring, and which differentiate individuals from one another (Costa & McCrae, 1992). Moreover, as previously stated, there are a number of theories that set out to explain the nature of personality. It is now generally accepted that the Big-Five and Five Factor models provide a common comprehensive descriptive set of broad human personality traits: emotional stability, extraversion, conscientiousness, agreeableness, and openness. It is not difficult to anticipate our own personality playing a huge part in our social and personal lives, affecting the way we both interact with and react to the world around us. The question for this discussion is to what extent individuality can be attributed to personality alone, or if and how another key construct might capture another unique aspect of a person's psychology? Is what we call style something that we can look at more closely to more fully explain how it is we leave our own unique mark on what we do and how we do it?

HISTORICAL PERSPECTIVES ON THINKING, LEARNING, AND COGNITIVE STYLES

In an earlier critical review, Rayner (2000) identified four major influences upon the development of theories of intellectual style: These were, first, a theory of perceptual differentiation and field drawing upon theories of gestalt psychology (Witkin, Moore, Goodenough, & Cox, 1977), and, second, the work of psychologists associated with the Messinger Clinic in the United States, investigating a widening range of control, function, and processes in cognition, related to individual adaptation to the environment. This included seminal work conducted by Gardener, Holzman, Klein, Linton, and Spence (1959) and linked in turn to subsequent work looking at stylistic patterns in cognition (Hudson, 1966; Kagan & Kogan, 1970; Pask, 1976, 1988). A combination of these two approaches at the time produced a proliferation of stylistic labels in attempts at redefining cognitive style as process, serving to enable regulation in a nonhierarchical series of structures in a hypothesized structure of cognition (Messick, 1976).

The third major force contributing to the development of theories of styles was associated with applied research in contexts such as business management, computer sciences, and pedagogical science. It comprised the work of professional practitioners and researchers combining the domains of organizational and educational psychology, in the effort to use the concept of intellectual styles in the practice of learning, teaching, and the world of work. Responsible for the resurgence of interest in styles identified by Sternberg and Grigorenko (Grigorenko & Sternberg, 1997; Sternberg & Grigorenko, 1997), this movement produced a wide range of style

models, many of which were specifically criticized in an extensive review by Coffield, Moseley, Hall, and Ecclestone (2005), and more recently by Pashler, McDaniel, Rowher, and Bjork (2009). The same period of research was described by Kozhevnikov (2007) as a third wave in the historical development of cognitive and learning styles research. It included leading researchers in pioneering work, for example, David Kolb's development of experiential learning styles and personal choice (Kolb, 2007; Kolb & Kolb, 2005, 2009), Rita Dunn's profiling of learning styles in the school classroom (Dunn & Dunn, 1978, 2008; Dunn & Griggs, 2007), Michael Kirton's theorizing of style in creativity, decision making, and innovation (Kirton, 1976; Kirton & de Ciantis, 1986), John Hayes and Christopher Allinson's style theory of intuition, information processing, and cognitive style (Allinson & Hayes, 1996), and Richard Riding's application of the law of parsimony in devising a conceptual integration of style labels to present a holistic model of cognitive style (Rayner & Riding, 1997; Riding, 1997, 2000; Riding & Rayner, 1998). Linked to this development, applied researchers, principally working in the areas of business management and education, were involved in producing yet more stylistic labels and theories to explain the performance of individuals in the organization and classroom. This, for example, in more recent work included researching how individuals engaged in decision making, group work, life choices and career trajectory, teaching, and management (Felder, 1996; Gordon & Yocke, 1999; Sadler-Smith, 1997, 1999, 2004, 2009).

Lastly, a fourth major tradition that played a pivotal role in the development of styles theories emerged from work on the concept of personality style. This research was largely dominated by the work of Myers, utilizing the psychodynamic theory of Jungian types (Myers & McCaulley, 1988). Jung (1959) first developed the *psychological type* construct that was largely operationalized by Briggs and Myers. The work of Myers-Briggs is centered on the Myers-Briggs's Type Inventory (MBTI). It is generally recognized as an indicator of intellectual style but conversely is described as a personality test (Hough & Ogilvie, 2005; Isaksen, Lauer, & Wilson, 2003). The MBTI was purported to have become one of the most widely used measures of psychological types in the 1980s, and indeed by the early 1990s had already sold over 3 million copies in the United States alone. Few studies, however, have been published examining its efficacy (Kelley, 2005).

Generally, in the area of personality other than with work linked to the MBTI, there has been limited research concerned with establishing a more clearly defined personality system of styles working interactively with other aspects of personal psychology. The need for gathering consensus in this area of styles theory as originally identified by Messick (1976) and later repeated by Sternberg (1994; Sternberg & Grigorenko, 1997), albeit as a concept more closely implicated in the context of education, argues for work aimed at improving a structural definition and theoretical classification of intellectual styles and for personality to be part of the wider profiling of the psychology of the individual. This is dealt with more fully in other chapters in this book on psychometric assessment and on the question of theory. For this immediate discussion, however, the question is more obviously one that asks for more understanding of the nature of personality with implications for intellectual styles, particularly personality-centered styles.

PERSONALITY PERSPECTIVES ON STYLES

Reber (1995) pointed out that in psychology, and as early as 1937, Allport was able to "cull nearly 50 different definitions [of personality] from the literature" (see Allport, 1937, p. 555). Reber suggested that there are an indeterminate number of definitions of personality in the field, with each author's meaning colored by his or her theoretical bias. Saucier (2009) more recently reiterated that there is still no single consensual definition of personality, and there is a continuing controversy in regard to categories or attributes said to characterize personality. There has been, however, some movement toward consensus, reflecting the definition offered by Fleeson (2001) as well as Mischel and Shoda (1998), reflecting the following position adopted by DeYoung and Gray: "Traits are probabilistic constructs representing the frequencies and intensities of particular classes of affect, behaviour, and cognition across situations" (DeYoung & Gray, 2009, p. 338).

More comprehensively, and combining notions that personality includes both the attributes and underlying systems of an individual's psychology, Funder defined personality as "an individual's characteristic patterns of thought, emotion, and behavior, together with the psychological mechanisms hidden or not behind those patterns" (Funder, 1997, pp. 1–2). Similarly, McCrae and Costa (1990) defined traits as dimensions of individual differences in tendencies to show consistent patterns of thoughts, feelings, and actions. Such a definition emphasized not only the role of observable behavior but also the role of cognition and emotion in determining consistencies in behavior and a definition of personality. Note also that these definitions are largely heuristic and avoid the problem of the "reification error" where a useful and predictive construct is assumed to represent something tangible and therefore causal.

In deciding exactly what it is we mean when referring to personality, and how we begin to better understand ourselves as individuals, the research literature reveals a consensus on the Five Factor Models previously mentioned. These are generally considered to provide a balanced and comprehensive set of factors reflecting Eysenck & Eysenck (1975) Giant-Three and Cattell's 16PF (1989). Their subsequent wide acceptance has been facilitated by the various excellent operationalizations such as the NEO-Personality Inventory (Costa & McCrae, 1992) and the Five Factor Personality Inventory (FFPI) (Hendriks, Hofstee, & De Raad, 2002). There are clear implications for the field of intellectual styles here, not least there being a need for a similar pantheoretical, comprehensive, and balanced operationalization of constructs akin to the Five Factor models. We return to this point later when we consider methods used in personality that offer a fast-track option for the identification of psychological factors investigating personality-based styles representing part of the wider system of intellectual styles.

Far from considering personality as fixed causative agents, a recent trend in research activity, as previously suggested, has been toward understanding personality as susceptible to the effects of situational interactions, including factors such as notions of identity within particular cultures. Saucier (2009), for example, defined personality as a set of predications made about individuals, that is, relatively stable descriptors of attributes or traits about a person. As color changes with context,

these personality predications are said to be subject to considerable change according to a number of situational dimensions, including environmental factors such as the demands of social and occupational roles or tasks. Again, as with cognitive style, there is continuing debate over which of these descriptors really define personality well and, as with the effect of mixing distinct colors, integrating psychological factors complicates how we can really distinguish one from another when using an idiographic personality-style descriptor (see Cloninger, 2009).

Messick (1996) argued that a view of personality, as part of a dominating influence in a tripartite view of mental life, can be traced back to Aristotelian notions of the mind comprising three major dimensions: affect, conation, and cognition. He pointedly added that there had been a failure in considering this notion of psychology or understanding it as part of researching individual differences during much of the 20th century. Messick (1996) restressed a need to open up new perspectives on personality, involving the articulation of this original tripartite conception of the mind claiming that

> ... understanding this integration is the central issue for personality theory and research. Indeed, it almost constitutes a definition of what is meant by personality that is, personality is the integration of differentiated psychological subsystems as distinctly manifested in each individual.
>
> *Messick, 1996, p. 358*

The key point in all of this, and one which was made by Rayner and Peterson (2009) in a description of a hierarchical system of "the personal self" as a psychological structure of human performance, is that both personality and intellectual styles affect the other and additional aspects of the self. As Messick has consistently argued, this is a reciprocating interrelationship and influence of personality and styles on the development of affective, conative, and cognitive processes and traits in the individual.

Taking up the perspective developed by Messick (op. cit.) and articulated over a period of several decades, the nature of individuality is helpfully organized into a sensible theoretical framework. It is, however, judicious at this point to note that while Messick (1976, 1984, 1994, 1996) made a full effort to integrate ways in which different traditions shaped a theory of styles and conceptions of individuality, his theory is firmly located in a traditional experimental and positivist model of cognitive psychology. This theory is elaborated by Messick (1994, 1996) as a "three-stream structure of intellect." It described a mix of fluid and more fixed aspects of intellect but importantly elaborated a system in which stylistic features interacted with personality and cognition to shape intelligence. The explanation relied largely upon factorial analysis to identify and validate theory via the use of measurement and a listed series of cognitive variables comprising style dimensions (Messick, 1996), and the need to establish psychometric assessment capable of further supporting and validating a theory of personality style. Nonetheless, all of this is worthy of reaffirmation and a similar approach will be further developed later in this discussion, describing how studies of personality structure might perhaps form an integrated base upon which to build a program of research aimed at opening up a new front in psychometric

assessment, seeking to reexamine potential series and interactions of domain, processes, and constructs associated with style and person within individuality. This idea of reframing the role of knowledge and disciplinary domain, particularly in terms of ontology, epistemology, and research methodology, has been more fully considered in Chapter 3 in this volume dealing with the theory of intellectual styles.

In regard to Messick's understanding of personality as an integration of differentiated psychological subsystems, Rachman (1978), in updating Aristotelian constructs, established the triple-response set system, validated as part of their research into anxiety, distinguishing affective, cognitive, and behavioral domains. Validating evidence from clinical observations shows clearly that changes in any one domain do not affect parallel changes in the others, a phenomenon called "desynchrony." Such desynchrony makes for a strong case for considering neurological explanation for personality. These distinctions identified by Rachman (1978) lie at the heart of cognitive behavioral therapy, one of the most well-validated therapeutic approaches in contemporary clinical psychology. Such distinctions have equal relevance to styles, offering a neurological foundation for differentiating between cognitive, affective, and behavioral intellectual styles.

Lastly, and in further support of a tentative argument for new approaches to conceptualizing personality and styles, Messick (1996) contended that it is important when considering the interrelatedness of noncognitive and cognitive domains, for a focus to be drawn to constructs that operate across domains but are also potentially integrative. This means that they are essentially adaptive and pervasive, and we suggest these might helpfully be understood to serve as "enabling synapses," which in turn can take a number of forms, for example, rather like the variation of homosynaptic and heterosynaptic plasticity in chemical synapses in the nervous system.

Quite crucially and as previously argued, such constructs are thought to be distinctively structural and are not traits, abilities, or intelligences. These styles as defined by Messick (1976) were identified as contributing to the efficacy of other key variables in an individual's psychology. The implication, in terms of both mental function and behavioral performance, is that styles can engage with and facilitate the work of competence or performance variables, which in turn interact to create processes of affect, conation, and cognition. If this account is accepted as a basis for understanding the structure of styles, it raises a need for revalidation, for more sophisticated measurement, and better forms of psychometric assessment in future experimental cognitive psychology (see also Pashler et al., 2009, for a similar critique of learning styles).

A substantial and separate but complementary development to both theorizing and measuring aspects of personality as individual *preferences* was constructed by Holland (Gottfredson & Holland, 1996), reflecting an applied perspective linked to decision making and running parallel to the information-processing approach described by Messick (1994). Holland's theory of career choice is based upon the idea of defining personality types in terms of occupational preferences: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional. Much of the theory reflects a similar set of ideas underpinning the application of a range of style theories

including the fundamental idea of the "matching hypothesis," which supposes that managing with a deliberate style-led organizing of these different personality types with task, mode of work, grouping, and context can enhance performance.

More than half of the total of 575 publications identified in a literature survey of key intellectual styles and personality completed for this chapter comprised research using Holland's Occupational Interests (337 separate publications), and it is generally held to be a particularly robust theory (Nordvik, 1996). It is often regarded, however, as being a personality theory (e.g., named "Holland's theory of career personality types" by Zhang & Sternberg, 2005, pp. 35, 38). Overall, and further reinforcing the value of Messick's position on personal style, the singular dominance of Holland's Occupational Interests measures in PsychINFO and ERIC literature searches conducted as preliminary work for writing this chapter, using the key words, "styles" and "personality" may point to how much styles as a theoretical concept and a structural aspect of the self is intimately connected with personality. Interestingly, the next most frequent indicator of styles associated with personality is the MBTI, with 78 references showing a sustained interest in an applied research that has shifted location in the last couple of decades from within the domain of Education to Psychology.

INTEGRATING STYLES WITH PERSONALITY FROM THE ABILITY-BASED PERSPECTIVE

Based on empirical studies centered on thinking styles defined in Sternberg's (1997) theory of mental self-government and further based on conceptualization of the then-existing literature, Zhang and Sternberg (2005) proposed a Threefold Model of Intellectual Styles. It is intended as an integrative styles model, with intellectual styles being an umbrella term for all existing style labels, including personality-centered, cognitive-centered, and learning-centered styles. The Threefold Model offers a framework for classifying intellectual styles into three dimensions. The first, Type I, is a set of intellectual styles showing preference for low degrees of structure, cognitive complexity, nonconformity, and autonomy. Type II intellectual styles normally locate along continua of preference comprising structure, cognitive simplicity, conformity, and authority. This type therefore reflects ways of thinking that are more simplistic and benefit conformity and regulation of behavior. Type III intellectual styles reflect a mix of the features associated with Types I and II, and are identified as a set of styles most susceptible to contextual cue and the social setting. While this is not the place to document the empirical research underpinning the psychometric tests used for assessing and subsequent validating of the theory of thinking styles, and subsequently, the early model of intellectual styles, such an account can be accessed by reviewing the work of Zhang (2001, 2002a, 2002b, 2003), Zhang and Sachs (1997), and Zhang and Sternberg (2000, 2005, 2009). More relevant to this discussion is the work around this development that touches upon the nature of the interrelationship between personality and styles, which we will consider next.

There is a substantive empirical account of work surveying the personality-based and style-based characteristics of groups using tests based on Sternberg's

model of thinking styles (e.g., Zhang, 2000, 2001, 2002a,b). Much of this work was aimed at establishing the construct independence of thinking styles, as is, for example, reported by Zhang (2002a,b) in a study looking at the interrelationship between variables identified using the Thinking Styles Inventory based on Sternberg's theory of mental self-government and the NEO Five Factor Inventory (NEO-PI, Costa & McCrae, 1992). The findings showed that while a relationship did exist between particular thinking styles and certain personality traits, it was not possible to use a personality measure such as the NEO-PI to measure thinking styles. An implication of this interpretation might be to regard the relationship of styles to personality as being like that of weight to mass: since the whole is greater than the sum of the parts, in understanding styles in conjunction with personality as a psychological structure, we gain depth in perspective (3-D) from which we can better understand individuals more holistically.

A dominant theme running through the entire history of individual differences is a reliance upon psychometric measurement and the notion of validity as demonstrated by testing in both the development and the justification of theory. Sternberg, Grigorenko, and Zhang (2008, p. 486) have recently stated that there are two "types" of learning and thinking styles: "ability-based" and "personality-based," and that both matter for instruction and assessment. In many respects, this echoes earlier statements by Messick (1994) about competency-based and performance-based variables constituting stylistic processes.

Grigorenko (2009) argued that not taking any of these styles into account would prevent students from capitalizing on strengths, compensation for, or correcting weaknesses, and thus is suboptimal educational practice. This recent articulation, however, is explicit in emphasizing styles as cognitive phenomena, and as "individual differences in approaches to tasks that can make a difference in the way in which and, potentially, in the efficacy with which a person perceives, learns, or thinks" (Grigorenko, 2009, p. 486). The cognition base to this perspective, as previously discussed, clearly and distinctively separates styles from personality. When cognitive or intellectual styles are considered in the literature, a conflation generally occurs; as, for example, when constructivist-based models of style (orientations to study represented by work associated with Entwistle (1981), Biggs (1987), and Vermunt (1998) are merged with more traditional trait or dispositional models of style (Holland, 1973; Myers & McCaulley, 1988). Furthermore, the remaining consideration given to personality-based styles by Sternberg, Grigorenko, and Zhang (2008) seems a light-touch and amounts to a summary of more general characteristics of personality-based styles of thought or cognition. It is for these reasons that we turn again to Messick's ideas about the stylistic manifestations of personality and a reference to the holistic model presented by Miller (1981), to argue for the potential in opportunities for bridging personality and cognition (Messick, 1996). The argument, we suggest, helps direct researchers toward attempting a more clearly established realization of theory through adopting a wider variety of research methodologies. This redirection might sensibly include widening the evidence base in research examining intellectual styles to include alternative contexts for projects comprising applied research as well as the use of mixed methodologies as a basis for further improving the rigor of the "science" involved (see Pashler et al., 2009, for a similar argument).

ADVANCING STYLES BY LEARNING FROM PERSONALITY RESEARCH

The contrast between cognition-centered and personality-centered intellectual styles mirror a similar range of issues distinguishing abilities and personality, with each style at risk of reduction and subjugation to the other dimension or construct (Sternberg & Grigorenko, 1996). In observations that echo the previously mentioned distinctions made by Messick or Sternberg and colleagues, Hofstee (2001) suggested that the difference between personality and ability is not as great as we are inclined to think, but that the difference lies substantially in how they are determined: one by maximal performance, yielding objective unipolar measures that are intrinsically value directional (more is better), and the other by more subjective survey or measure (self or other report). The latter is more inclined to yield bipolar factors where any associated values are extrinsic or culturally sensitive. Personality psychologists have been known to regard abilities as traits and cognitive psychologists to conceptualize personality as types of ability, although their actual independence as a construct is a matter of theoretical validity ideally supported by empirical evidence.

It is the association of cognitive styles, respectively, with abilities and personality that offers a rationale for why they are considered a conflation of the two, though much-needed studies designed to examine moderating relationships are most likely to untangle more complex relationships, such as personality resulting from a moderating relationship between certain abilities and intellectual styles. It is possible that well-established psychometric principles and methodologies developed in personality and ability research offer robust approaches for unraveling relationships and model building wherewith to facilitate a validating nomological net for styles (see Roodenburg & Roodenburg, 2011). But this depends upon robust instruments, and as Coffield et al. (2005) have cogently pointed out in their critical review of learning styles, there is still much work to do in advancing psychometrically adequate instrumentation to allow the styles field to meaningfully move forward. This is not a new perspective, however, as the same argument formed part of Messick's call for better science in the domain of cognitive styles research (Messick, 1996). A renewed approach to assessment and the psychometric based validation of construct in styles research can arguably be critically advanced by researchers who take the time to learn from more recent methods, issues, and design in the research of personality and ability.

APPLYING PERSONALITY METHODOLOGY TO INTELLECTUAL STYLES: THE PSYCHOLEXICAL METHOD

In psychology, psycholexical methodology (De Raad, 2000; De Raad & Hendriks, 1997) has played a major role in defining personality traits. An appropriate adaptation of such psychometric techniques developed for personality offers a tantalizing opportunity for a fast-track option to ascertaining pantheoretical, comprehensive, and balanced modeling of a personality-centered domain of intellectual styles. This path to instrumentation can obviate the more traditional and otherwise complex iterative theory-based and therefore theory-biased and theory-limited process of

traditional styles research. In facilitating balanced comprehensiveness, this approach, as part of the psychometric method, helps overcome problems of bloated specificity (Cattell, 1988) that involves an unbalanced overemphasizing of some factors, as well as the problem of construct underrepresentation (Messick, 1995) where essential factors are missing. These problems may be better understood by an analogy with geography. Consider the limits on understanding the earth prior to global exploration: The discovery of Australia by Western people radically challenged and expanded their previously distorted narrow and unbalanced worldviews.

The psycholexical approach is based on the observation that language contains many thousands of words that describe people's typical ways of behaving (Allport & Odbert, 1936). It involves extracting the underlying clustering structure of synonymy extracted from ratings of individuals across a balanced set of words. In personality research, thousands of descriptors have been extracted by systematically combing through dictionaries, providing an exhaustive list as the first foundational step in what has developed into a well-established and validated methodology for delivering such a balanced and comprehensive set of personality factors. This in turn has produced the modeling of robust Big-Five measures such as the FFPI (Hendriks, Hofstee, & De Raad, 1999) that complement the Five Factor model-based instruments of Costa and McCrae (Costa & McCrae, 1992). This "new" methodology has allowed for additional complementary statistical analysis such as the circumplex representations and cluster analysis (Hofstee & de Raad, 1991; Hofstee, de Raad, & Goldberg, 1992). These alternatives have helped in overcoming some of the form-giving limitations of simple hierarchical structure modeling (Roodenburg & Roodenburg, 2011). The circumplex representation, for example, more readily captures finer-grained lower-level structures of a factorial system (De Fruyt & Furnham, 2000), offering an infinite number of axes, at all possible angles, as viable alternatives.

Roodenburg (2003) adapted this method to the intellectual style domain, exploring the language of senior secondary school teachers for describing differences in the thinking styles evident in late adolescents. This approach involved using a key sentence that anchored words to "Thinking" in a focus group using a large cohort of teachers to generate a comprehensive domain specific lexicon of some 1,400 words. The lexicon was subsequently agglomerated into a balanced set of 99 key words on the basis of a thesaurus and vetted using expert judges following the established psycholexical procedures. Teachers' ratings of students against the resulting refined list of key adjectives were then analyzed resulting in a spherex, abridgeable as three circumplexes, and reported as six single factor facets and 24 blended facets. The structure appeared to be somewhat confounded by extraneous (known as error) variance. Extraneous variance representing acquiescence and a ubiquitous good–bad ability factor was identified and removed. Subsequent modeling using the residual data revealed an optimum alternative structure of the same six factors when arranged as a single circumplex. Roodenburg and Roodenburg (2009) found that this circumplex closely reflected the hexagon of Holland's Occupational Interests (Gottfredson & Holland, 1996).

Such a model similarity across domains is highly confirmatory of a useful model for offering a comprehensive and inclusive mapping of personality-centered intellectual styles, a superordinate structure, working in the same way as the Big-Five has

done when providing a balanced defining framework for personality. Such a superordinate framework has the potential to yield much-needed integrating perspectives to the wider range of stylistic theories. Finer-grained facets in personality have subsequently been developed and their associations with other constructs (such as with personality disorders) have been investigated, Costa & McCrae (1990) thereby advancing a viable nomological net for personality traits. With the application of a psycholexical methodology to the instrumentation and validation of such a superordinate framework for intellectual styles, a similar facet structure might emerge providing a finer-grained facet structure. This approach might therefore also offer a way forward to advancing a unified nomological net for intellectual styles.

RETHINKING RESEARCH DESIGN AND METHODOLOGY

To further consider an application of this kind of methodology, the following discussion is aimed at presenting a more detailed case for a renewed approach in the field of individual differences, and of course, in this chapter, more specifically, the research of personality and intellectual styles. We reiterate that the personality domain has three main factorial organizations: Eysenck's Giant Three (1975), Cattell's 16PF (1989), and the two parallel but not identical models of the Big-Five (De Raad & Perugini, 2002) and the Five Factor models of Costa and McCrae (2009). The factorial structure of each can be seen as a different organization of much the same material. This offers intellectual styles researchers a glimpse of the history and continuing approach of cognitive and developmental psychologists in the field of cognitive styles research (see Grigorenko & Sternberg, 1995; Kozhevnikov, 2007; Rayner & Peterson, 2009; Sternberg & Grigorenko, 1996, 1997). This kind of approach demonstrates how and what might be achieved in styles research, as evident in the following points about the approaches to theorizing the nature of personality type constructs.

Determining psychological structure is as much an art as a science. It is highly dependent upon the analyst's epistemologies and theoretical presumptions, many of which are implicit and simply taken for granted (Roodenburg & Roodenburg, 2011). Any statistical model can at best only offer representations of actual phenomena, and even then these particular models can be inappropriately constrained and shaped by the assumptions inherent in particular statistical routines. McKnight (2005), in drawing distinctions between poor data and poor modeling, likened the effect of statistical routines on data to the way a pie tin molds the dough. In this same way, the modeling of psychological variables and their effects identified in experimental work, including individual differences, carry significant proportions of "error" and are at best pale representations of the characteristics of actual people and as such, using them is something akin to boxing with shadows. This has led some to suggest that far from clear conclusions, the tenuous nature of psychological constructs means they are constantly and chronically at crisis point (Meier, 1994). Some of the reasons for this "state of the psychological science" include several previously identified by Messick (1994). Epistemologically, personality traits are a direct descendent of psychodynamic, phenomenological, and cognitive theories of personality, and therefore, intellectual styles stands securely in the same tradition. In a

prescient appraisal of the contemporary rigor of the styles research field at the end of last century, Messick (1994) stated that the wider domain of mainstream psychology and indeed education appeared to be "excessively polarized" in the theory and the research of personality and cognitive styles:

> This polarization appears to reflect different stances not just with respect to scientific evidence but also with respect to ideology. Concluding remarks broach the issue of how styles are organized, not just within an information-processing framework but within the structure of personality.
>
> *Messick, 1994, p. 121*

The debate at one level might be dismissed as a series of never-ending abstractions and disagreements between critics and opponents of the paradigm. There are, therefore, researchers who are committed as "not to be turned" expert knowledge gatekeepers of grand theory, but their critics might in turn allege this kind of knowledge is based upon conviction. This controversy is, however, at a second and more significant level, the basis of "paradigm dialogue" and hopefully the stuff of thinking hard about practices, beliefs, and assumption. It is probably and positively a necessary albeit often uncomfortable part of the way forward for the advancement of knowledge rather than retrenchment to established orthodoxy (Rayner & Peterson, 2009).

In this same way, Zhang and Sternberg (2009) have recently established a platform for this kind of debate concerning polarization. Zhang and Sternberg argued that first, intellectual styles are value-laden, or at least value-differentiated, but never value-free; second, styles are malleable; and third, although different styles share certain degrees of common variance, most style constructs make unique contributions. For the moment, this discussion is focused upon the first issue, that is, whether styles are states or traits. There is an ongoing uncertainty. The various conceptualizations of intellectual style in a recent survey of the researcher community specializing in cognitive and learning styles (Peterson, Rayner, & Armstrong, 2009) are characterized by a pervading theme of preference, wrestling with implied choice, suggesting that practising researchers remain unsure about whether styles are fixed or partly fixed, relatively stable, and possibly innate preferences. This is equally applicable and in a very similar way a continuing issue for the personality trait domain where personality research has been affected by its association with medicine, and its primary interest in subsequent forms of classification predicated upon disease, diagnosis, and causality.

When Reber (1995) suggested that there are an indeterminate number of definitions for personality, rather than one single defining term, he reviewed its use in eight main theoretical perspectives. He concluded that the various usages are characterized by two distinguishable groupings: One group views personality constructs as *internal entities* with a *causal* role in behavior. This group generally includes type, trait, or psychodynamic theorists who have a tendency toward psychological structuralism viewing personality constructs as "real." The other group views them in a more functionalist manner as secondary *summative* factors, useful heuristics inferred on the basis of consistency of behavior caused by other operations and processes,

typically described by behavioristic, humanistic, and social learning theorists. This illustrates that the debate is epistemological rather than only empirical. It also speaks to the increasing relevance of critical interrogation and a thinking through the gamut of research methodology. There are interesting possibilities in the use and/or misuse of theory-building, mixed methodologies, and the interaction between basic and applied research (see Rayner & Peterson, 2009; Roodenburg & Roodenburg, 2011; Sternberg, 2008).

The comprehensive breadth of intellectual styles as a concept makes it difficult to consider the trait or state question in its entirety. The inclusiveness of the model means that it is likely to contain both aspects of trait and state and not one or the other. Moreover, and further complicating the issue, personality trait constructs also have their more state-like activity-based "cousins" in the form of models of applied or experiential process. In respect to the field of styles, the well-established but broad tradition of assessing orientations to study encompasses a constructivist frame-working of cognitive strategies, learning tactics, and learning patterns that may also be classified as activity-based models of style (Biggs, 1987; Entwistle, 1981; Vermunt, 1998). Perhaps more clearly relevant as a discrete model in its entirety, for this discussion, is Kolb's model of experiential learning based on the theory of Lewin (1946) and to some extent Dewey's (2009) pragmatic philosophy of education (see Boyatzis & Mainemelis, 2011; Sharma & Kolb, 2011). It is as a theoretical model of learning styles and as a form of assessment, comparable to Holland's work in the field of types and career choice.

In the same way, therefore, and although on occasion loosely referred to as personality, Holland's occupational interests (Gottfredson & Holland, 1996) are somewhat to personality what learning and teaching styles are to intellectual style. Each represents a grouping of occupational behaviors in the modern world much in the same way as Kolb's model of learning styles report individuals interacting and learning from experience within the world. Much of this has been documented in Curry's "Onion" Model for categorizing style differences in the individual (Curry, 1983), and still offers a very useful heuristic for articulating the nature of activity-based styles as a manifestation of, but not in themselves necessarily as deeper inner intrinsic traits in an individual's psychology. Again, and in a similar manner, Gorsuch described the two opposing views of state–trait in the personality field as a "factors-are-real versus factors-are-inventions debate" (Gorsuch, 1988, p. 233). He suggested that the debate represents a scientific–theoretical "exploratory" view versus mathematical "taxonomic" perspective, with roots that can be traced back to differences in Platonic and Aristotelian thinking. While the conflict has been long-standing, Gorsuch considered recent shifts in the philosophy of science to now favor the primacy of data over theory. In the field of statistics, the difference manifests itself in the viewpoint that has been described as one of a mathematical fundamentalist versus a theoretical conceptualizer (Nunnally, 1978).

As previously explained, however, an increasing number of theorists prefer to conceptualize personality as a continuous conceptual geography of more fuzzy and dynamic constructs (Acton & Revelle, 2002; De Raad, Hendriks, & Hofstee, 1992; Romney & Bynner, 1992; Sternberg, 1997; Tracey & Rounds, 1997). These researchers consider that personality type constructs are best mapped spatially,

with factors regarded as relative and at best used as reference lines. They often prefer the representations and modeling available through multidimensional scaling, simplexes, circumplexes, and the like (Guttman, 1954; Kruskal & Wish, 1978). If we think of styles as representing in form, stable heuristics, this might arguably enable style researchers in the use of advanced statistical techniques such as Smallest Space Analysis and Structural Equation Modeling, making possible appropriate dynamic construct validation (Roodenburg & Roodenburg, 2011). Such complex modeling allows for a deeper understanding of the nature of styles as well as a broadening of styles construct interactions and relationships with other aspects of the individual's psychology. In this discussion, the focus is on personality, but there are other recent examples of the same approach being applied to reasoning, creativity, and intuition. One interesting applied example of this kind involves the theoretical work presented by Sadler-Smith (2009) in his dual-process conceptualization in which he advanced the notion of an interrelationship between rational analytic systems and the intuitive nonemotional affective domain.

Implicitly linked to the question of causality in respect to traits is the person–situation controversy in the field of personality. Although traits were long assumed to exert stable and generalized causal effects on behavior, Mischel (1968) attacked traits as being of questionable reliability, reflecting the experience of researchers' difficulty with using these variables to predict much of the variance in a given situation (Epstein & O'Brien, 1985; Matthews, Deary, & Whiteman, 2003). The ensuing decades of debate have led to two important outcomes. First, trait research has been strengthened by findings that traits are very good predictors of behavior aggregated across many situations. Second, an interactionist approach has developed in contemporary research, which recognizes that personal and situational factors play an important role in moderating the impact of traits on behavior (Matthews et al., 2003; Smith & Shoda, 2009). This is recognized for styles where Sadler-Smith stated that stylistic "predispositions develop as a result of a variety of factors, including age, gender, personality, ability, education, experience, and the nature of the task" (Sadler-Smith, 2009, p. 13).

SUMMARY AND CONCLUSION

An intellectual style, like personality, is a broad and comprehensive construct. It provides a useful framework for establishing analytic synthesis, conceptual coherence, and consensual theory. It also presents a considerable challenge, however, in what is a hugely contested and frequently confused and confusing styles domain. While perhaps at the risk of being too inclusive, it nevertheless represents a useful platform upon which to build a comprehensive review of psychological styles from multiple perspectives. It is hopefully part of a movement that will ideally facilitate what Rayner and Peterson called a "paradigm shift" (Rayner & Peterson, 2009, p. 117). It is this same idea of shifting a knowledge base that we argue here is ultimately one of constructing ways in which to facilitate new thinking around old problems of understanding and developing our knowledge of aspects of the self in the psychology of the individual.

It is clear that the style constructs that come under the intellectual styles umbrella have enormous intuitive appeal, as evidenced by broad and enduring interest and continuing confirmation of face validity, albeit this momentum still urgently needs to be supported by more rigorous psychometric work. Moreover, a review of the empirical research shows that links between styles and personality are actually still quite limited, certainly disjointed, and generally reflects a pattern of independent projects and separatist ways of working. The absence of any coherent bridge between the field of personality and that of style is surprising considering that style is traditionally and so frequently considered a conflation of personality and ability. Utilizing methodologies developed in personality has great promise for unification of theory and the realization of new levels of understanding.

It is tempting to simply comment that this state of the science is largely due to a lack of psychometrically robust instruments in the styles field. Bad tools inevitably produce unreliable and wasted work. While reliability and validity are key aspects to making good theory, the work is yet even more involved as we seek to reestablish and develop new theory, affirm understanding, and confirm meaning. This work, as argued by Sternberg (2008), requires that we move forward via the construction of domain general models and new forms of measurement. This, by necessity, involves exploring ways in which assessment is positioned at the heart of any understanding of the nature of individual differences (see chapters in this handbook on theory and assessment). There is also a necessary challenge for researchers in drawing upon lessons learned in related fields, and allied work in researching other aspects of the individual, including those areas traditionally marked out as intelligence, ability, creativity, self-perception, and personality. In all of this, we invariably return to a conclusion that in matters of difference, as Sternberg asserted, "styles matter!" (Sternberg, 1996, p. 363).

The aim in this discussion, nonetheless, has consistently striven to identify relevant ways in which we can engender a significant impetus for the study of intellectual styles and personality. To this end, we have presented an overview of the development of style theories in the field as it relates to personality, emphasizing the distinctiveness yet interdependence of what we suggest are conceived as personality-centered intellectual styles. Further, we argue these styles are not merely aspects of the larger and more encompassing construct of personality. A second intention has been to seek out one or more pathways as a way forward for researching personality and styles. To this end, we suggest framing research synergies within four epistemological approaches. The first is "conceptual," "knowledge-based," and "definitional" (working with definitions by leading scholars); the next two are each "quantitative" in nature (meta-studies and meta-modeling); and the last is "qualitative" (representing the individual in the actual world of practice). This knowledge continuum infers a need for integrated methodologies of research including holistic and narrative approaches that rely upon ideographic data and an alternative validation. This theme is further addressed in Chapter 3.

We also wish to argue for recognition of important foundational conclusions about the nature, structure, differentiation, and singularity of intellectual styles in juxtaposition with personality. It is, as a consequence of reaching this point, that a more productive investigation might be attempted focusing upon the complex

interface between personality and styles as two key dimensions of an individual's psychology. We see this as long overdue and indeed regard it as essential for the continuing effort in unifying a field frustrated by a history of paradoxical overlap and the separation of theory, domains, and constructs. This theme is again further developed in Chapter 3 on developing theories of intellectual styles.

In an attempt to consider how new approaches drawn from paradigms of research located in both the fields of personality and styles should be used, we have inferred an important conceptual distinction between activity-based styles and those envisaged by Curry (1983) as personality- or cognition-centered. The former "process bound" styles are less implicitly part of what we might discern to be individuality and the human persona, but as a result are not subsequently less useful as types of styles. The distinction is made that as a more elementary psychological property of individuals, cognitive or personality styles have reflected a more clearly focused effort to explain the nature of a "human being," that is, *who* a person is, and in that, such styles are more closely implicated in the work of a personality. In contrast, activity-based styles are more about what individuals characteristically *do* in the current world around them, reflecting or influenced by, rather than being, inner or innate dispositions. The valuable function of the term intellectual styles, therefore, is that it can be used to integrate all three of these levels of an individual's style profile.

In taking this approach, we have hopefully moved forward and demonstrated how, using the psycholexical method as a means of building a comprehensive model of theory, we can effectively borrow from personality theory as an established and closely implicated research paradigm in the field of individual differences, to advance the field of intellectual styles. Such borrowing when it involves a sophisticated means of model-building can give us clues in further developing a theory of personality-linked styles. From a deconstructive point of view, just as chemistry advanced significantly with the periodic table, ability research has advanced with its equivalent of the ten-factor CHC theory (McGrew, 2005), and personality with the Big-Five, there is yet continuing promise in the method of a similar unifying factorial superordinate structure for styles. Such models are comprehensively inclusive, yielding a pantheoretical and balanced taxonomy of styles, offering an ideal, sound, and safe basis for the generation of sound psychometric instruments.

There is, finally, and as predicted in the opening section of this chapter, clear and present indication that we need to know more about the way in which personality and personal or intellectual styles work within an individual's psychology. There is not only a need to be smarter in adapting and utilizing psychometric tools and methodologies, for example, as with the psycholexical approach, but also for a mix of basic and applied research, reflecting Sternberg's argument about theory construction and design of research in the field of educational psychology (Sternberg, 2008). Crucially, and as previously stated, it clearly follows that there is an equal and complementary need for eclectic research, combining educational philosophy, differential psychology, and psychometrics, in the critical analysis of personality and intellectual styles. In this way, we think it is more rather than less likely that we will further develop more robust personality-based style constructs that contribute to a better understanding of key factors and interactions that make up a holistic system in the psychology of the individual.

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12

Academic Achievement and Intellectual Styles

Weiqiao Fan and Yunfeng He

INTRODUCTION

Intellectual styles have been widely cited as bases of the marked differences in performance shown by people as they think, learn, or rather, process and use information and carry out various tasks (Messick, 1984; Riding & Cheema, 1991; Zhang & Sternberg, 2005). Most earlier literature provides supporting evidence that intellectual styles have been shown to be an important factor in explaining and predicting students' learning achievement in both traditional and nontraditional learning environments (e.g., Davidson, Savenye, & Orr, 1992; Fan, Zhang, & Watkins, 2010; Saracho, 1984; Zhang & Sternberg, 2005).

Since the flourishing ages for styles research in 1950s, various style labels under the specific categories of cognitive styles, learning styles, and thinking styles have been proposed by researchers when they addressed the issue of the contribution of styles to academic achievement. The mainstream in the field is to directly examine the effects of students' and teachers' styles on students' academic achievement by employing common statistical procedures such as correlation and regression analyses. Particularly, the relationship between different intellectual styles and academic achievement is largely examined by the capacities of styles serving as independent variables to explain the variance in academic achievement.

When addressing the relationship between intellectual styles and academic achievement, the contributions of the styles described in eight popular models to academic achievement are very often used as bases of various investigations. They include (1) four one-dimensional style models: Witkin's (1962) field dependence/independence (FDI), Kagan's (1966) reflective–impulsive styles, Guilford's (1967) divergent–convergent thinking, and Biggs's (1978) learning approaches, and (2) four multidimensional models: Kolb's (1976) learning styles, Gregorc's (1979) mind styles, Riding and Cheema's (1991) cognitive styles, and Sternberg's (1997) thinking styles. The rest of this chapter will briefly review the relationship between the above-mentioned intellectual styles and academic achievement. Three largely unsolved problems will be discussed as well, including the influences of style match/mismatch between teachers and learners and those of style awareness on academic achievement, and the effects of both traditional and nontraditional learning environments on the relationship between styles and academic achievement.

Witkin's (1962) Field Dependence/Independence and Academic Achievement

Field-dependent people tend to be affected by the prevailing field or context, whereas field-independent people incline to see objects as discrete from their backgrounds (Witkin, 1962). According to empirical studies in the literature, significant contributions of FDI to academic achievement are strongly supported (e.g., Bal, 1988; Tinajero & Páramo, 1997), despite some inconsistent findings (e.g., Zhuo, 1999).

Some studies investigated relationships between FDI styles and general academic achievement at the elementary (Saracho, 1984), secondary (Kirk, 2000), and higher education (Savage, 1983) levels. For example, Saracho (1984) found that young children's academic achievement rose as a function of their cognitive styles. Significant correlations were also found between FDI and all American College Test (ACT) scores, undergraduate and graduate grade point average (GPA), and graduate student career commitment (Savage, 1983).

There have also been many related studies investigating the contributions of FDI to students' academic achievement in particular subject matters. Specifically, the subject of mathematics is commonly studied. For instance, Abdollahpour, Kadivar, and Abdollahi (2006) found a significant difference between field-dependent and field-independent groups in math achievement, with the independent group performing better in math. Zhang, Meng, and Zheng (1981) suggested that the degree of field independence was positively correlated with performance in mathematics among Chinese students ($r = .42$, $p < .01$). Some other researchers conducted studies on the relationships between FDI and achievement in reading and language learning (e.g., Robeck, 1982; Wineman, 1971). For example, Wineman (1971) found that field-independent children were more advanced in reading ability, as measured by the California Reading Test Elementary, than were field-dependent children. At the same time, close associations between FDI and students' learning achievement in other subject matters, such as chemistry, biology, and information management (e.g., Kirk, 2000; Murphy, Casey, & Young, 1997), were also reported in the literature.

Moreover, a number of studies in the literature address a comparatively new issue concerning the influences of FDI on academic achievement in nontraditional learning environments such as hypermedia and computer-assisted learning. As in the traditional environment, FDI styles significantly contributed to students' general learning performance in many nontraditional learning contexts. For example, Spanjer and Tate (1988) found that the field-independent students achieved higher grades and a lower failure rate than did the field-dependent students in a broadcast telecourse. However, some other findings were inconsistent with those in the traditional learning environment. Ku and Soulier (2009) examined whether or not general versus specific learning goals have a different effect on adolescents with FDI in a hypertext environment, and suggested that field-dependent adolescents performed significantly better when they had specific rather than general learning goals. However, a group of studies concerning the area of second language learning and reading comprehension rarely supported the significant relationship between FDI styles and academic achievement (e.g., Liu & Reed, 1994; Zhuo, 1999). In

general, most studies have reported that Witkin's (1962) cognitive styles do not significantly contribute to academic achievement in nontraditional learning contexts.

Kagan's (1966) Reflective and Impulsive Styles and Academic Achievement

Concerning the relationship between the reflective–impulsive styles (also referred to as conceptual tempo) and academic achievement, the literature reflected the significant influences on mathematic learning (e.g., Feij, 1976; Navarro, Aguilar, & Alcalde, 1999) and reading or language learning (Stahl, Erickson, & Raymasn, 1986) across cultural backgrounds (e.g., Andrulis & Bush, 1972; Buela-Casal, Carretero-Dios, & De los Santos-Roig, 2000). A major difference between the reflective and impulsive styles is whether or not an individual tends to reflect on alternative solution possibilities in the process of problem-solving. For example, Feij (1976) reported a negative correlation between impulsiveness and grades in statistics. Buela-Casal et al. (2000) suggested similar results among a primary school student sample in Spain while Andrulis and Bush's (1972) study yielded similar findings among an adult sample.

Particularly, many empirical results tended to suggest that individuals with a reflective style showed higher levels of achievement than ones with an impulsive style (e.g., Adejumo, 1979; Margolis, 1977). Adejumo (1979) found that 7-year-old children in the reflective and fast-accurate groups were superior in performance on visual–perceptual tasks. Even though the reflective style is often suggested to be superior in influencing various learning performance than is the impulsive style, there is an exception a study by Zelniker and Jeffrey (1976) concluded that in contrast to existing views, impulsive children are not inferior to reflective children in general potential or problem-solving ability. With regard to this finding, Zelniker and Jeffrey (1976) rather argued that the inferior performance of impulsive children frequently reported in the literature may be due to incompatibility between their preferred global-processing strategy and the detail analysis typically required for successful performance.

Guilford's (1967) Divergent–Convergent Thinking and Academic Achievement

Strictly speaking, the construct of divergent–convergent thinking is not very suitable to be grouped into a typical label of intellectual styles, because the original intention was to define a model of intellect structure (Guilford, 1967). A divergent thinker tends to deal with problems in a flexible way; in contrast, a convergent thinker tends to deal with problems in a mechanical way. Nevertheless, there has been some empirical evidence of an association between this thinking pattern and academic achievement (e.g., Demirbas & Demirkan, 2007). As a matter of fact, recent literature is more likely to consider divergent–convergent thinking styles as intellectual styles (Zhang & Sternberg, 2005).

Most relevant empirical results were largely consistent in the literature. In general, learners with a divergent thinking style tend to attain better academic achievement. A number of investigations (e.g., Bennett, 1973; Eastwood, 1965;

Feldhusen, Treffinger, Van-Mondfrans, & Ferris, 1971; Saracho, 1984; Taft, 1971) have supported the significant relationship between divergent–convergent thinking types and various academic achievements. For example, Feldhusen, Treffinger, and Elias (1970) found that the divergent thinking mode was a valuable predictor variable in senior high school performance. Taft (1971) also suggested that divergent thinking is beneficial to obtaining better achievement than convergent thinking in college contexts. According to Eastwood's (1965) study, the relationship between achievement and divergent thinking was stronger for Science students, less so for Arts students. Bennett (1973) also obtained similar results to show that highly divergent students tended to gain better scores on the creative attainment criterion than did highly convergent counterparts.

Based on the above-mentioned findings, at least two conclusions could be made: First, Guilford's divergent–convergent thinking is largely related to learners' learning performance, and second, the divergent thinking style often shows positive effect on academic achievements at different educational levels and various subject matters.

Biggs's (1978) Learning Approaches and Academic Achievement

Biggs's (1978) learning approach model defined three learning styles surface, deep, and achieving approaches. A learner with a surface approach tends to reproduce what is taught to meet the minimum requirement. A learner with a deep approach aims to understand what is learned. A learner with an achieving approach inclines to maximize his/her learning performance. Concerning this model, even though there are three styles, the deep and achieving approaches can be put into one category based on previous research (e.g., Zhang, 2000). Therefore, Biggs's (1978) model is clarified as a one-dimensional model in the present review. Like Witkin's (1964) FDI construct, this model has been widely investigated in connection with the issue of academic achievement across cultures and across educational levels (e.g., Albaili, 1997; Bernardo, 2003; Cano, 2005; Rodriguez, 2009; Shokri, Kadivar, Farzad, & Sangari, 2007; Zhang, 2000). In general, consistent evidence for close associations of the styles defined by this intellectual style model with achievement has been empirically generated. Among the three learning approaches, the achieving approach is often associated with higher academic achievement, while the surface learning approach is related to lower academic grades. The deep approach, sometimes but not always, shows positive influence on academic achievement (e.g., Zhang, 2000). Such a conclusion has been demonstrated at both secondary (e.g., Cano, 2005) and higher educational (e.g., Bernardo, 2003; Shokri et al., 2007) levels, and validated in different cultural contexts, including the United Arab Emirates (Albaili, 1997), Australia (Biggs, 1988), China (Drew & Watkins, 1998), Philippines (Bernardo, 2003), Spain (Cano, 2005), and the United States (Zhang, 2000).

Biggs's learning approaches are often examined along with other psychological variables, such as personality and motivation, and taken as a mediating variable between these classical variables and academic achievement (e.g., Albaili, 1997; Cano, 2005; Shokri et al., 2007). For instance, Shokri et al. (2007) found that the indirect effect of openness, conscientiousness, and agreeableness on academic

achievement through the deep-learning approach was significant and positive, while the indirect effect of conscientiousness and openness on academic achievement through the surface-learning approach was significant and negative. Cano (2005) suggested that the relationship between epistemological beliefs and academic achievement is mediated by approaches to learning. In addition, some authors also explored the incremental validity of learning approaches to academic achievement beyond other variables. For instance, Bernardo (2003) found that the deep and achieving approaches were positively related to academic achievement, even when the effects of school ability and prior academic achievement were controlled.

Kolb's (1976) Learning Styles and Academic Achievement

Kolb's (1976) model was widely examined with respect to the contributions of styles (diverging, assimilating, converging, and accommodating) to academic achievement. The features of the diverging and converging styles are largely consistent with those of Guilford's (1967) thinking model. An individual with assimilating style prefers abstract conceptualization/reflective observation, whereas an individual with accommodating style prefers to learn primarily through hands-on experiences. According to previous reports, the contributions of Kolb's learning styles to general academic achievement are well supported (e.g., Cano-Garcia & Hughes, 2000; Maldonado Torres, 2009). At the same time, substantial research has investigated the relationship between Kolb's learning styles and some specific subject matters. For example, learning styles were found to significantly predict academic achievement in middle-school geography students in Korea (Yoon, 2000). Jones's (2001) study indicated that different subject matters such as English, math, science, and social studies tend to invoke different learning preferences among community college students. Furthermore, some other studies examined the influences of Kolb's learning styles on achievement in particular domains or populations. For example, Davies, Rutledge, and Davies (1997) examined the impact of learning styles on 200 first-year medical students' academic performance and interviewing skills. The findings revealed statistically significant differences in academic performance and interviewing skills as a function of students' learning styles. Taylor (2001) investigated the relationship between the learning styles and academic achievement in athletic training, and found that the Abstract Conceptualization–Concrete Experience continuum was positively linked to academic achievement for this sample of athletic training students and educators.

In addition, some studies reported significant differences in the relationships of Kolb's learning style construct on learning performance between traditional and nontraditional learning environments. Hijazi (2009) found that some learning styles appeared to be best suited to the online learning environment. Nonetheless, most relevant studies (e.g., Miller, 2005; Paolucci, 1997) did not obtain significant results. For instance, Paolucci (1997) examined the relationships between learning styles and learning achievement, but did not obtain any significant results. This might suggest that not all learning styles are suitable for nontraditional environments such as hypermedia learning environments. However, because Kolb's model

worked very well in traditional learning situations, further studies based on this style model in nontraditional learning environments should be very valuable.

Gregorc's (1979) Mind Styles and Academic Achievement

Gregorc (1979) defined mind styles with the dimensions of use of time and use of space with four types: abstract random, concrete sequential, abstract sequential, and concrete random. A learner with the abstract random style tends to approach learning holistically and prefers to learn in an unstructured way, whereas a learner with the abstract sequential style inclines to take a logical approach to learning and strong in decoding written, verbal, and imagery symbols. A learner with the concrete sequential style tends to extract information through hands-on experiences and prefer well-structured learning environments, whereas a learner with the concrete random style prefers to adopt trial-and-error, intuitive, and independent approaches to learning. The relevant findings in the literature supported that learning performance can be understood as a result of an interaction between intellectual style and learning tasks. Concrete sequential types generally showed better learning performance than other types in both traditional and nontraditional environments. For instance, O'Brien (1994) found that concrete sequential participants tended to have higher grade point averages than participants with other styles among high-school students.

As in traditional environments, some authors also obtained similar results for Gregorc's style types in nontraditional environments (e.g., Davidson et al., 1992; Ross & Shultz, 1999). Using a linear format in which "next" and "previous" buttons were used to traverse a computer-based instruction course on cardiopulmonary resuscitation, Ross and Shultz (1999) found that abstract sequential students performed the best, while abstract random students performed the worst.

However, some inconsistent findings were also reported in the literature. In contrast to his own findings from middle school students (O'Brien, 1991), O'Brien (1994) found that the abstract sequential and abstract random scales provided the greatest information yield from college students, among all Gregorc's (1979) mind styles. This might be due to the difference of learning tasks and circumstances between middle school and college. Similarly, Miller's (2005) study indicated that the learning style significantly influenced learning performance: Students identified as concrete sequential scored significantly lower than students identified as concrete random. Therefore, concerning the mind style model, on the one hand, its contributions to learners' academic achievement were well supported; on the other hand, unlike the clearly directed effects of FDI and reflective–impulsive styles on learning performance, the work on mind styles (Gregorc, 1979) bears further investigation.

Riding and Cheema's (1991) Cognitive Styles and Academic Achievement

An individual with the verbal–imagery style inclines to represent information during thinking verbally or in mental images, whereas an individual with the holist–analytic style tends to process information in wholes or parts (Riding & Cheema, 1991). The

influences of the two styles on academic achievement have been widely investigated and some empirical results from different contexts are reported (e.g., Ford, 1995; Russell, 1997). According to the existing studies, different dimensions in the model seem to show significant influences on academic performance in some specific learning tasks. Under traditional learning conditions, for example, Russell (1997) examined the effect of learner's cognitive style on learning performance in a vocational training environment and found that imagers performed better on posttest measures involving naming or identifying location of equipment than verbalizers, whereas Riding and Mathias (1991) found that the performance of the holists on reading attainment was superior to the verbalizers and declined fairly linearly with increasing imagery style.

However, after examining the relationship between cognitive style and General Certificate of Secondary Education (GCSE) performance in mathematics, English, and French, Riding and Caine (1993) found that those students who were intermediate on both dimensions of cognitive style (e.g., the Wholist-Analystic Intermediate and Verbal-Imagery Intermediate) tended to show the best academic achievement.

The above findings indicate that even if its style dimensions could significantly contribute to academic performance, the results are often inconsistent. Some relevant results from nontraditional environments also supported this argument. For instance, a study by Atkinson (2004) indicated that (1) in the Computer-Assisted Learning (CAL) conditions, verbalizers performed the best and achieved the greatest learning benefit, while analytics were ranked at the bottom; holists were second; imagers were third; and (2) analytic–imagers gained the least from the CAL context while holist–imagers gained the most. Similarly, Graff (2005) found that verbalizers visited more pages in the hierarchical architecture, whereas imagers visited more pages in the relational architecture.

Sternberg's (1997) Thinking Styles and Academic Achievement

Sternberg (1997) proposed a theory of mental self-government and defined 13 thinking styles. Zhang (2002) further conceptualized these styles into Type I (including legislative, judicial, hierarchical, global, and liberal), II (including executive, conservative, monarchic, and local), and III (including internal, external, oligarchic, and anarchic) styles in terms of their value difference and practical validity. Type I styles are characterized by low degree of structure and cognitive complexity, whereas Type II styles are characterized by a high degree of structure and cognitive simplicity (Zhang, 2002). Type III styles may manifest the characteristics of either Type I or II styles, depending upon the stylistic demands of the particular tasks (Zhang & Sternberg, 2005). Related studies in the literature have largely supported the view that thinking styles significantly contribute to academic achievement in traditional environments (e.g., Bernardo, Zhang, & Callueng, 2002; Cano-Garcia & Hughes, 2000; Grigorenko & Sternberg, 1997; Zhang, 2000; Zhang & Sternberg, 2000). Some of these studies (e.g., Zhang, 2004) have indicated that the contributions of thinking styles are beyond those of students' self-rated abilities.

Thinking styles could contribute to learning achievement in both secondary and higher education in different cultural contexts (e.g., Mainland China, Hong Kong, Philippines, and the United States). Grigorenko and Sternberg (1997) found consistent positive correlations between legislative and judicial styles and academic performance, and consistent negative correlations between the executive style and academic performance among college students. In contrast, among Hong Kong secondary school students, Zhang and Sternberg (2000) indicated that thinking styles related to creativity (i.e., Type I thinking styles) had significantly negative correlations with academic achievement (e.g., the liberal style with average grades in Art and Chinese language), whereas, thinking styles that required conformity (conservative) and respect for authority (executive) (i.e., Type II styles) were significantly positively correlated with academic achievement (e.g., executive style and conservative style with achievement in computer literacy). Similarly, Cano-Garcia and Hughes (2000) found that the legislative (in a negative sense), executive, and internal styles could best predict academic achievement among a Spanish middle school student sample.

Concerning the relationships between thinking styles and achievement in non-traditional environments, Lee and Tsai (2004) found significant differences between the near transfer of the executive group and the legislative group. In another study, Workman (2004) found that people who scored higher in the global style performed better in computer-aided education than people who scored lower in the global style, whereas the converse was found in computer-based education. In a recent study among Chinese college students, Fan et al. (2010) concluded that the results were basically consistent with the literature with regard to traditional learning environments (e.g., Grigorenko & Sternberg, 1997), and provided evidence of close associations between thinking styles and academic achievement in hypermedia learning environments. For instance, the executive, conservative, monarchic, and local styles were significantly negatively related to achievements in analysis and problem-solving tests (Fan et al., 2010). However, as the findings in the traditional environments, the results were opposite to those results from middle school students (e.g., Cano-Garcia & Hughes, 2000). Fan et al. (2010) also found that the contributions of particular thinking styles to academic achievement were sometimes over and above the amount of variance explained by personality traits and achievement motivation in hypermedia-based learning environments.

Taken together, prior to the studies identifying the role of styles, students' academic achievement was mainly ascribed to some classic variables such as ability, personality, and motivation. For instance, there was a general impression in everyday life that a learner with poorer learning performance should be of lower ability. After styles were noted by researchers, the literature largely supports the argument that intellectual styles significantly contribute to students' academic achievement at different educational levels across cultures.

With respect to the four one-dimensional models, the styles such as field independence, reflective style, divergent thinking style, and achieving approach that are located at one pole often showed positive contributions to various learning performances (e.g., Abdollahpour et al., 2006; Shokri et al., 2007). Other styles including field dependence, impulsive style, convergent style, and surface approach that are located at the other pole in these models often negatively influence learners' academic

achievement. The rest of the four multidimensional intellectual style models (namely, Gregorc's mind styles, Kolb's learning styles, Riding and Cheema's cognitive styles, and Sternberg's thinking styles) are comprehensive and include very different labels with different values (Zhang & Sternberg, 2005). Their contributions to academic achievement are significant but sometimes inconsistent depending upon the types of tests, learning tasks, or specific disciplines under different cultural and educational contexts or specific assessment situations.

In addition, some studies also suggested that styles have incremental validity in predicting academic achievement over and above other important classic variables such as ability, personality, and achievement motivation (e.g., Fan et al., 2010; Zhang & Sternberg, 2000).

CONTROVERSIAL ISSUES ABOUT THE RELATIONSHIP BETWEEN INTELLECTUAL STYLES AND ACADEMIC ACHIEVEMENT

Even though some relevant issues about the relationship of intellectual styles with achievement have been well addressed, some important issues for further explorations include the connections of style match/mismatch, style awareness, and utilities of styles in different learning environments with students' academic achievement. Adequate research on them might enhance our understanding about the work of intellectual styles on learning performance.

Style Match/Mismatch Between Students' and Teachers' Styles and Academic Achievement

Empirical studies have actually produced a paradox on the issue of the influences of style matching/mismatching on academic achievement. Some empirical results have revealed the importance of style matching between teachers and students in students' learning performance. The relevant supporting evidence was mainly related to Witkin's (1962) FDI styles (e.g., Paradise & Block, 1984) and other styles based on other models (e.g., Gregorc's mind style). For instance, meta-analyses on the studies in FDI model, done by Garlinger and Frank (1986), argued that field-independent students showed greater achievement when matched with similar teachers. It has also been reported that learning style matching may have a positive impact on student achievement. Teachers even tend to positively estimate those students whose styles match those of the teachers (Sternberg & Grigorenko, 1995). Saracho's (2001) study provided evidence for this view, reporting that field-dependent (FD) students rated teachers with FD characteristics higher than teachers with field-independent (FI) characteristics; meanwhile, FD students preferred FD teachers, and FI students preferred FI teachers.

However, a number of investigations have found little impact of style matching on students' achievement levels, based on different style constructs, such as cognitive styles and learning styles (e.g., Riding & Cheema, 1991; Thomas, 2001; Tomes, 2005). Kavale and Forness (1987) reviewed 39 studies and found that matching children by cognitive styles had nearly no effects on achievement. Meanwhile, some experiments

on cognitive-style matching have failed to find the proposed matches. For instance, Tomes (2005) found that style match between a professor and students according to Gregorc's (1979) mind styles did not affect students' learning performance. Particularly, in computer-based training programs, Smutz (2003) found no significant difference between those participants whose learning styles were matched and those whose learning styles were mismatched. Accordingly, some researchers (e.g., Rayner & Riding, 1997) have criticized style-matching research for overemphasizing teachers' matching their styles to their individual students and for unreasonably thinking that a good instructor should try to know his or her students' internal traits so that individuals can reach their potential.

Style Awareness and Its Influences on Academic Achievement

Style awareness in the learning process refers to self-recognition and identification of one's own intellectual styles, and goal-directed application of style strategies in learning (Hacker, 1998). Theoretically, the significance of an awareness of style has its potential for enhancing and improving learning performance in a variety of learning contexts. By investigating the effects of learning-style strategies applied to mathematics homework and studying, Cook (1990) identified the relationships between learning-style awareness and responsive study strategies. Fourier (1983) indicated that disclosure of cognitive style map information has an important beneficial effect on academic achievement. Awareness of intellectual styles has been found to relate positively to achievement because the awareness of different styles can help students become more "in tune with how they usually approach their learning tasks and help them identify their preferred, as well as their non-preferred learning styles" (Zhang & Sternberg, 2000, p. 479). In general, these findings support the claim that there are significant relationships between learning-style awareness and academic achievement.

However, some results did not support the effect of style awareness on academic achievement. For example, Ehrhard (2000) reported that those students who knew their learning-style preferences and were assisted with study strategies did not academically outperform those students who did not know their preferences. Within an instructional hypermedia module, Fyle (2010) even found that both field-dependent and field-independent students with style awareness achieved higher scores on the multiple-choice test than their counterparts who received no style awareness; he also found, however, that there was no effect of style awareness on performance on a design task. Therefore, as one of the issues related to metacognition, style awareness should be further investigated with more well-designed studies.

Comparison of the Effects of Styles on Academic Achievements Between Traditional and Nontraditional Environments

Since the 1980s, with the rapid development of computers and the Internet, people have begun to consider computers and the Web (e.g., Intranet, World Wide Web) as learning tools that students learn with, not from. In consideration of some

theoretically claimed advantages (e.g., instant interaction between teacher and students) over traditional learning (Nielsen, 1995), some authors (e.g., Large, 1996) have argued that various nontraditional learning environments are multiple-style-like and adaptive to different learners with different learning styles. Given the significant influences of intellectual styles on academic achievement, could these "all-style" learning conditions provide more effective environment for the contributions of intellectual styles to academic achievements?

As reviewed in the preceding, some individual studies simply examined the relationships between intellectual styles and academic achievement under different types of nontraditional environments, but generated very inconsistent results by using different style constructs, such as Witkin's (1962) FDI styles, Kolb's (1976) learning styles, and Gregorc's (1979) mind styles (e.g., Ku & Soulier, 2009; Liu & Reed, 1994). Some other empirical studies (e.g., Atkinson, 2004; Cicco, 2008; Fan et al., 2010; Musgrove, 2002) have been conducted comparing the relationship between intellectual styles and academic achievement in traditional and nontraditional environments; however, the results were controversial as well. For example, Fan (2008) longitudinally investigated the contributions of Sternberg's (1997) thinking style model in predicting academic achievement in hypermedia-based and traditional learning environments. In his study, even though the relationships between thinking styles and academic achievement were supported in both types of learning environments, the study did not support that the nontraditional learning environment possesses obvious advantages over the traditional environment in using particular styles for improving students' learning performance (Fan, 2008).

This might suggest that not all learning styles are suitable for nontraditional learning environments. Or rather, those proposed advantages in nontraditional learning environments over traditional conditions are yet to be empirically demonstrated (Moore, 1994). Many authors have suggested that the associations between intellectual styles and academic achievement are not better supported in those nontraditional environments over than those in traditional conditions (e.g., Dillon & Gabbard, 1998). In other words, those nontraditional learning environments are no more effective than traditional methods in the use of intellectual styles in terms of producing better academic achievement. To sum up, as in the traditional situations, even though the significant connections between styles and academic achievement were supported, the inconsistent findings in the relationship still need to be further examined; in addition, the nontraditional environments did not show obvious advantages over the traditional environments in influencing the relationship between intellectual styles and learning performance.

FUTURE DIRECTIONS IN THE RELATIONSHIP BETWEEN INTELLECTUAL STYLES AND ACADEMIC ACHIEVEMENT

Even though a great deal of empirical evidence reported in the literature tends to support close associations between intellectual styles and academic achievement, our review obviously indicated that there are some unsolved problems that need to be further explored. Some scholars (e.g., Rayner & Riding, 1997) have also

suggested that the practical validities should be further demonstrated, including the relationship between intellectual styles and academic achievement.

First, solid longitudinal data are necessary in understanding the relationship between intellectual styles and academic achievement. Most relevant evidence is based on simple research designs and cross-sectional investigations. Longitudinal data might be more advantageous for understanding the relationship between intellectual styles and academic achievement. At the same time, whether or not there is a statistically significant relationship between styles and achievement might be affected by some incidental factors, including particular instructional conditions, and learners' personality traits, abilities, achievement motivation, and attitudes toward learning (Fan & Zhang, 2009). These might play a mediating or moderating role or both in the associations between intellectual styles and academic achievements. Particularly, some of them such as learners' personality traits and achievement motivation might change in different learning stages or life periods (Caspi, Roberts, & Shiner, 2005). A longitudinal design would also be helpful in analyzing the interactions between intellectual styles and the previously mentioned additional variables on academic achievement from a developmental perspective.

Second, domain specificity (e.g., subject matter) and individual characteristics (e.g., gender, school level, and parental styles) should be emphasized more within the context of examining the relationship between intellectual styles and academic achievement. Existing literature shows that some domain specificities of the contributions of intellectual styles to academic achievement were found. For example, field dependence, convergence, and assimilation are often reported to positively contribute to academic achievement in mathematics (e.g., Abdollahpour et al., 2006). Gender difference in FDI and judicial thinking style are also reported in many studies (e.g., Savage, 1983; Tinajero & Páramo, 1997). As another example, Type II thinking styles (Zhang, 2002) are found to have positive influences on academic achievement among middle-school students (Fan et al., 2010), but have negative contributions to academic achievement among college students (Cano-Garcia & Hughes, 2000). Concerning these domain specificities and individual features, a systematic research design might obtain solid evidence for the relationship between particular intellectual styles and academic achievement. For example, a comprehensive comparative study on different styles' contributions to math achievement (or that of other specific subject matters) can further clarify whether there are true domain differences of styles in math learning.

In addition, some direct research work related to those unsolved issues proposed in this chapter such as style match/mismatch, style awareness, and style contribution in different learning environments would definitely contribute to the understanding of the relationship between intellectual styles and academic achievement.

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13

Learner Developmental Outcomes and Intellectual Styles

Melissa I. Gebbia and Andrea Honigsfeld

The question of how people learn has been the topic of numerous, large-scale scientific investigations conducted both by cognitive scientists and by educational researchers. One unique aspect of how we learn is to identify and utilize one's own unique style. The study of these styles through which learners apply their personal abilities has evolved quickly and is in need of a comprehensive theory to connect the disparate research findings. Recently, the concept of intellectual styles has been offered as a means to connect the many branches of styles research (Sternberg & Grigorenko, 1997). "An intellectual style refers to one's preferred way of processing information and dealing with tasks. To varying degrees, an intellectual style is cognitive, affective, physiological, psychological, and sociological" (Zhang & Sternberg, 2005, p. 2). This general term is used as an overarching construct for three types of style theories (Table 13.1):

1. Cognitive-centered style theories that look at modes of thinking, reflective–impulsive styles, conceptual tempo, and field dependence–field independence (Sternberg, Witkin, Kagan, Torrance);
2. Personality-centered styles that look at career personality type, Jungian personality type, and decision-making style (Myers, Holland, Gregorc, Kirton); and
3. Activity-centered style theories that look at divergent/convergent thinking, surface and deep processing, and learning styles (Biggs, Guilford, Dunn, Kolb, Grasha).

The organization of cognitive-centered, personality-centered, and activity (learning)-centered approaches to style has been presented by multiple theorists (Cassidy, 2004; Grigerenko & Sternberg, 1995; Rayner & Riding, 1997; Sternberg & Grigorenko, 1997). Zhang and Sternberg (2005) went beyond the triarchic organization of approaches to style research and proposed a Threefold Model of Intellectual Styles based on 10 styles models/constructs. The goal of this chapter is to present the experimental findings connecting intellectual styles to student outcome measures. Due to the limited space and the comprehensive goals of the chapter, we selected

TABLE 13.1
Models Included in the Chapter With Prominent Measurement Instrument and Reference for Each Model, Organized by Cognitive-, Personality-, and Activity-Centered Approaches to Learning

Models		References
Cognitive-centered approaches		
• Sternberg Thinking Styles	TSI-R	Sternberg et al. (2003)
	TSI	Sternberg and Wagner (1992)
• Witkin Field-Independent and Field-Dependent Styles	GEFT	Witkin et al. (1971)
• Kagan Impulsive/Reflective Styles	MFFT	Kagan et al. (1964)
• Torrance Styles of Learning and Thinking	SOLAT	Torrance (1988)
Personality-centered approaches		
• Myers-Briggs Types	MBTI	Myers and McCaulley (1988)
• Holland—RIASEC	SDS	Holland (1994)
• Gregorc Style Delineator	GSD	Gregorc (1982)
• Kirton Adaptive Innovative Styles	KAI	Kirton (1976)
Activity-centered approaches		
• Biggs Study Process	SPQ	Biggs (1987)
• Dunn and Dunn Learning Styles	LSI	Dunn, Dunn, and Price (1978, 1990)
• Kolb Learning Styles	LSI	Kolb (1976/1985)
• Grasha–Reichmann Learning Styles	GRSLSS	Grasha (1996)
• Guilford Thinking	Divergent–Convergent[a]	Guilford (1950, 1967)

[a]No universal test exists for this model.

prominent studies from primary, secondary, and postsecondary education from the last three decades that may be considered representative of the overall body of research or indicative of unique, current directions. Our aim is to offer a balanced representation of the various style constructs that have been used by researchers.

The literature search for this chapter focuses primarily on the models covered by Zhang and Sternberg (Sternberg's thinking styles Sternberg, Wagner, & Zhang, 2003; Biggs's learning approaches Biggs, 1987; Holland's career personality types Holland, 1994; Torrance's modes of thinking Torrance, 1988; Myers and McCaulley's personality types based on Jung's work Myers & McCaulley, 1988; Gregorc's mind styles Gregorc, 1982; Kirton's adaption–innovation decision-making and problem-solving styles Kirton, 1976; Kagan and his colleagues' reflective–impulsive styles Kagan, Rosman, Day, Albert, & Philips, 1964; Guilford's divergent–convergent thinking Guilford, 1950/1967; and Witkin's field-dependence/independence Witkin, Oltman, Raskin, & Karp, 1971). However, this

organization underrepresented the activity-centered approach to learning, which constitutes a large percentage of the applied, educational research on styles and leads us to include additional models (Dunn and Dunn's learning styles Dunn, Dunn, & Price, 1990; Grasha–Reichman learning styles Grasha, 1996; and Kolb's learning styles Kolb, 1985) (see Table 8.1). Recently, Sternberg, Grigorenko, and Zhang (2008) have presented a dyadic organization of styles research looking at ability-based and personality-based styles. This organization addresses the difficult separation of cognitive- and activity-centered styles. In the past, levels of processing and divergent/convergent thinking were seen as activity-based style models (Zhang & Sternberg, 2005). However, this removal of an activity-centered styles demarcation further discredits decades of practical, applied research on styles (such as the work of Dunn and Dunn).

In this review, we present a sampling of the styles research in primary, secondary, and postsecondary education from the past three decades. A great deal has been written about the variations in approaches to learning adopted by a learner without equal focus on the outcomes of those approaches or styles (Entwistle, 1991).

STUDENT DEVELOPMENTAL OUTCOMES

This chapter is written with the organization presented by the Collaborative for Academic, Social and Emotional Learning (CASEL) for the study of school-based youth development outcomes (Greenberg et al., 2003). Student development outcomes can be broadly defined to encompass academic, social, and emotional learning. Greenberg et al. noted that academic learning outcomes typically involve analytical success, verbal and logical/mathematical success demonstrated through grades, grade point average (GPA), and occupational assessment through training retention and implementation. Many studies on the use of styles as well as other developmental programs have been incorporating these outcome measures. Yet, a more comprehensive understanding of programmatic impact on the life-long learner is needed. Students' social, emotional, and health outcomes should also be assessed to determine the true utility of any programmatic intervention (Greenberg et al., 2003). "CASEL has identified five core categories of social and emotional skills: self-awareness, self-management, social awareness, relationship skills, and responsible decision-making" (Ragozzino & O'Brien, 2009, p. 3). Because the connection between emotional and social skills is inherent, making any distinction between the two is tenuous. For the purposes of this chapter, we discuss outcomes that involve the core skill categories of self-awareness (self-confidence, understand your own interests, values, and strengths) and self-management (emotional regulation, monitoring, goal setting) as emotional outcomes and incorporate outcomes that relate to the remaining three categories in social outcomes: social awareness (taking another's perspective, empathizing, recognizing social resources), relationship skills (creating and continuing healthy interpersonal relationships), and responsible decision making (following social norms, contributing to groups, respecting others as well as ethical and safety concerns) (Ragozzino & O'Brien, 2009). This literature review focuses on academic,

social, and emotional outcomes only because no health outcome studies were located in our search. This is not surprising as health is rarely assessed in the styles literature.

REVIEW CONTENTS

In this review, we present research studies that connect intellectual styles and the outcome measures of academic success, social relationships, and emotional learning for learners of all ages. Literature that is theoretical, not as yet published in peer-reviewed journals (such as dissertations or conference presentations), or reflects solely the application of learning-style information in a particular setting without connection to learner outcomes, is not included here. This chapter is not designed to represent an exhaustive review of the research on learning, cognitive, and intellectual styles but rather to organize relevant research findings to develop a theory- and research-based representation of the current state of academic findings on the impact of learning styles on learner outcomes throughout the various stages of academic and professional learning.

ACHIEVEMENT OUTCOMES

Styles research at the elementary and secondary school levels (grades kindergarten through 12) has predominantly focused on demonstrating the predictive value of styles for academic achievement. Within higher education, academic achievement is the first and foremost outcome of interest, typically measured with GPA, but also assessed with course or project grades, self-evaluation of learning, retention, and expert evaluation of work quality. The surge in styles research over the last 30 years is not exclusive to academic settings; occupational research has also investigated the impact of styles. Achievement outcomes in occupational research include a variety of sources for work performance information such as self-reported abilities, supervisor ratings, salary, sales, training effectiveness, and peer or customer appraisals. A brief overview of achievement findings are given in this section and a more detailed examination of student achievement are presented in Chapter 12 of this volume.

Cognitive-Centered Approach to Learning

Extensive work utilizing the cognitive-centered model proposed by Sternberg has been done by Zhang and her colleagues (Grigorenko & Sternberg, 1997; Zhang, 2001a, 2004a, 2007, 2008a). Zhang summarized that:

> [I]n general, thinking styles that require conformity (conservative), respect for authority (executive), and a sense of order (hierarchical) were positively related to academic achievement. Thinking styles that are creativity generating (legislative and

> liberal styles) tended to contribute negatively to academic achievement. Furthermore, a preference for working individually (internal style) was positively correlated with academic achievement, whereas a preference for working in groups (external style) was negatively associated with academic achievement.
>
> *Zhang, 2004a, p. 335*

In some representative studies with secondary school-aged learners, Zhang (2004a) examined the contributions of thinking styles to academic achievement in specific subject areas. Later, Zhang (2007) further researched whether or not intellectual styles have an impact on students' academic achievement by examining the relationship between Torrance's modes of thinking (holistic, analytical, and integrative) and Sternberg's (1988) thinking styles as well as the role of these two style constructs in secondary school students' self-rated level of achievement in Chinese, English, and mathematics. Based on Sternberg's theory of thinking styles, Zhang (2008a) also investigated secondary students' preferred teaching styles and the positive effects thereof on their academic achievement.

Higher education cognitive-centered approach to styles research findings cover a wide breadth of cultures, including Filipino, Arabic, Chinese, Spanish, and American. Sternberg's thinking styles approach has been studied with university students in a variety of cultures and significant correlations with general academic achievement have been found: Spain (Cano-Garcia & Hughes, 2000); Philippines (Bernardo, Zhang, & Callueng, 2002); Mainland China (Zhang, 2004a); rural China secondary school students (Zhang, 2007); and America (Zhang, 2002). Additional research has been conducted with business personnel. Type II thinking styles (the more conservative, norm-following thinking styles) have been found to be related to job satisfaction and salary in China (Zhang, 2005), and in Britain salary related positively to the judicial thinking style and most Type I styles (the more creativity generating and complex thinking styles) related to self-reported abilities (Zhang & Higgins, 2008).

Research approaching styles as field dependent and field independent in Witkin's model (Witkin et al., 1971) has found that styles differentiated Scottish secondary and college students in terms of working memory (Bahar & Hansell, 2000), but not in terms of final course grades for an online course (Spears, Fried, Olia, Manski, Craig, & Covington, 2008). However, O'Brien and Wilkinson (1992) found a demographic specific effect; field independence was related to differential performance for older students on the state board nursing examination while field dependence was not. Bahar (2009) investigated learning styles with middle school Turkish students and found field independence to be related to their science performance.

Personality-Centered Approach to Learning

The Myers-Briggs's Type Indicator (MBTI) (Myers & McCaulley, 1988) is a commonly used personality measure in styles research; respondents are characterized in terms of four dichotomous traits: extravert–introvert, intuition–sensing, judging–perceiving, and feeling–thinking. There are mixed findings on the relationship between the Myers's personality-centered approach to styles and achievement outcomes.

For example, Harasym, Leong, Juschka, Lucier, and Lorscheider (1996) found that the MBTI and the Gregorc Style Delineator (GSD) (Gregorc, 1982) measure the preferred learning styles but do not relate to GPA for college students. Emerson and Taylor (2007) also found no differentiation in GPA for various MBTI styles even when different instructional methods were used. However, Shi, Shan, and Tian (2007) noted a strong relationship to achievement for sensing, thinking, and judgment style dimensions. Neither Jie and Xiaoqing (2006), nor McNulty, Sonntag, and Sinacore (2009) obtained a significant difference in the styles of different level achievers in a medical school population. In occupational research, Jacobson (1993) established a significant relationship between extraversion and the feeling style dimension on the MBTI and performance on the job for service-sector managers.

In research based on Gregorc's personality-centered approach to learning, O'Brien (1994) found that concrete-sequential high school students had higher GPAs than students with other cognitive-centered approach to styles. Yet more recently, Smith, Cavanaugh, Jones, Venn, and Wilson (2006) found that style had no significant effect on college examination grades. However, in 2001, Drysdale, Ross, and Schulz established a connection between Gregorc's styles and academic performance by course content area: Science and math are best for sequential thinkers and fine arts for random thinkers.

Activity-Centered Approach to Learning

Within the abundant research on K–12 populations (elementary and secondary school students between the ages of 5 and 17), activity-centered approach to learning are frequently examined in relation to academic achievement. Dunn and Griggs (2003, 2007) synthesized 35 years of research with the Dunn and Dunn (Dunn et al., 1978/1990) model, systematically addressing each of the 21 learning styles elements and the outcomes aligning learning-styles responsive instruction yielded. Additionally, Braio, Beasley, Dunn, and Quinn (1997), and Rayneri, Gerber, and Wiley (2006) conducted prominent work with the Dunn and Dunn model. Other activity-centered approaches to learning have found a relationship between specific styles and achievement measures: Kolb's (Kolb, 1976/1985) model was used in Sun, Lin, and Yu's (2008) experimental study with 5th grade elementary school students in Taiwan exploring the effects of different learning styles on science achievement, and in Wang, Wang, Wang, and Huang's (2006) study on the effects of formative assessment and learning styles on middle school students' achievement in a Web-based learning environment. In a recent study, Tatar and Dikici (2009) examined the effects of the 4MAT method of instruction (based on the Kolb model) versus traditional methods for achievement in mathematics and found the 4MAT to be more effective. Additionally, Lau and Yuen (2009) utilized the GSD (Gregorc, 1982) to measure learning styles. Learning styles in this context are defined as the external appearance of an individual's mediation abilities. Four styles are delineated as combinations of the two abilities, concrete and abstract, with two different styles, sequential and random. Based on the learning styles subgroups, "sequential" learners in general performed better than "random" learners.

Many higher education styles research studies have been conducted within specific academic disciplines. Researchers have found a relationship between specific styles and achievement measures, while incorporating different activity-centered models such as Biggs's tradition of deep and surface learning (Cantwell & Moore, 1998; Cassidy & Eachus, 2000); Kolb's model along the convergent and divergent tradition (Hargrove, Wheatland, Duowen, & Brown, 2008; Lam, 1998); and Dunn and Dunn's model (Nelson et al., 1993). However, Young, Klemz, and Murphy (2003) did not find a differential relationship between Kolb's specific learning styles and course grades for American university students. The researchers attributed this lack of differentiation to the multiple experiential learning opportunities provided by the faculty, indicating that such a variety of experiences works for all learning styles.

In sum, the research on achievement outcomes has connected GPA, course grades, academic achievement, and job performance with specific styles in a breadth of models and across a variety of cultures.

SOCIAL OUTCOMES

As evidenced by the preceding discussion of research on academic achievement outcomes, the focus of styles research has been to understand and predict academic success. However, the inclusion of social and emotional dimensions in social science research studies is increasing and the research on styles is not different.

Cognition-Centered Approach to Learning

Cognitive approaches are prominent in styles research, including Kagan's conceptual tempo and impulsive–reflective styles, Sternberg's thinking styles, Torrance's modes of thinking, and Witkin's field dependence–field independence. There is a wealth of past research connecting impulsive–reflective styles with aggression and attentiveness, but this research is older (found in reviews by Jonassen & Grabowski, 1993 and Messer, 1976). Recent studies utilizing a cognitive-centered model and the connection of styles within that model to social outcome measures are predominately based on Sternberg's thinking styles.

In 2002, Zhang introduced the role of thinking styles in psychosocial development to investigate the very socially loaded Chickering vector of defining purpose (Chickering, 1969; Chickering & Reisser, 1993). As students go through their university education, they need to put limits on social and recreational activities as they focus and clarify their vocational purposes. Zhang (2002) found purposefulness could be predicted from the liberal thinking style. Additional support for the connection between Type I thinking styles and vocational purpose was demonstrated in Zhang's (2004b) study with college students from a Chinese university. The contribution of thinking styles to vocational purpose was beyond that explained by self-rated abilities.

Life management strategies is a construct found in life span research focused on successful development similar to the defining purpose construct presented by Chickering and studied by Zhang. In 2002, Freund and Baltes conducted an extensive

construct validation study for a self-report measure of selection, optimization, and compensation (SOC) strategies of life management in which they examined thinking styles as a related construct. The researchers also noted that hierarchic and monarchic thinking styles were related differentially to SOC life management strategies. Involvement in extracurricular activities was investigated in Zhang's (2001b) study of thinking styles and their relationship to a social outcome. A large sample of Chinese university students was surveyed and a statistically significant relationship was found between extracurricular activity and Type I thinking styles.

The relationship between cognitive styles and trust in team members was evaluated by Liu, Magjuka, and Lee (2008) with a large sample of online graduate students at an American university. Although thinking styles, in terms of scope and level, was not related to performance in the online course, it was predictive of self-reported satisfaction with their teamwork experience and trust levels.

Navia Rodriguez and Navia Rodriguez (1994) established connections between hemispheric modes of cognitive functions using Torrance's SOLAT in a Finnish school and student achievement and school behavior. Even though statistical significance was not established, right hemisphere-dominant students scored higher to indicate impulsiveness and behavior problems. Puustinen, Kokkonen, Tolvanen, and Pulkkinen (2004) also found field independence to be related to impulsivity. DeBell and Crystal (2005) examined the relationship among 6th- to 12th-grade students' scores on field dependence and field independence and sensory learning preference, cognitive learning styles, personality, interpersonal trust, attributions of responsibility for solving social problems, and attitudes regarding citizenship among youth. The researchers found that field independence was associated with Intuitive–Thinking personality, Concrete–Global learning styles, and rejection of individual responsibility for social problems, relative to governmental and community responsibility.

Personality-Centered Approach to Learning

There are a limited number of studies that focused on social outcomes using personality-centered approaches within the recent K–12 literature. Hollinger (1986) examined talented female adolescents' career aspirations using Holland's framework of personality types. However, in the higher education and occupational styles literature, work in the tradition of Myers and Kirton are frequently incorporated in research studies.

Individual differences such as personality traits have been a basic component of intellectual styles studies. General personality inventories as well as career personality inventories have been used: Holland's Career Interest Inventory, the Myers-Briggs Type Indicator, the Gregorc Style Delineator, and the Kirton Adaption–Innovation Inventory. In a recent study by Choi, Deek, and Im (2009), investigating the learning styles and outcomes of students in pair programming activities, the researchers concluded that communication was not affected by matching the pair on personality type (MBTI). However, McTurk and Shakespeare-Finch (2006) established a relationship between employment status and personality styles. Sensing–perceiving temperaments were overrepresented in the unemployed group as opposed to the employed

group of participants. The researchers suggested that individuals that favor this particular style prioritize themselves to internal rather than external parameters, a decision-making preference ill-suited to the ambiguous nature of a job search (McTurk & Shakespeare-Finch, 2006). In a study of accounting professionals, Stetson (2007) found a higher prevalence of judging thinking types in this demographic, using the MBTI, and they suggested a connection between this cognitive-centered style and a greater willingness to approve of aggressive transactions that are inappropriate given accounting standards.

Studies based on other models focus on personality types in terms of decision-making and problem-solving styles. Kirton (1976) refers to these styles as adaption and innovation. In a review of adaptive–innovative cognitive styles studies, Tullett (1997) found that these styles do not differ by the socialization of different cultures.

Activity-Centered Approach to Learning

Information processing models take an activity-centered approach to the study of intellectual styles focusing on type of thought (Biggs's surface, deep, and achieving styles), typology of styles (Guilford's divergent and convergent styles and Kolb's activists, theorists, pragmatists, reflectors), and environmental conditions preferred for informing processing (Dunn and Dunn's environmental, emotional, sociological, physical, and psychological elements).

The styles model proposed by Biggs (1987) discusses three distinct approaches to learning: deep, surface, and achieving. In addition to academic achievement, researchers have found various psychosocial outcomes related to these styles. Phan (2008) researched a causal model that showed learning approach as the product of epistemological beliefs in the prediction of reflective thinking among university students. In a study by Sadler-Smith and Tsang (1998), the lack of findings for a relationship between college students' approaches to learning and performance was interpreted as the impact of culture and assessment regimes on student approaches to learning.

Guilford (1950, 1967) presented the dichotomy of divergent and convergent thinking to understand the style with which learners prefer to process information. Researchers (e.g., Kolb, 1985) have followed this model and continue to identify styles based on the preferred information processing approach, a prominent styles model in management research. Although there are mixed findings on the predictive validity of Kolb's types for overall achievement (measured with global measures such as GPA), researchers have found team learning style profiles to predict specific criterion measures such as the cooperative work measured by product quality (Erdem, 2009) and team performance measured by completion time on a team-building exercise (Jackson, 2002). Utilizing Kolb's learning styles model, Erdem examined learning styles and the collaborative process of teams. Turkish university students were involved in team projects with varying group learning-styles composition. They found that the collaboration process related to the level of complexity in group learning-styles composition; however, the small sample size made it difficult to glean specific relationships. In addition, Jackson concluded that a team balanced in learning styles is most efficient to complete its task. Yet in comparison, Kappe,

Boekholt, Rooyen, and Flier (2009) did not find learning styles to have predictive validity for specific criteria, such as negotiating and debating.

In a study comparing the learning activities and learning styles of gifted and nongifted secondary students in Hong Kong, Chan (2001) found that when investigating styles under the Kolb tradition, gifted students had significantly stronger preferences for learning styles related to interpersonal verbal exchanges and autonomous learning.

Dunn et al. (1990) examined the effects of matching and mismatching middle school students with a preference for learning *alone* or learning with peers, and the matched students performed better on teacher-created social studies assessments. An unanticipated finding regarding social outcomes indicated that students who did not identify a sociological preference also performed significantly better in the learning-alone condition than with peers. In addition, data revealed that the learning-alone and the learning-with-peers students had significantly more positive attitudes when matched with their preferred learning styles, while the no-preference students had more positive attitudes in the learning-alone condition.

Group climate is a social outcome that has been investigated in conjunction with learning styles. Hendry et al. (2005) conducted an experiment with small tutorial groups of medical and dental students given a workshop intervention evaluating their styles, educating them about styles, and about working with others that have different styles preferences. Though this study did not result in significant differences in group climate between the experimental and control tutorial groups, qualitatively, students reported that the workshop helped them develop a great understanding and acceptance of the behavior of others, in addition to feeling more comfortable in groups (Hendry et al., 2005).

In the literature described in this section, connections have been demonstrated between social outcomes and diverse style models. Multiple variables of social interaction, including life management strategies, employment behaviors, extracurricular activities, team behaviors, and responsibility for social problems, have been related to cognitive-, personality-, and activity-centered styles.

EMOTIONAL OUTCOMES

While most studies conducted at the elementary and secondary level focus on academic achievement outcomes, many also considered emotional variables. In this subsection, we highlight some critical contributions to the field with a predominant interest in emotional outcomes. Emotional outcomes encompass self-awareness and self-management.

Cognitive-Centered Approach to Learning

In the 1970s and 1980s, several studies investigated brain dominance and creativity based on Torrance's (1988) Style of Learning and Thinking. More recently, Kim and Michael (1995) found that students who revealed a learning and thinking styles

preference associated with right-brain dominance (holistic mode of thinking) were likely to earn higher scores on creativity measures, corroborating previous findings by Okabayashi and Torrance (1984), Tan-Willman and Gutteridge (1981), and Torrance and Reynolds (1978). The latter study by Torrance and Reynolds also revealed a relationship between right hemisphere-specialized functions and greater satisfaction with careers and self, as well as optimism about the solving future problems and the changing world.

In a study establishing the construct validity of a problem-solving style assessment, Houtz and Selby (2009) examined the relationship between personal control over emotions and the cognitive styles presented by Torrance. Participants did not differ in perceived control of their affect based on styles, but it was found that undergraduate students were significantly lower in control of their affect than graduate students. A related line of research connecting Kagan et al.'s (1964) impulsive–reflective styles to the emotional outcomes of anxiety and locus of control was conducted in the 1960s and 1970s (Messer, 1976), yet it has not been continued in recent years.

Based on Sternberg's theory of thinking styles, Park, Park, and Choe (2005) noted that gifted high school students were characterized by the legislative, judicial, anarchic, global, external, and liberal styles, and at the same time also scored higher on scientific accomplishments, creativity, motivation, morality, and cognitive experimentalism. Martín and Burón (2005) were also seeking to establish a relationship between thinking styles and the types of motivation students apply to the learning process, such as goal setting, task planning, and efficiency. Additionally, using the Matching Familiar Figures Test (MFFT), Barstis and Ford (1977) investigated kindergarten and second-grade children's ability to adapt their cognitive tempo. It was found that significantly more fast-accurate than reflective children were able to appropriately modify their performance. It was concluded that during the early school years, young children may be able to learn to modify information-processing tempo appropriately based on situational demands.

A recent study focused on the relationship between Sternberg's thinking styles and managing emotional stress through a measure of anxiety (Zhang, 2009). Several of the thinking styles (Type I and external) in a large group of Chinese university students were negatively related to state-anxiety scores as predicted. Zhang also found that Type I thinking styles and the external style have predictive power for managing emotions in a 2008 study. Using Chickering's (1969) theory of psychosocial development to guide the choice of emotions most relevant to the identity formation of university students, the researchers measured: happiness, attraction, anger, depression, and frustration. They found thinking styles to be differentially related to emotions (Zhang, 2008b).

More recently, Zhang (2008c) conducted a study relating thinking styles to identity development with a population of Chinese university students. This study focused on Chickering's (1969) vector entitled establishing identity, described as the most critical vector of development. The establishing identity vector includes the concepts of confidence, body and appearance, and sexual identity and all three concepts had significant relationships with specific thinking styles.

Another emotional outcome researched by Zhang and colleagues is achievement motivation. In a study of Chinese university students, the researchers found

that Type I thinking styles were positively correlated with achievement motivation scores (Fan & Zhang, 2009). Self-esteem is a prominent emotional outcome (in the CASEL core category of self-awareness) for which research evidence has demonstrated a relationship to thinking styles (Zhang, 2001b; Zhang & Postiglione, 2001). Zhang and Postiglione surveyed a large group of university students from Mainland China and found that high and low self-esteem was differentially correlated with thinking styles.

Personality-Centered Approach to Learning

This literature review yielded no results for studies conducted with school-aged learners using the Kirton's Adaption–Innovation Inventory (Kirton, 1976) decision-making styles and focusing on outcome measures, whereas the MBTI and the GSD seemed to be the preferred approaches to assessing secondary school students' personality styles. In a unique study, gifted adolescents' personality types and their connection to suicide ideation were investigated (Cross, Cassidy, & Miller, 2006). Female students exhibiting introversion-perceiving (IP) types reported higher levels of suicide ideation than those with other types. Additionally, students identified as perceiving personality type held higher levels of suicide ideation than those with the judging personality type.

In the social outcomes section of this chapter, findings from a recent study by Choi et al. (2009) were discussed in terms of communication skills. However, additional emotional outcomes were investigated in this study. The researchers concluded that satisfaction and confidence in team product were not affected by matching the pair on personality type (MBTI). In a distance learning situation, researchers also found that graduate students did not differ in their perception of their own learning based on personality type (Rovai & Grooms, 2004).

Career personality types are often investigated with Holland's theory of realistic, investigative, artistic, social, enterprising, and conventional (RIASEC) types. Armstrong and Vogel (2009) tested a model that examined the connections between interest types and self-efficacies. They established the relationship between the psychosocial component of self-efficacy and Holland's types. However, future research needs to evaluate the developmental sequence of these variables. In a study utilizing the Kirton problem-solving styles, no support was found for differentiation in achievement motivation among Canadian university students based on adaptive–innovative styles (Skinner & Drake, 2003).

Activity-Centered Approach to Learning

As early as 1987, Biggs (1987) noted that students' locus of control has a significant effect on which learning approach they adopt. Watkins and Hattie (1990) established a positive correlation between the deep and achieving approach to learning and students' perceptions of the quality of school life (which included enjoying school, seeing it useful, and considering teachers fair). In 1996, Watkins reported a strong

relationship of student self-esteem to both deep and achieving approaches when comparing nine related studies. Later, Watkins (2003) also offered an overview of more recent studies with both school- and university-level students and found strong association of deep and achieving approaches to learning with self-esteem and locus of control. Additionally, Burnett, Boulton-Lewis, and Campbell (1996) also examined the relationship between Australian high school students' self-concept and learning strategies. Connections were established between positive learner self-concepts and a deep approach to learning, and between lower levels of self-concept and a surface approach to learning. Several studies focusing on secondary students' approaches to learning using Biggs's or Entwistle's assessment tools found that students' self-concept, beliefs about learning, perceived self-ability, locus of control, and their approaches to learning were correlated (Dart et al., 1999; Dart et al., 2000).

Though Farkas (2003) examined the effects of traditional (teacher-directed, teacher-centered) versus learning-styles instructional methods (that respond to students' needs as identified by the Dunn and Dunn model) on middle school students' achievement and transfer skills in response to lessons on the Holocaust, her study also systematically focused on students' attitudes, empathic tendencies, and stages of moral development and transfer of knowledge. The data supported the implementation of a multisensory rather than a traditional approach for teaching lessons concerned with emotionally charged events and revealed a positive and statistically significant impact on achievement, empathy, more positive attitudes, and higher performance on the transfer of skills when students were instructed with a multisensory instructional method rather than with a traditional approach.

Also based on the Dunn and Dunn model of learning styles, Lenehan, Dunn, Ingham, Signer, and Murray (1994) investigated the impact of a learning-styles intervention called homework prescriptions on nursing majors' negative emotions of anger and anxiety. Students working with homework prescription had significantly lower anxiety than controls on the final test. The experimental group reported less anger at the end of the experiment than they did prior to the treatment.

In a 2009 study of college women at a private university in the southern United States, Vaughn, Battle, Taylor, and Dearman found a relationship between avoidant and competitive learning styles (using an instrument by Grasha that shares elements with the Dunn and Dunn model in terms of social interactions with peers and instructor direction) and both psychological distress and attachment-related anxiety. Another study based on Grasha's model of styles not only investigated the relationship between 7th-grade students' learning styles and their academic performance in science, it also measured students' degree of enjoyment (Bahar, 2009). The results indicated that with the exception of Avoidant students, the mini-projects were stimulating. Students identified as Independent, Competitive, and Participant had both higher achievement scores as measured by grades on mini-science projects and higher degrees of enjoyment while completing the mini-projects than students in the Avoidant, Dependent, and Collaborative groups.

Achievement motivation and the self-regulatory control to set and follow goals are outcomes that fit into the self-management core CASEL category of emotional outcomes. Cantwell and Moore (1998) found the deep learning approach (in the Biggs tradition) to be related to adaptive self-regulatory control by which students

use a great array of cognitive strategies in their learning. Similarly, a study with Arabian university students found that those high on motivation scales employ appropriate learning strategies (Albaili, 1997).

The above review clearly suggests that particular styles are related to emotional outcomes. These emotional outcomes studied include negative emotions such as anger, aggression, and suicidal ideation, as well as positive ones such as confidence, self-esteem and self-efficacy, control over emotions, and satisfaction.

To summarize, this review highlights recent styles research with academic, social, and emotional outcome measures based on styles models that present cognitive-centered, personality-centered, and activity-centered approaches to learning.

DISCUSSION

All the studies reviewed in this chapter discuss the relationship between learner outcomes and styles as well as the practical implications and applications of the findings. Despite recently emerging criticism of styles research, many suggest that intellectual styles should be taken into account in a variety of instructional contexts. Synthesizing the outcome research presents inherent challenges because of the plethora of styles constructs, models, and both styles and outcome assessment measures utilized in the literature.

In our review of current research, we found that the *cognitive-centered approaches* to styles have contributed the majority of the research findings. In terms of achievement outcomes, field independence has been found to relate to achievement in many but not all studies (Bahar, 2009; Bahar & Hansell, 2000; O'Brien & Wilkinson, 1992; Spears et al., 2008). However, the building use of the Mental Self-Government model helps to illuminate the findings with common terminology. Throughout educational settings (K–12 as well as higher education), we found a connection for Type I styles and academic achievement.

In the higher-education context, social outcomes such as psychosocial development were found in the studies, specifically defining purpose (Zhang, 2002) and establishing identity (Zhang, 2008c). In addition to identity formation, other social outcomes such as involvement in extracurricular activities (Zhang, 2001b), community responsibility (Puustinen et al., 2004), and trust in team members (Liu et al., 2008) have been evidenced in styles research studies. Social outcomes parallel achievement outcomes in their relationship to intellectual styles. Type I styles tend to correlate with higher achievement scores and matching can enhance performance for children.

Cognitive-centered studies involving emotional outcome measures have linked right brain dominance and creativity (Kim & Michael, 1995; Okabayashi & Torrance, 1984; Tan-Willman & Gutteridge, 1981; Torrance & Reynolds, 1978), optimism (Torrance & Reynolds, 1978), and control over emotions (Houtz & Selby, 2009). However, the majority of the findings support a relationship between Type I styles and emotions such as high self-esteem (Zhang, 2001b; Zhang & Postiglione, 2001) and the ability to manage emotional stress (Zhang, 2008b, 2009).

The relationship between achievement and *personality-centered styles* are not as uniform as the cognitive-centered styles findings. They are mixed by age group

(Harasym et al., 1996; Jacobson, 1993), instructional styles (Emerson & Taylor, 2007), and discipline (Drysdale et al., 2001; Jie & Xiaoqing, 2006; McNulty et al., 2009). Research with the personality-centered approaches demonstrated styles to be differentially related to occupational activities (McTurk & Shakespeare-Finch, 2006; Stetson, 2007). Although research has been done with personality-centered approaches and the emotional outcomes of confidence, satisfaction, self-efficacy, suicidal ideation, and achievement motivation, the findings are not clear and the research lacks the methodology to address developmentally related issues (Armstrong & Vogel, 2009; Choi et al., 2009; Cross et al., 2006; Skinner & Drake, 2003).

Activity-centered styles models such as that of Kolb, Biggs, and Dunn and Dunn have demonstrated differential predictive validity for achievement outcome measures (Braio et al., 1997; Cantwell & Moore, 1998; Cassidy & Eachus, 2000; Hargrove et al., 2008; Nelson et al., 1993; Rayneri et al., 2006; Sun et al., 2008; Wang et al., 2006). In the K–12 literature, social outcomes investigated in studies focused on preferences for working alone or with peers (Chan, 2001; Dunn et al., 1990). Team or group work has been the predominant social outcome studied with activity-centered styles models. Team collaboration (Erdem, 2009; Jackson, 2002) and acceptance of others behavior in groups (Hendry et al., 2005) is associated with styles. The activity-centered approaches associate deep learning with a variety of emotional outcomes: strong self-concept, self-esteem, internal locus of control, motivation, and self-control (Albaili, 1997; Burnett et al., 1996; Cantwell & Moore, 1998; Dart et al., 1999, 2000). Additionally, the emotional concerns of psychological distress and attachment-related anxiety were correlated with specific styles (Vaughn et al., 2009). Finally, several experimental studies found that learning styles instructional methods lead to higher empathetic tendencies in emotional situations (Farkas, 2003) as well as lower anxiety and less anger at the end of the instructional period (Lenehan et al., 1994; Zhang, 2009).

CONCLUSION

It is our hope that the presence of a comprehensive theoretical model for styles research on mental self-government will allow researchers in the future to investigate many pertinent variables in the same study and include more diverse aspects of academic, social, emotional, and health outcomes in their models. In the past, the focus of styles research has been on understanding and predicting academic success. However, the inclusion of social and emotion outcome measures in styles research is necessary to gain full perspective of learners. It is this type of comprehensive research that will elucidate the potential impact of styles on life-long learners as they develop into contributing members of society.

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14

Intellectual Styles, Management of Careers, and Improved Work Performance

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INTRODUCTION

Individual differences have a significant effect on the ways in which people think, behave, interact with, and relate to others in social settings. One aspect of individual differences that is significant in this regard is cognitive style, defined as a person's characteristic and consistent approach to perceiving, thinking, organizing and processing information, solving problems, learning, and relating to others. The implications of cognitive styles for enabling both employees and organizations to manage careers more effectively in the interest of improved workplace performance have received comparatively little attention in the literature. This is despite the fact that they have been previously identified as having a potentially significant effect upon individuals' work experiences and occupational learning, as well as individual career progression and succession planning in organizations (Hayes & Allinson, 1998). At a more structural level, intellectual style is also likely to be relevant in the context of issues such as team and interpersonal functioning (e.g., via dyadic exchanges and cognitive climate; see Basadur & Head, 2001), global career management (e.g., in terms of cross-cultural differences in intellectual styles), and workplace diversity (as manifested in the spectrum of styles that will exist within a workforce). Given the potential of the intellectual styles construct, we argue that its scientifically sound application has the potential to contribute to career-relevant processes at the individual and organizational levels. The objective of this chapter is to evaluate the relevance and implications of styles for the management of careers in the interest of improved workplace performance.

One of the problems facing researchers interested in the application of intellectual styles in this context, however, is the plethora of constructs and measures that are available (Armstrong & Cools, 2009). These have proliferated over recent decades to the extent that similar terms are sometimes used for different constructs, for example, "analysis" (Allinson & Hayes, 1996) and "analytic" (Riding, 1991), or similar constructs go by different names, such as "intuitive" (Khatri & Ng, 2000) and "experiential" (Epstein, Pacini, Denes-Raj, & Heier, 1996). To bring about a semblance of order,

Zhang and Sternberg (2005) used intellectual style as a general term that encompasses the meanings of all major "style" constructs postulated in the past few decades such as cognitive style, conceptual tempo, decision-making and problem-solving styles, perceptual style, and thinking style. For the purpose of consistency throughout this chapter, we will use the same umbrella term of intellectual style to represent the range of constructs being considered. Our analyses are confined to those intellectual styles constructs that have a robust conceptual and empirical foundation in business and management, and we will focus on those aspects that have a direct relevance to career and performance management in the workplace.

The remainder of this chapter is divided into five sections: (1) assessment of intellectual styles, where we consider a number of constructs and measures that have an empirical base in the occupational psychology and organizational behavior literature; (2) malleability of intellectual style, where we explore the possibility that individuals can be trained to adopt strategies that overcome the weaknesses of their styles; (3) relevance of intellectual style for the management of careers, which outlines specific ways in which the intellectual styles literature can help career management researchers inform theory in a way that leads to improved workplace performance; (4) implications of intellectual styles for career management research and practice; and (5) conclusions.

ASSESSMENT OF INTELLECTUAL STYLES

Different ways of measuring intellectual styles have evolved. They range from laboratory-based tests, including the use of embedded figures, paper-and-pencil tests, and computer-based assessments. The majority of intellectual styles assessments are in the form of self-report inventories. In this chapter, we will consider only those intellectual styles constructs and measures that have strong theoretical bases, have valid and reliable measurement instruments, have an empirical base in the wider occupational psychology and organizational behavior literature, and may be used to inform specific aspects of career management practice. It is on this basis that we have chosen to focus on the Myers-Briggs's Type Indicator (MBTI) (Myers, 1980), Witkin, Oltman, Raskin, and Karp (1971) Group Embedded Figures Test used to measure the field dependence–field independence (FDI) construct, Kirton's Adaption–Innovation (KAI) theory (Kirton, 1989), the Rational–Experiental Inventory (REI) (Epstein et al., 1996), and the Cognitive Style Index (CSI) (Allinson & Hayes, 1996).[1]

Gardner and Martinko (1996) undertook a major review of the properties of the MBTI and found internal consistencies above 0.75 for all four continuous scales

[1]In Kolb's (1976) experiential learning theory, learning styles are described in terms of an interaction between two orthogonal modes of grasping and transforming experience. While this theory has also played an important part in the management of careers, we have chosen to exclude models of learning from our discussions in order to focus on those intellectual styles concerned with individual differences in representing, organizing, and processing information.

(sensing (S)/intuiting (N); thinking (T)/feeling (F); extraversion (E)/introversion (I); and judging (J)/perceiving (P), while mixed findings as regards the factorial validity have been found. The evidence for criterion-related validity is "extensive" revealing "differences in type proportions across occupations that are consistent with type theory" (Gardner & Martinko, 1996, p. 49).

FDI is most often measured using the Embedded Figures Test (EFT) and a Group Embedded Figures Test (GEFT) developed by Witkin et al. (1971). Reliabilities ranged from 0.61 to 0.92 (Witkin et al., 1971) for the EFT, and numerous studies have verified the concept of FDI and the construct validity of EFT (Jonassen & Grabowski, 1993). Reliability of the GEFT has been reported at 0.82 and appears to be highly correlated to the EFT ($r = 0.63$ to 0.82) (Jonassen & Grabowski, 1993).

The KAI (Kirton, 1976) requires individuals to indicate how easy or difficult it would be for them to behave consistently and over a long time in ways described by 32 statements pertaining to occupational settings. A body of evidence for the instrument's validity has accumulated, and the KAI has shown high levels of internal (0.88) and test–retest reliabilities (0.82) (Kirton, 1978). Moreover, studies by McKinnell (1993) and Carne and Kirton (1982) found statistically significant correlations between the KAI and the MBTI.

The REI (Epstein et al., 1996) is a means of assessing individual differences in preferences for use of rational and experiential processing. It consists of two subscales: (1) "Need for Cognition" (NFC) that measures *rational* processing, and (2) "Faith in Intuition" (FI) that measures *experiential* processing. Epstein et al. (1996) found that the two scales had acceptable internal consistencies and were orthogonal ($r = -.07$), and predicted a wide variety of self-reported personality, coping and adjustment variables, as well as participants' degrees of heuristic thinking in response to a series of vignettes. Pacini and Epstein (1999) examined the relationship between the REI and personality and basic beliefs, and found that rational thinking style was most strongly related to ego strength, openness, conscientiousness, and inversely related to neuroticism and conservatism. Experiential thinking style, on the other hand, was most strongly related to extraversion, agreeableness, favorable relationships, beliefs, and emotional expressivity, while it was inversely related to categorical thinking, distrust of others, and intolerance.

The CSI exhibits good reliability, both in respect of internal consistency (Allinson & Hayes, 1996; Armstrong, 1999; Doucette et al., 1998; Murphy et al., 1998; Sadler-Smith, Spicer, & Tsang, 2000) and test–retest reliability (Allinson & Hayes, 1996; Armstrong, 1999; Armstrong, Allinson, & Hayes, 1997; Murphy et al., 1998). Moreover, a number of significant relationships have emerged in studies that have explored the CSI in relation to cross-national differences (Allinson & Hayes, 2000), entrepreneurial behavior (Armstrong & Hird, 2009; Allinson, Chell, & Hayes, 2000), gender differences and differences on the basis of job level (Allinson & Hayes, 1996; Sadler-Smith et al., 2000), the impact of cognitive style on leader–member relations (Allinson, Armstrong, & Hayes, 2001), and its degree of correlation with a variety of personality scales (Allinson & Hayes, 1996). More recently, the unifactorial structure of the CSI has been challenged by researchers who dispute its bipolarity (Hodgkinson & Sadler-Smith, 2003) advocating instead, on the bases of

dual-process theory and empirical evidence, two unipolar (intuition vs. analysis), albeit correlated, dimensions (see Coffield, Mosely, Hall, & Ecclestone, 2004).

A clear understanding of the nature of contemporary career patterns and orientations is essential in the light of an approach wherein intellectual styles and career theory are to be integrated. Gone are the days when careers consisted of upward moves within a framework of long-term employment relations (Arthur & Rousseau, 1996; Briscoe, Hall, & Frautschy DeMuth, 2006; DeFillippi & Arthur, 1996; Feldman & Ng, 2007; Sullivan, 1999). An economic environment, characterized by ever-increasing market pressures, leaner organizations, more transactional psychological contracts, and boundaryless careers, has forced working organizations to become more flexible to remain competitive (Greenhaus, Callanan, & DiRenzo, 2008; Lazarova & Taylor, 2009). In line with this, we advocate an approach wherein, on the one hand, both antecedents and outcomes of the boundaryless career perspective are integrated. On the other hand, research on traditional career issues benefits from incorporating a boundaryless perspective. To this end we will offer a number of theoretically based intellectual style propositions that may be empirically tested by careers researchers.

MALLEABILITY OF INTELLECTUAL STYLE

While some researchers assert that intellectual style is a fixed trait (Zelniker, 1989), others claim that it changes in a natural manner with age (Kagan, Rosman, Day, Albert, & Phillips, 1964), and that it can be shaped by the culture of a work environment (Nulty & Barrett, 1996), or through training (Rush & Moore, 1991). Others have argued that intellectual style can even be adapted quickly to given situations (Streufert & Nogami, 1989). A potential confusion arises because some researchers have used terms such as "learning style" and "cognitive style," and "style" and "strategy," synonymously. Messick's (1984) conception of style is closest to the one used in our review: He considers that intellectual styles imply a general orientation and are spontaneously applied without conscious consideration or choice across a wide variety of situations. Strategies, on the other hand, are reflective of decision choices exercised among alternative approaches that vary as a function of a particular situation, and may be amenable to change through training. This leads us to the following proposition that has important implications for career development and mobility between different roles and occupations. For example, Workman, Kahnweiler, and Bommer (2003) applied intellectual styles as a factor that exerts impact on career development in teleworking, and Creed, Patton, and Bartrum (2004) explored the predictive value of intellectual style in the light of career decision-making self-efficacy.

> *Proposition 1:* Individuals can be trained to adopt strategies that overcome the weaknesses of their styles in specific sets of circumstances, and therefore extend their career potential.

If the possibility exists of individuals being trained through self-awareness raising and personal development programs to learn when and how to adopt different strategies of thinking, this is likely to confer on them a greater range of job

flexibility, career choice, and career opportunities as they will be able to respond both cognitively and behaviorally to a variety of situations in adroit ways.

RELEVANCE OF INTELLECTUAL STYLE FOR THE MANAGEMENT OF CAREERS

We will now outline specific ways in which the intellectual styles literature can provide career management researchers starting points, which may help to inform theory, research, and practice, ultimately leading to improved workplace performance. In the following sections, we will consider the significance of styles in seven relevant career areas, namely, (1) selection, vocational choice, and career success; (2) diversity, group processes, and conflict management; (3) gender differences and careers; (4) intuition and emotion in the workplace; (5) training and development; (6) styles profiling; and (7) career management in global organizations.

Selection, Vocational Choice, and Career Success

Holland's (1966, 1985) theory of vocational choice and P–E (Person–Environment) fit, an important style-related theory and measure of vocational guidance (Furnham, 2001), hypothesizes six "types" of professionals: realistic, investigative, artistic, social, enterprising, and conventional. Vocational environments can be categorized in the same terms, and Holland's theory predicts that individuals will seek environments congruent with their type, and flourish in situations where there is a fit between personal attributes and those of the environment, whereas incongruence will lead to dissatisfaction, unstable career paths, and lowered performance (Holland, 1996). On the basis of significant relationships between Holland's theory and intellectual styles, Alvi, Khan, Hussain, and Baig (1988) concluded that vocational orientation and style "dovetail" well. Relationships have been found between Holland's vocational orientations and perceptual–intellectual functioning. For example, analytical information processors preferred vocational activity that required competence in analytical articulated cognitive structure, whereas more global information processors were drawn to occupations with high levels of social content and an emphasis on interpersonal relations (Alvi et al., 1988; Witkin, Moore, Goodenough, & Cox, 1977).

Two advantages of the application of intellectual styles in the area of selection, vocational choice, and career success are, first, they offer managers the possibility of identifying habitual (rather than maximal) performance, and second, if presented in nonpejorative terms, styles may be seen by candidates as less threatening than ability measures (Hayes & Allinson, 1994, p. 55). Kirton and DeCiantis (1986) argued that the measurement of intellectual styles may be a useful addition to the selection process for a number of purposes, including building a "balanced team" and identifying those individuals whose style may be most appropriate for a given task, job, or vocation. Witkin et al. (1977), using a sample of 1,422 participants, found that knowledge of a person's style predicted his or her major field of college study and eventual occupation. More specifically, personnel managers, sociologists, probation officers,

salespersons, and psychiatric nurses tended to be field dependent, while production engineers, architects, mechanics, and surgical nurses tended to be field independent (ibid.). Grasha found that:

> When the career selected is compatible with their style … students tend to be equally satisfied with their choices and their grades, and ability to achieve are not different. However, when students did not select [subjects] that suited their individual styles their satisfaction and achievements were not as good.
>
> *Grasha, 1987, p. 58*

Wooten, Barner, and Silver (1994), in a study of the influence of FDI on work environment preferences, found a significant degree of association between intellectual style and preferred work environments with field-independent subjects preferring work environments that are highly involving, emphasizing innovation and autonomy.

Intellectual style is also relevant to the degree of fit between individuals and the task requirements of their job roles. For example, psychological type as measured by the MBTI is related to the degree of task structure; sensing types are more satisfied and effective than intuitive types on structured tasks and may have stronger preferences than other types for routine, detail-oriented activities (Gardner & Martinko, 1996, p. 64). These findings are relevant in the context of innovation and creativity management, and the selection of individuals for job roles within innovation teams where different types of thinking skills are required (Henry, 2001). Gul (1986), in a study of accountancy undergraduates, found that the KAI scores were skewed toward adaption that supports Kirton's (1989) assertion that particular occupational groups tend to have distributions that are displaced in accordance with the nature of the job. Kirton observed an overall pattern that suggested that in occupations where adaptors or innovators can do equally well (e.g., general managers), the scores approximate those of the general population. Where occupations are more structured (e.g., production or accounting), the mean is skewed toward adaption, whereas for less structured occupations (e.g., marketing, sales, or personnel), the mean is skewed toward innovation (Kirton, 1989, p. 64).

> *Proposition 2:* Consideration of intellectual styles is important for selection and vocational choice involving particular tasks and job roles.

Relationships have also been observed between intellectual styles and job level. Gardner and Martinko's (1996) review of MBTI research revealed that intuitive types are predominant among top managers, while sensing types are most common among middle- and lower-level ones. They attribute this observation to the hypothesis that "creative, imaginative and cognitively complex managers will be well suited to executive positions" (Gardner & Martinko, 1996, p. 64). Armstrong (1999), Sadler-Smith et al. (2000), and Hodgkinson and Sadler-Smith (2003) noted that senior managers tend to be more intuitive and less analytical than their middle- or junior-level counterparts. The extent to which these effects of intellectual style on managerial level are a function of job demands (e.g., senior roles may require more intuitive behaviors) is not clear and presents one avenue for further investigation. Moreover,

Gardner and Martinko (1996) suggested that the prevalence of intuitive types at senior levels could cause similar types to be promoted to those top levels. Alternatively, once at the top, managers may be at liberty to display intuitive behaviors, or may even feel compunction to do so. Whatever the direction of causality, this observation is of relevance for career success research and practice because the assessment of styles may be a necessary and important selection method for entry to senior positions, and/or an important aspect of executive development programs for those new to or in-post (see Chilton, Hardgrave, & Armstrong, 2005, and Miner, 1997, for supportive lines of reasoning from, respectively, the occupational sector of software development, and entrepreneurial success).

> *Proposition 3:* Training in the area of intellectual styles is an important component for maximizing career success and for succession planning in organizations.

Diversity, Group Processes, and Conflict Management

Research suggests that intellectual style is crucial for effective interpersonal relations in leader–subordinate (Allinson et al., 2001) and mentor–protégé dyadic relationships (Armstrong, Allinson, & Hayes, 2002). Individual differences in intellectual style are also known to have a significant impact on group processes. Armstrong and Priola (2001), for instance, found that intellectual style affected the behavior of team members on task-oriented behaviors and social–emotional acts in self-managing work teams, and concluded that these effects were also likely to be mediated by the nature of the work environment. Their follow-up research indicated that the behavior and effectiveness of teams operating in organic and mechanistic settings were also dependent upon levels of homogeneity and heterogeneity of the intellectual styles of team members (Priola, Smith, & Armstrong, 2004).

Clearly, therefore, the extent to which intellectual style is a factor in interpersonal relations and group processes may need to be taken into account when individuals' work patterns and relationships are being set. Styles may impede individuals in a setting that is dissonant with their styles and patterns of interactions and, hence, may have an influence over the extent to which they can perform effectively and progress in particular circumstances. If an individual's intellectual style matches the information-processing requirements of his or her job role or task, it is more likely that the individual will perform effectively (Hayes & Allinson, 1994). This assertion has significant implications both for job selection, work design, and task assignment, and, ultimately, workplace performance.

Intellectual styles may also have a significant influence on organizational climate and intragroup differences (e.g., as a source of synergy or as a potential source of conflict). Kirton and DeCiantis (1986) suggested that group members may personalize differences in outlook and exert pressure on individuals who do not fit the group style consensus (the "cognitive climate") to leave, but, paradoxically, might also accept wide "misfits" because they provide a function that may have some value to the group. Schroder (1989) observed the differences between adaptor teams and innovator teams, and concluded that adaptor teams proceeded topic by topic, whereas innovator teams tended toward "blue skying"; adaptors covered the task,

whereas innovators went outside the task; and adaptors solved the problem talked about while innovators brought up new problems. He argued that it may sometimes be the case that people whom we perceive as having styles that are different from our own may be perceived as difficult to work with. However, Leonard and Straus (1997) suggested that different styles are essential because each makes a unique contribution to the team and the organization. They assert that innovation is imperative for all businesses today and only takes place when different ideas, perceptions, and ways of processing and judging information "collide." Leonard and Straus also argued that even when managers do not fall victim to the "comfortable clone syndrome" and value employees with a variety of intellectual styles, they frequently do not understand how to manage them. For those who do, Leonard and Straus suggested that:

> The manager successful at fostering innovation figures out how to get different approaches to grate against one another in a productive process we call creative abrasion. Such a manager understands that different people have different thinking [intellectual] styles: analytic or intuitive; conceptual or experiential; social or independent, logical or values driven.
>
> *Leonard & Straus, 1997, p. 112*

In relation to diversity, group processes, and conflict management, the preceding theory leads to the following proposition:

> *Proposition 4:* Managers need to consider ways of (a) redesigning jobs to fit the information-processing requirements of the group and (b) assembling groups according to the information-processing requirements of the job, or manage creative abrasion in a productive way by deliberately designing heterogeneous teams with a full spectrum of intellectual styles. Appropriate strategies will depend upon the nature of the work context but where these are cognizant of stylistic differences and preferences, satisfaction and performance will be enhanced.

We advocate that the management of heterogeneous teams will be more effective if managers spend time getting cognitively diverse people to acknowledge their differences and respect the intellectual styles of others in the interests of "creative conflict," idea generation, idea implementation, and innovation.

Gender Differences and Careers

Gender-centered stereotypical thinking tends to characterize intuition as a feminine trait whereas rationality, logic, and analysis are seen as masculine traits (Bancroft, 1995; Clares, 1999). Empirical research in the field of intellectual styles has revealed that while the opposite may be true for women and men in general, this stereotypical thinking may hold true for management populations. Studies of nonmanagers have found that females tend to be significantly more analytic/adaptive, and males more intuitive/innovative using the analytic–intuitive dimension of the CSI (Armstrong, 1999; Doucette et al., 1998; Hayes, Allinson, & Armstrong, 2004; Murphy et al., 1998) and the innovator–adaptor dimension of the KAI, respectively (Kirton, 1989). Studies among the management population, however, have revealed different

findings (see, e.g., Agor, 1986; Parikh et al., 1994). A recent study using the CSI (Hayeset al., 2004) revealed that female managers were more intuitive than female nonmanagers, although there were no significant differences between male and female managers. In other words, female managers are more like male managers than female nonmanagers.

These findings have important implications for the careers of women, especially as there is evidence indicating the possibility that intuition increases employees' progress to senior positions (Agor, 1989; Allinson et al., 2001; Allinson & Hayes, 1996; Hodgkinson & Sadler-Smith, 2003). If Wajcman (1996) was correct in her assertion that the social construction of management is one in which competence is linked to qualities attaching to men, then women subordinates (more analytic) may need to behave more like men (more intuitive) before they are selected for promotion. Clearly, work situations are nothing if not context dependent, and analysis may often be preferred over intuition, in which case employees may need to adapt their styles to match the information-processing requirements of the task.

> *Proposition 5a:* In job roles or tasks that require individuals to see a problem holistically, where it is important to generate ideas rapidly, and where working with others is an important component in a decision-making process, women may need to emulate the more intuitive processes adopted by successful male managers in order to improve their chances of promotion.
>
> *Proposition 5b:* In careers where tasks require careful planning and analyses of information to solve derailed problems, or where logical, reflective, and linear approaches are required for long-term solitary tasks, men may need to emulate the more analytic processes adopted by the general population of females to improve their chances of promotion.

Intuition and Emotion in the Workplace

Style is relevant in relation to affect in the workplace to the extent that intuitive types are more likely to trust their "gut feelings" than are "rational types." CEST (Epstein et al., 1996) postulates that individuals may have a predisposition for one mode of processing over the other. Under these circumstances one might anticipate cognitive dissonance between particular individuals or groups, as a result of differences in the ways in which intellectual styles affect behavior (with some "trusting their gut" while others need the "facts and figures"). Indeed the usefulness of emotional intelligence (see Zeidner, Matthews, & Roberts, 2004) in the workplace may be relevant with regard to intellectual styles, given that previous research has pointed out that highly emotional intelligent individuals may be more effective in managing their own emotions, and the impact of emotions in their interactions with others, and also in reading the motives and intentions of others (related to so-called social intuition; see Myers, 2002). Likewise, individuals will differ in the faith they have in their intuitions (Epstein et al., 1996) and in the ways in which they are able to manage their intuitions (Sadler-Smith & Shefy, 2004).

Individuals may need to undergo training to enhance their less developed styles if they are to succeed in a particular job role to which they aspire, for instance, by

developing expertise that enables them to put greater faith in their informed intuitions, in order to be able to make decisions in the fast-paced and loosely structured situations that may face senior managers circumstances under which intuitive judgment comes to the fore (see Klein, 2003). In a similar vein, Gardner and Martinko (1996), in relation to the MBTI, observed that "feeling" types are more affective, cooperative, personal, and supportive, while "thinking" types are more logical, assertive, and impersonal. Their findings are likely to be of relevance when selecting or assigning individuals to job roles or tasks that require effective interpersonal functioning (e.g., coaching or human resources) and collaborative working.

> *Proposition 6:* From a career management perspective it is important to recognize and accept that an employee may have a stronger preference for one particular mode of thinking, and this is a particularly important factor that needs to be taken into account when appraising performance and identifying training and development needs.

Training and Development

Intellectual style is relevant for employees' training and development because, as a result of differences in intellectual styles, individuals organize and process information in differing ways, and, therefore, respond differently to varying modes of learning and instruction. The latter forms the basis for them developing alternative cognitive strategies. Recognizing one's general learning processes, the demands of a particular task, and which strategies are most appropriate for successfully carrying out that task is referred to as metacognition (Flavell, 1976). Metacognition is the knowledge that a learner has about how s/he learns best, and involves the process of planning, assessing, and monitoring one's own thinking. It involves being able to "think-about-thinking" and requires conscious reflection on one's learning processes and of evaluating the standards of one's own thinking, learning, and strategies for personal development. One way of promoting the acquisition of metacognitive skills is to introduce learners to the concept of individual differences in intellectual styles. Indeed, it has been argued that one of the keys to organizational effectiveness lies in a synthesis of clear-headed logic and powerful intuition (Mintzberg, 1989). Khatri and Ng (2000, p. 58) argued that rational analysis is a useful and indispensable tool in strategy making but that a "theory of strategic decision-making has to take into account both rational and intuitive processes." Over recent decades, there have been a number of attempts to pioneer methods of developing managers' intuitive/experiential/innovative capabilities (see Blackburn, 1971; Sadler-Smith & Shefy, 2007; Smith, 1978).

Creativity training may be another important facet of learning and development geared toward differences in intellectual styles. For example, the concept of "lateral thinking" was developed and popularized by De Bono (1970) as a technique for escaping from conventional ways of solving problems that too often rely upon convergent cognition, that is, adaptive, rational, and analytical thinking. The concept was based on the assumption that the human mind processes and stores information in ways that create patterns, and that these patterns have a self-persistence that can

constrain thinking (see also Langer, 2000, who referred to "mindlessness" as well as "mindfulness"). Lateral thinking and other techniques are part of a self-awareness training that is an important element in the light of personal and career enhancement (Tesolin, 2000). Relaxation and time management can also facilitate intuitive thinking as noted by Claxton (2001) who suggests that problems on which people have become "stuck" are more likely to be solved after a break, rather than when problem-solving behavior is persistent, thus allowing space for incubation to produce insights. In terms of mode of instruction, ever greater use is being made of distance learning and e-learning, particularly for management education (Greco, 1999), and the importance of style differences are likely to become increasingly significant in the future.

A number of researchers have suggested that the greatest potential impact of individual differences in FDI may be on self-directed and distance learning because the capacity for autonomy may be more limited in field-dependent than in field-independent learners (Even, 1982; Joughin, 1992). Field-dependent learners prefer environments in which there is greater social interaction, more immediate instructor feedback, and more structure and direction. Participation in distance education is therefore less suited to field-dependent learners and, consequently, they have been found to be more vulnerable to dropping out of distance learning programs (Thompson & Knox, 1987, p. 21). Similarly, Ross and Schulz (1999), in a study of the impact of styles measured using the Gregorc Style Delineator (Gregorc, 1982), found that certain styles are at risk for doing poorly with certain forms of computer-aided instruction.

The possibility that researchers and managers can design and implement interventions that may facilitate personal transformation presents a challenge for human resource practitioners and career management and development more generally. As such, educating individuals with respect to differences and similarities in intellectual style based on self-awareness can be emancipating for them, and also beneficial in the light of their future careers (see Fugate, Kinicki, & Ashforth, 2004; van der Heijde & van der Heijden, 2006 on the importance of employees' self-insight in the light of their future employability enhancement).

> *Proposition 7:* Individuals will be liberated to aspire different career paths, different vocational routes, and alternative developmental trajectories if they are trained to understand the significance of their own intellectual style in the context of workplace behaviors, and to develop both personal strategies that help them overcome the limitations of their style and coping strategies that enable them to deal with individuals whose style is dissonant with their own.

Styles Profiling and Career Management

Given that individual stylistic differences exert a strong influence on many aspects of cognition, it is important that employees and managers understand and manage the effects that intellectual styles may have on experiences at work, the occupational opportunities that individuals identify and exploit, their progression and succession, and their personal and professional learning and development. The application of diagnostic testing using valid and reliable instruments is a starting point in this process. Practitioners may readily do this using some of the instruments reviewed

in this chapter as a means of raising employees' awareness of the impact that styles may have had on vocational choices made in the past, ways in which they perform their current job role, and how their styles may unconsciously be affecting their future career plans.

However, intellectual styles should not be regarded as a "straight-jacket," but through awareness training, as a development tool enabling individuals to better manage their careers and fulfil-their work, personal, and life goals. In this sense, intellectual styles profiling is the first step in a process of career self-management (see also, King, 2004) and personal transformation, which may involve conscious development, under guidance and coaching, of cognitive and behavioral strategies that overcome the limitations of an individual's habitual style. The development of such strategies is a key element of effective individual career management and development.

Moreover, at the organizational level, similar awareness of the influence that intellectual styles may exert upon gender-related issues, career success, cross-national issues, and interpersonal and collaborative functioning in team environments may enable strategists and managers to make more productive use of their human resource base.

> *Proposition 8:* The application of diagnostic testing using valid and reliable instruments, such as those reviewed in this contribution, can provide a vehicle not only for enabling individuals to better manage their careers and fulfil their work, personal, and life goals, but may also enable strategists and managers to make more productive use of their human resource base.

Career Management in Global Organizations

Increasing globalization leads both to foreign staff needing training in alien work practices and to growing numbers of employees crossing national borders. Most studies addressing the difficulties and complexities of cross-cultural management since Hofstede's (1980) seminal work have concentrated either on the socioeconomic, environmental, and organizational factors surrounding international firms, or on explicit aspects of national culture, such as attitudes, values, and social practices (Hill, Puurula, Sitko-Lutek, & Rakowska, 2000).

In doing so, they have tended to ignore aspects of culture covered by the term "cognition" (Redding, 1980), and while more research into cross-national cognitive differences has been called for, there is still a dearth of empirical studies in this area (Armstrong, 2006). Pauleen and Murphy (2005) illustrated why culture has important effects on cognitive processes by describing those processes favored by the ancient Chinese as holistic compared with those of the Greeks, which tend to be more analytic. They suggest that holistic thought involves an orientation to the context or field as a whole, including the relationship between a focal object and the field, and a preference for explaining and predicting events on the basis of existing relationships. Analytic thought, on the other hand, is defined as detaching the object from its context, a tendency to focus on attributes of the object, to assign it to categories, and a preference for using rules about the categories to explain and predict the object's behavior.

Redding (1980) highlighted this East–West distinction by suggesting that Western thinking tends to be rational (analytic), with a focus on links between cause and effect, whereas Eastern approaches are more inclined toward relying on intuition. Allinson and Hayes (2000) challenged this traditional dichotomy between the "holistic/intuitive" East and the "rational/analytic" West. Their empirical study using the CSI showed that the most intuitive groups were located in the Anglo, North European, and European Latin slices of Hickson and Pugh's (1995) "culture cake," and the most analytic ones were in the developing countries, and Arab categories. On the basis of their findings they argued that it may be more fruitful to classify nations in terms of their stage of industrial development rather than the hemisphere in which they are located.

While further studies are required to explore how intellectual style can discriminate between managers and staff in a wider societal context, it seems clear that the construct has potentially important implications for the management of careers in various ways (see also Yiu & Saner, 2001). Allinson and Hayes provided one example of how differences in intellectual style may create difficulties in work encounters between managers of different cultures "for example, a British negotiator might find a representative of a Jordanian organization to be ponderous, over-reliant on structure and too concerned with particulars, while the Jordanian might regard the Briton as being impulsive, disorganized and insufficiently attentive to detail" (Allinson & Hayes, 2000, p. 167). Ways of overcoming difficulties like these might include training on how to recognize and deal with differences in intellectual style. Alternatively, training could be given to help staff to adapt and modify intellectual styles to facilitate more effective interaction.

Training techniques may be characterized as falling along a spectrum from didactic to experiential. Didactic techniques can be considered to have a high power distance, and strong uncertainty-avoidance value orientation, while experiential techniques have a low power distance and weak uncertainty-avoidance value orientation. Didactic approaches would more often be preferred by field-independent (analytic) learners, whereas experiential approaches would more often be preferred by field-dependent (intuitive) learners (Witkin et al., 1977). Intellectual styles are one factor that should be taken into account when designing and delivering training programs in a cross/multicultural context.

A recent study by Yamazaki and Kayes (2004) of expatriate adaptation proposed that cross-cultural learning competencies may be related to differences in styles. In line with their arguments, we have formulated the following proposition:

> *Proposition 9:* Cross-cultural adaptation depends upon the degree of congruence between person and culture, but intellectual styles will converge within, and vary between cultures. Organizations, therefore, should either select individuals and teams whose styles are compatible with the people, organizations, and cultures they will be working with(in), or provide training to help staff to adapt and modify intellectual styles, or develop appropriate strategies to facilitate more effective interaction.

IMPLICATIONS OF INTELLECTUAL STYLES FOR CAREER MANAGEMENT RESEARCH AND PRACTICE

Intellectual styles are relevant for a range of career management issues, including selection, vocational choice, and career success; diversity, group processes, and conflict management; gender differences; intuition and emotion in the workplace; training, development, and metacognitive learning; styles profiling; and cross-cultural career management. There are, however, a number of opportunities and challenges for researchers and practitioners alike.

Implications for Research

It is self-evidently important to focus only on those measures that are valid, reliable, practical, and easy to use for career management practitioners, and this is especially important if the diagnosis of intellectual styles is taken up more widely in the field of career management. This chapter has already identified a number of candidate measures in this regard, including the MBTI (Myers, 1980), the CSI (Allinson & Hayes, 1996), the GEFT (Witkin et al., 1971), the KAI (Kirton, 1976), and the REI (Epstein et al., 1996). To this list may also be added the Linear–Nonlinear Thinking Styles Preference Inventory (Vance, Groves, Paik, & Kindler, 2007) and the Cognitive Style Indicator (Cools & Van den Broeck, 2007).

Guided by relevant, reliable, and valid intellectual style instruments, the scope for valuable and meaningful research in the context of career management has considerable potential. At the individual level, one important area of research would be to consider ways of increasing employees' capacity for coping and dealing with stress, dissatisfaction, and poor performance arising from congruence/incongruence in intellectual styles in superior–subordinate relationships, person–role and person–environment fit, and cross-cultural adaptation needs. The relationship between gender and intellectual styles is another crucial area for future research at the individual level, especially in the context of the well-known "glass-ceiling" effect (see also Rosenfeld & Spenner, 1992).

In terms of interpersonal skills and building relationships with others, research needs to focus on the effects of (mis)matching intellectual styles on communication and interaction patterns, influencing tactics, conflict management, and resolution. With regard to groups and teams, more needs to be known about the possibility that homogeneity of intellectual styles may increase the likelihood of satisfying behaviors (Rickards & Moger, 1994), whereas heterogeneity may reduce these effects, but at the risk of increased levels of conflict (Lindsay, 1995). More also needs to be known in relation to Leonard and Straus's (1997) assertion that conflict is essential to innovation and that innovation only takes place when different ideas, perceptions, and ways of processing and judging information collide. They recommend assembling heterogeneous teams on the basis of the intellectual styles of team members in the interest of developing creative abrasion.

At a societal level, more needs to be known about difficulties associated with retrieving, managing, and networking appropriate knowledge and information, for

application and transfer in different organizational and cross-cultural settings, in the context of differences between individuals' intellectual styles and prevailing cognitive climates. While most career research has taken place in North America, worldwide contributions using career management models are strongly needed (Inkson, Khapova, & Parker, 2007).

Much of this research might draw upon the "matching hypothesis" and the value of this will depend upon the extent to which intellectual style is malleable or a fixed characteristic of the individual. If fixed, it may be of value to organizations wishing to select and match employees to job role, task, team, or other organizational or national cultures. If malleable, it may be possible for employees to learn flexibility of style through training and development, and then adopt an approach appropriate to a given situation (Feller, Russell, & Whichard, 2005).

More longitudinal career research (Arnold & Cohen, 2007) is therefore required that focuses on the temporal nature of intellectual styles. Research using multiwave designs can provide more specific information about the stability and change of intellectual styles, and about cross-lagged relationships compared with cross-sectional approaches (see also Taris & Kompier, 2003). Life history calendars and diary research comprise another possibility for future research (Bolger, Davis, & Rafaeli, 2003). Cross-validation of research outcomes in different occupational settings is needed as well.

Furthermore, it is beneficial to control for internal (within one's own working organization) and external (outside one's current organization) labor market opportunities in research on the relationship between intellectual styles and career patterns. More specifically, it might be conceivable that in cases of a lack of employability (career potential), individuals will have to collaborate with colleagues, even in cases of nonmatching intellectual styles. They will continue to do so, in case they are not able to "escape" into a situation with better matching opportunities, and/or are not able to adjust their intellectual style accordingly. Obviously, this might be detrimental for both the individual workers and the working organization.

Implications for Practice

Intellectual style has direct implications for the ways in which individuals acquire the knowledge and skills necessary to carry out their current tasks, as well as those required to equip them for future job roles. Whether intellectual style is fixed or malleable is to an extent unresolved; however, what is not in doubt is that training and development in organizations can do much to assist individuals in acquiring the skills that are needed to effectively overcome limitations of their habitual style. We would argue that intellectual style is the cornerstone of "learning-to-learn" or metacognition (Weinstein & Van Mater Stone, 1996). Individuals with an adaptive, field-dependent, rational, or analytical intellectual style, for example, are likely to approach tasks in a methodical and sequential way, with conformance to set goals and attention to detail. While such an approach may be valid in certain sets of circumstances, it is unlikely to work well in situations that demand lateral thinking, divergent thought patterns, and creativity. With regard to the

latter, two things are necessary. First, individuals need to be made aware of their own thinking style and its strengths and limitations. Second, they need to be equipped with the thinking strategies that may enable them to tackle problems in ways that are not commensurate with their habitual style but which do fit the requirements of the task. Human resource managers and other career management and development professionals are well placed to develop and implement such interventions.

Induction and familiarization training for cross-cultural and overseas assignments should also take into account the cross-national differences that exist with respect to intellectual styles. This would provide employees with one important basis on which they may begin to understand different national cultures, and reflect on ways in which their own intellectual style and associated behaviors might be interpreted differently according to cultural setting. Such approaches might also be important for training of indigenous employees by expatriate workers. Training providers also need to be culturally aware, however, because training activities that may be acceptable in Western settings, such as experiential approaches, may be threatening in some non-Western contexts and should be adjusted accordingly. The structure of individuals' mental models may also vary as a consequence of intellectual styles, and mismatches between individuals' intellectual styles and mental models may present barriers to communication and organizational learning (Hayes & Allinson, 1998). Cognitive mapping exercises, in which individuals explicate the content and form of their mental models, may aid the exchange of information and provide other synergies, too. Intellectual styles awareness training and cognitive mapping techniques may also present a valuable tool for organizational learning. Finally, raising people's awareness of the fact that certain behaviors and dispositions are attributable to differences in intellectual style may lead to a deeper understanding of interpersonal functioning and underlying communication processes. A better understanding of the reasons why individuals behave and relate to others in the ways they do leads to one important way in which employees can begin to expand their emotional intelligence and improve their overall performance in the workplace.

CONCLUSION

Having briefly discussed the origins, theoretical background, empirical evidence, and methods of assessment of intellectual styles, this chapter has explored ways in which this individual differences construct may be an important variable in enabling both employees and organizations to manage careers more effectively in the interest of improving work-based performance. After identifying five particular models of intellectual style that have strong theoretical bases and valid and reliable measurement instruments associated with them, the chapter then argued that intellectual style has a number of important work-oriented applications in the context of career management. These included links between intellectual styles and work design to fit the information-processing requirements of the individual; selection of individuals and tasks according to the information-processing requirements of the job; matching

people to tasks in the interest of enhanced job performance, or to other people in the interest of enhanced interpersonal functioning and communications; career guidance; vocational preferences; and career choice and success. The interactions between intellectual styles and local organizational and national environments were also considered in relation to cross-cultural career management, together with their implications for education, training, and development of staff. The education and training of individuals with respect to their styles were also considered as a way of enabling individuals to manage their careers more successfully and develop in appropriate directions. The implications of intellectual styles for team composition, group processes, and conflict management have also been dealt with, as were empirical studies of gender differences that point to important implications for the careers of women.

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15

Applications of Styles in Educational Instruction and Assessment

Carol Evans and Michael Waring

The aim of this chapter is to identify the nature and impact of styles research on educational instruction and assessment in schools and higher education institutions (HEIs) across a variety of contexts through a systematic review of the associated literature between 1999 and 2010. Such a review is timely given the intensification of the debate over the use and place of styles research, particularly in relation to issues concerning provenance (Ellis & Allan, 2010). Within this chapter, the term "styles research" is used holistically to encapsulate the varied terminology that has been deployed within the literature.

First, to contextualize the findings of the review, the chapter provides an overview of the current debates within styles research, including a consideration of the relationship of styles with instruction and with assessment. Second, the method of the review is outlined. Third, a summary and discussion of the outcomes of the review are presented. This is structured around two levels of analysis of the review data: a general overview concerning the distribution, research foci, instruments employed, and their associated theoretical framework, the research method, and design of the articles reviewed; followed by a thematic analysis of the nature and impact of styles research on educational instruction and assessment. Finally, the implications for further research and practice are considered.

STYLES DEBATES WITHIN THE CONTEXT OF EDUCATIONAL INSTRUCTION AND ASSESSMENT

The past decade may have witnessed considerable expansion and development within the field of styles research (Kozhevnikov, 2007; Riding & Rayner, 1998, 2000; Zhang & Sternberg, 2009). However, the nature and extent to which this expansion has influenced instruction within various phases of education is often contradictory and ultimately confusing (Coffield, Moseley, Hall, & Ecclestone, 2004; Sharp, Bowker, & Byrne, 2008). The reasons for this have been attributed to many factors: a lack of consensual theory; confusing terminology; difficulties in identifying valid and reliable measures; and vague practical implications (Coffield et al., 2004;

Cools, 2009; Kozhevnikov, 2007; Rayner, 2006, 2007; Sharp et al., 2008; Zhang & Sternberg, 2006, 2009). In addition, the styles research area has been plagued by one or more of indifference, poor dissemination leading to a lack of awareness of what is going on elsewhere or siloed competition with individual researchers wanting to become the one "coherent, consensual view" (Yates, 2000, p. 349). Therefore, a key question from a practitioner teaching in school or higher education today has to be: How can I make sense of current style debates in order to navigate the rigorous research evidence to allow me to make critically informed decisions about the influence that styles can have on my instruction and assessment practices? Furthermore, it is equally relevant to consider the potential impact of practice on styles.

When one analyzes those consultations with leading researchers in the styles field and the key recommendations being made across the styles literature in an attempt to move the field forward (Evans, Cools, & Charlesworth, 2010; Peterson, Rayner, & Armstrong, 2009b; Rayner & Cools, 2011; Zhang & Sternberg, 2009), there are identifiable common priorities associated with the advancement of a more integrated framework for the styles field (Kozhevnikov, 2007; Zhang & Sternberg, 2009). These have particular relevance to educational instruction and assessment and involve the need for coherent theory building, methodological development, and enhanced links with pedagogy (Cools, 2009; Curry, 2006; Evans & Cools, 2009; Evans et al., 2010; Pashler, McDaniel, Rowher, & Bjork, 2009; Peterson et al., 2009b; Rayner, 2007; Rayner & Cools, 2011; Riding, 2000). Kozhevnikov (2007) has also raised the need to map how style constructs relate to one another, as well as the importance of identifying the hierarchical nature of such links in relation to the nature of the learning they impact upon. The issue for the field of styles research and its application in educational instruction and assessment is very much about taking these priorities forward in a coherent, strategic, and integrated way. This will require a consistency in approach that is underpinned by a rigorous theoretical and conceptual foundation, and equally rigorous research evidence to support and promote the effective application of styles in educational instruction and assessment.

From both theoretical and conceptual perspectives, Kozhevnikov (2007) has argued that the styles field needs a general theory of cognitive styles that is developed in relation to current research in psychology and neuroscience. Conceptual clarification will be achieved by situating the style construct within the individual differences field so as to consider the interaction of styles with other individual learning difference variables, including motivational, self-awareness, and personality constructs. Strategic integration and application of style theories to enable an integrative overview of the field are essential. Identifying the fundamental cognitive and learning style dimensions within the wide range of style labels is also an imperative. Those definitions for cognitive styles, learning styles, and approaches to learning adopted in this chapter will be those provided by Peterson et al. (2009b, p. 11). Therefore, cognitive styles are seen as "individual differences in processing that are integrally linked to a person's cognitive system … they are a person's preferred way of processing … they are partly fixed, relatively stable and possibly innate preferences." Learning styles represent "an individual's preferred way of responding (cognitively

and behaviorally) to learning tasks that change depending on the environment or context. . . ." Approaches to learning focus on whether an individual takes a deep, surface, or strategic approach to learning and consider self-regulation, motivational, and affective domains. There have been various attempts to build a common language among scholars in the styles field. Zhang and Sternberg (2005) have put all style constructs, with or without the root word "style," under the umbrella term "intellectual styles." Alternatively, Evans and Waring (2009) and Rayner (2000) have used the term "personal learning styles" to represent the complex and multifaceted styles profile of any individual.

EXPLORING THE RELATIONSHIP BETWEEN STYLES, EDUCATIONAL INSTRUCTION, AND ASSESSMENT

The relationship of styles to instruction and assessment has been documented (Rayner & Cools, 2011; Riding & Rayner, 1998; Zhang, 2011; Zhang & Sternberg, 2009). However, the potential of styles to inform teaching and learning and vice versa remains underexplored. It is known that styles do have the capacity to influence instruction in the ways that an educator chooses to design and deliver the curriculum (Evans, 2004; Riding, 2002). The nature of the instruction also has the capacity to influence the development of styles, although there are relatively few longitudinal studies exploring this (Kozhevnikov, 2007; Vanthournout, Donche, Gijbels, & Van Petegem, 2011). The links between cognitive and learning styles and teaching styles have also been identified (Evans, 2004; Riding, 2002; Zhang, 2008). However, whether teachers adopt teaching styles that are related to their own underlying styles profile is questionable (Evans, 2004). In addition, while students may prefer certain teaching styles, this may not necessarily lead to enhanced performance (Zhang, 2011). Little work to date has explicitly considered the nature of assessment and its impact on cognitive styles and instruction; that which exists is evidenced within work focusing on approaches to learning and the investigation of deep, strategic, and surface approaches to learning.

Given that styles and instruction are interwoven, one would expect that the nature of assessment would influence learning styles and teaching styles. While the power of assessment to influence instruction is noted "Assessment methods may be the first aspect of the educational culture on which educators should focus, since it appears to affect satisfaction in any sample under consideration" (Karagiannopoulou & Christodoulides, 2005, p. 347) very little work has concentrated on the place of styles within this agenda. The role of assessment and assessment feedback in enhancing student performance has been noted in many studies (Segers, Gijbels, & Thurlings, 2008). However, with the exception of a growing body of work focusing on the effects of assessment on student approaches to learning (SAL), there is again very little work which specifically focuses on the nature of the relationship between assessment and styles.

The fundamental challenge facing the styles field remains that of addressing the desperate need to synthesize research and practice (Evans & Sadler-Smith, 2006), an important part of which involves the dissemination of clear guidance on effective

ways of using styles research in practice (Hargreaves et al., 2005). Translation of styles research into educational instruction and assessment practices is dependent upon the particular style model being used, how style is perceived (fixed or mobile; uni-multi-dimensional; uni- bipolar; pejorative or nonpejorative) and crucially on how practitioners view the process of learning (Ellis & Allan, 2010). The more judicious use of instruments has been highlighted by Ritter (2007) "authentic appreciation of diversity would require a holistic approach that only uses psychometric instruments with caution … such an approach would recognize that the various instruments have quite specific purposes and use them aptly … such an approach sees the collection of measurable differences as a constellation of factors …" (p. 574). Such a holistic approach needs to situate styles within the wider body of individual learning differences including specific contexts (Sternberg, 2008), as well as achieving greater consensus on what a styles approach within education should involve (Evans & Waring, 2009).

METHODS OF THE REVIEW

The Education Resources Information Center (ERIC) is an online digital library of education research and information sponsored by the United States Department of Education, Institute of Education Sciences. An automated advanced search of this single database was conducted using increasingly refined search criteria to identify those potentially relevant studies for use in the review (Figure 15.1). In addition to the advanced search of ERIC, six international peer-reviewed journal special editions focusing on styles research were hand searched: *Educational Psychology* (2004); *Education and Training* (2006, 2008); *Psychology of Education Review* (2008); *Re"ecting Education* (2009); *Multicultural Education and Technology Journal* (2009). Thirteen of the 40 articles in these special editions were additional ones to those identified as part of the ERIC advanced search. Initially, to be included in the review, the use of styles in educational instruction and/or assessment needed to be evident in the abstract. More specific inclusion criteria employed to review these journal special editions and inform the subsequent screening of those abstracts and titles that had been identified in the ERIC advanced search were: The focus of the paper is on styles research; styles research is being used to inform learning and/or assessment; the setting is a school or HEI; the population is school pupils (4–18 years) or students (17+ years); the instruments employed are appropriate measures of style; the article is conceptual or investigative in nature; and the outcomes are clearly reported. The abstract and title screening portion of the review was conducted independently by each of the two authors of this chapter. Any discrepancy in the independently generated lists of included and excluded journal articles was subsequently collaboratively revisited by the two reviewers and, using the inclusion criteria, a consensus decision was agreed.

The next phase of the review involved the retrieval and screening of the full articles. Using the more detailed information from each of the full articles, the inclusion criteria were reapplied by the reviewers to confirm their selection. In addition to the original inclusion criteria, those full articles that formed the initial

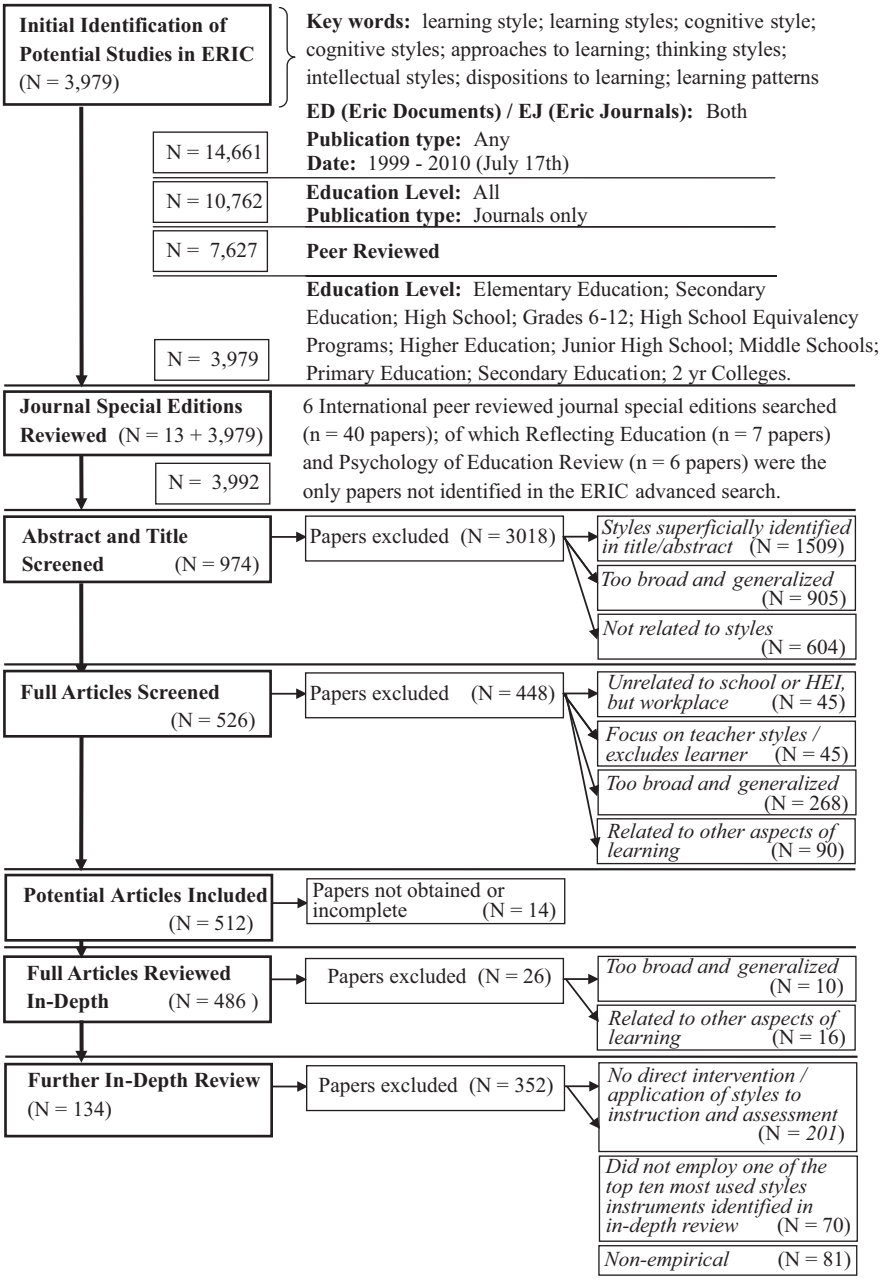

FIGURE 15.1
Summary of method of review.

in-depth review were also judged and selected on the basis of the extent to which they provided comprehensive accounts of different aspects of the nature, methodology, and findings of the study. The quality assurance procedure at this point of the review involved the two authors once again independently reviewing the data. Only on completion of each review did the reviewers then identify and resolve any

variations in interpretation. In terms of the data extraction, the following categories were employed: *Nature*: journal type/subject area; lead author and country of origin of study; HEI and/or School context; instruments used (including theoretical framework); focus of the article and reported outcome; *Methodology*: paradigm of the study; methods identified (number of instruments); research design; nature of the sample; construct validity and reliability; *Impact*: degree of collaboration within/across school(s)/HEI(s) nationally/internationally; capacity building; consolidation or development; involvement of research subjects in the research process. The extracted data were entered into SPSS Version 16. Descriptive statistics were employed to consider frequencies in relation to: journal distribution; journal dominance; distribution of articles per year; country of origin of articles; method; nature of measurement employed; number of instruments used; size of research sample populations; and subject area of research.

The top 10 most employed styles instruments in the articles reviewed were identified (Table 15.1). A further level of in-depth analysis was then undertaken on those articles ($n = 486$) that had employed one or more of these instruments. This involved additional inclusion criteria: a direct/central focus on applications of styles to educational instruction and assessment; articles to be empirical in nature with clear outcomes identified; and a focus on the learner. At this point of the review the two authors again independently reviewed the data with any discrepancies between the independently generated lists of included journal articles being collaboratively revisited by the two reviewers and a consensus decision was reached. Using the remaining 134 articles, a thematic analysis (Braun & Clarke, 2006) of the data was then carried out independently by each of the two researchers to identify

TABLE 15.1
Dominant Styles Instruments Employed in Articles Reviewed

Rank	Instrument	Frequency of Use of Instruments (%)
1.	Kolb: Learning Style Inventory (LSI) 1976, 1984, 1985, 1999	14.3
2.	Biggs: Study Process Questionnaire (SPQ) 1987 Biggs, Kember, & Leung Revised (R-SPQ-2FSPQ) 2001	10.4
3.	Entwistle & Ramsden: Approaches to Studying Inventory (ASI) 1983 Entwistle & Tait: Revised Approaches to Studying Inventory (RASI) 1995 Tait, Entwistle, & McCune: Approaches and Study Skills Inventory for Students (ASSIST) 1998 Entwistle, McCune & Hounsell (2003)	8.9
4.	Witkin, Oltman, Raskin, & Karp: Group Embedded Figures Test (GEFT) 1962–1971	7.9
5.	Felder & Silverman: Inventory of Learning Styles (ILS) 1988 Felder & Soloman: ILS Revised 1999, 2007	6.9

(*Continued*)

TABLE 15.1 *Continued*

Rank	Instrument	Frequency of Use of Instruments (%)
6.	Sternberg: Theory of Mental Self Government 1988 Sternberg & Wagner: Thinking Style Inventory (TSI) 1992 Sternberg, Wagner, & Zhang: Thinking Styles Inventory Revised 2003 Zhang: Preferred Thinking Styles in Teaching Inventory (PTSTI) 2003 Zhang: Preferred Thinking Styles in Learning Inventory (PTSLI) 2007 Sternberg, Wagner, & Zhang: Thinking Styles Inventory Revised II 2007	6.7
7.	Dunn, Dunn, & Price: Learning Styles Inventory (LSI) 1975–1996 Dunn, Dunn, & Price: Productivity Environmental Preference Survey (PEPS) 1979–1997 Dunn & Griggs: 2003	5.2
8.	Riding & Cheema: Cognitive Styles Analysis (CSA) 1991 Peterson, Deary, & Austin: Extended (CSA) Test 2003 Peterson, Deary, & Austin: (VICS) Cognitive Style Test 2009	4.7
9.	Vermunt: Inventory of Learning Styles (ILS) 1994 Vermunt & Vermetten 2004	4.7
10.	Gregorc: Gregorc Style Delineator (GSD) 1977, 1982	4.2
11.	Myers Briggs: Myers Briggs Type Indicator (MBTI) 1962, 1978 Myers & McCaulley 1985	2.2
12.	Torrance: The Torrance Tests of Creative Thinking 1966, 1988 Taggart & Torrance: Human Information Processing Survey (HIPS) 1984	2.2
13.	Fleming: VARK 1995 Fleming and Mills: VARK 1992, 2001	1.98
14.	Honey and Mumford: Learning Style Questionnaire (LSQ) 1992	1.98
15.	Canfield: Instructional Styles Inventory (ISL) 1992	1.98
16.	Pintrich, Smith, Garcia, & McKeachie: Motivated Strategies for Learning Questionnaire (MLSQ) 1991	1.98
17.	Barsch: Learning Style Inventory (LSI) 1996	1.98
18.	Reid: Perceptual Learning Style Preferences (PLSPQ) 1984	1.98
19.	Allinson & Hayes: Cognitive Style Index (CSI) 1996 Hodgkinson & Sadler-Smith: Modified (CSI) 2003	1.48
20.	Grasha–Reichman: Student Learning Styles Questionnaire (SLSQ) 1975	0.98

key themes occurring within the papers focusing on the applications of styles to educational instruction and assessment. The two authors compared outcome data and through subsequent discussion and review reached consensus leading to the identification of the key themes.

ERIC offers a comprehensive indexing of education-related bibliographic records, making it an ideal database to use in this review. However, those potential limitations associated with the review predominantly revolve around the nature and use of this single electronic database (ERIC). The interrogation of this (and other) databases is dependent upon the use and accuracy of key words employed to describe each paper. This database is also developmental, in that it is being added to on a daily basis. The review was confined to a consideration of texts in peer-reviewed journals written in English. Ranking methods involving citation frequencies and journal impact factors that are traditionally employed to assess the quality of publications were not employed in this review. That is not to say they do not have a place in literature reviews, but they are an instrument that does not reflect adequate coverage of various culturally located scientific publications (EERQI, 2008). There is a complexity associated with the attribution of the impact that a particular piece of research may have that cannot be underestimated. Part of this is the potential time-lag between the completion of a research project and any respective impact (ESRC, 2009). Consequently, the potential impact associated with the research reviewed is likely to have been underestimated.

RESULTS AND DISCUSSION

This section outlines the outcomes of the review. It is structured around two levels of analysis: a general overview concerning the distribution, research foci, instruments used and associated theoretical frameworks, research method and design; followed by a thematic analysis and discussion of the data in relation to the nature and impact of styles research on educational instruction and assessment.

Distribution

A total of 486 articles were included in the initial in-depth review, 405 of these being empirical articles. In all, 16% of these articles focused on styles applications within schools, 79% focused on higher education and 5% focused on both HEIs and schools. The articles reviewed had been published in a total of 210 peer-reviewed journals, with 10 of these journals being responsible for 30% of that copy (Table 15.2). Journals focusing on educational psychology and technology dominated the top 10 of the type of journal distribution (Table 15.3). A relatively small proportion of studies were published within dedicated teaching and learning journals (9% and 10%, respectively). The accessibility of such work to those involved in educational instruction and assessment is important to consider.

Incremental growth in the number of published articles on styles research between 1999 and 2010 was evident, as illustrated in Table 15.4. Approximately 50% of these articles were published between 2007 and 2010, substantiating Penger, Tekavcic, and Dimovski's (2008) contention of a revival of styles research. When considering the affiliation of the lead author of these articles, a total of 44 countries were represented, with 15 countries responsible for 421 (87%) of the 486

TABLE 15.2
Top 10 Journals: Number of Articles Published on Styles (1999–2010)

Rank	Journal Name	Number of Articles	% of Total
1.	*Educational Psychology*	39	8.0
2.	*British Journal of Educational Technology*	19	3.9
3.	*Education and Training*	14	2.9
4.	*Learning and Instruction*	13	2.7
5.	*Learning and Individual Differences*	12	2.5
6.	*Computers and Education*	12	2.5
7.	*Studies in Higher Education*	11	2.3
8.	*British Journal of Educational Psychology*	10	2.1
9.	*Journal of Research on Technology in Education*	7	1.4
10.	*International Journal of Science Education*	7	1.4

articles published (Table 15.5). The top five ranked countries in terms of published output were the United States (29.4%), followed by the United Kingdom (15.8%), Australia (8%), China (including Hong Kong), and Turkey, each with approximately 6%. ELSIN (now known as the Education, Learning, Styles, Individual differences Network) is a specific styles research group that has played a major role in debating and disseminating the latest developments in styles research, particularly through special editions, four such publications were featured between 2006 and 2009 with a further special edition on styles research appearing in the journal *Learning and Individual Differences* (2011).

TABLE 15.3
Distribution of Articles Reviewed by Journal Type

Journal Type	Number of Journals (N = 210)	Number of Articles (N = 486)	% of Total
General Education	55	97	20.0
Psychology	15	76	15.6
Education Technology	12	49	10.1
Learning	16	47	9.7
Higher Education	16	46	9.5
Teaching	31	45	9.3
Science Education	20	43	8.8
Computing	9	30	6.2
Business Education	4	9	1.9
Medicine/Health	9	16	3.3
Miscellaneous	23	28	5.8

TABLE 15.4
Distribution of Articles Reviewed by Year

Year	Number of Articles (N = 486)	% of Total Articles
1999	23	4.7
2000	35	7.2
2001	31	6.4
2002	29	6.0
2003	26	5.3
2004[a]	35	7.2
2005	44	9.0
2006[b]	34	7.0
2007	58	11.9
2008[c]	73	15.0
2009[d]	69	14.2
2010 July	29	6.0

Special editions of journals focusing on styles research: [a]*Educational Psychology*; [b]*Education and Training*; [c]*Education and Training*, *The Psychology of Education Review*; [d]*Reflecting Education*, *Multicultural Education and Technology Journal*.

Research Foci

The relationships between style variables (cognitive styles, learning styles, approaches to studying, thinking styles, intellectual styles, dispositions to learning, and learning patterns) and other individual learning style difference variables (such as gender, age, culture) were the main focus of the research in 87.9% of articles. A specific feature of 20% of all articles was their focus on SAL. The application of styles work to the development of e-learning was acknowledged in 24% of articles, with most of these reporting on interventions to support learning; e-learning was more of a focus in HEI-based studies compared to school-based ones. The relationship between dimensions of style and subsequent performance was the main focus in 25% of articles. The use of styles approaches within teaching was addressed in 23% of articles, with an additional 14% focusing on the impact of interventions on performance/approaches to learning. An emphasis on using styles research in teaching was greater in the school-focused studies compared with the HEI-focused ones. Within 17% of articles, the application of styles within the specific subject context was highlighted. Measurement of styles, including development of new measures (validation of instruments), was the primary focus of approximately 9% of articles. The validity and reliability associated with the particular style instruments employed in the research was identified and assessed in more than 52% of the articles. There were few articles that focused on gender and/or cultural interrelationships with style (4% and 9%, respectively).

TABLE 15.5
Country of Origin of Articles Reviewed (Top Ranked 15 Countries)

Rank	Country	Number of Articles (N = 486)	% of Total Articles
1.	United States	143	29.4
2.	United Kingdom	77	15.8
3.	Australia	39	8.02
4.	China (including Hong Kong)	30	6.1
5.	Turkey	27	5.6
6.	The Netherlands	10	3.9
7.	Belgium	14	2.9
8.	Greece	14	2.9
9.	Taiwan	14	2.9
10.	Spain	10	2.1
11.	Canada	10	2.1
12.	Portugal	7	1.4
13.	South Africa	5	1.0
14.	Israel	5	1.0
15.	Austria	4	0.8
16.	Fiji	4	0.8
17.	Finland	4	0.8
18.	Italy	4	0.8
19.	Southern Ireland	4	0.8

Similarly, there was limited attention to how styles research could be applied to team development (3%). Significantly, there was very little focus on assessment design in relation to style differences (2.7%). When considering the emphasis of research relating styles to performance, even where styles approaches were being used within teaching, there has been little linkage to the design of assessment. This would suggest a lack of constructive alignment between curriculum goals and measured outcomes (Biggs, 1999).

Instruments Used and Associated Theoretical Frameworks

Attempts at mapping the styles literature have revealed that there are currently over 30 different cognitive style models and in excess of 100 learning style models (Cools, Evans, & Redmond, 2009). In our review, 84 differently named style models were used in those articles selected for the in-depth review. However, certain style instruments were dominant within this (see Table 15.1). The top five most commonly used models were employed in nearly 50% of the articles and the 10 most used instruments featured in

74% of the articles. The dominance of Kolb's and Dunn and Dunn's respective learning styles models, Witkin's cognitive style model, and Biggs's and Entwistle's respective approaches to learning inventories concurs with previous reviews examining the impact of specific style researchers (Desmedt & Valke, 2004). There is generally a close relationship between the 10 most used styles instruments identified in this review and those recommended by leading styles researchers in a recently conducted Delphi study (Peterson et al., 2009b). However, there are some exceptions. For example, the Allinson and Hayes' Cognitive Styles Index (CSI) and Kagan's (1965) Impulsivity-Reflectivity Style Construct, while highly recommended in the Delphi study, were not found to be widely employed in the in-depth review of articles (1.48% and 0%, respectively). Alternatively, the Felder and Solomon learning styles model and the Myers-Briggs (MBTI) cognitive style model were seen to be widely used in this in-depth review (6.9% and 4.7%, respectively), but were not recommended by many researchers in the Delphi study. Focusing on those styles models that have previously been recommended for their high reliability and validity (Coffield et al., 2004), the Vermunt Inventory of Learning Styles (ILS) featured in the top 10 most used models (4.7% of articles). However, the original version of Allinson and Hayes's CSI and the modified form of this model (Hodgkinson & Sadler-Smith, 2003) have not been employed widely in education (1.48% of articles). The limited transfer from its popular use in a business context to an education context, despite its relevance to learning and teaching, is a notable finding in this review and something which reinforces findings from elsewhere (Evans & Waring, 2009).

The top 10 most used models identified in this review (see Table 15.1) demonstrate considerable variation in the theoretical perspective they adopt in relation to styles and learning preferences. For example, two of the models (Dunn, Dunn, & Price; Gregorc) consider styles and preferences to be largely biologically based and focused on instructional preferences; two others (Riding; Witkin) consider styles to reflect deep-seated features of cognitive structure; another two consider styles to be flexibly stable learning preferences (Kolb; Felder & Silverman), and four of the models consider styles to be learning approaches, strategies, orientations and conceptions of learning (e.g., Biggs, Entwistle, and Vermunt). The Sternberg model (Sternberg, 1997) represents a more general model of style that considers cognitive, personality, and activity aspects of styles. So within this top 10, there are actually very few cognitive styles models (excepting the cognition-based models of Riding and Witkin). In addition, it can be argued that the Kolb's LSI, the most used model identified in the review, is more about the process of learning rather than learning style (Riding & Rayner, 1998). Therefore, the majority of the 10 most used models identified in this review see styles as multidimensional, flexible, and amenable to change, although approaches to learning could be said to exhibit both stable and flexible components.

Within this review, the rank order of the five most dominant models being employed within a school setting were: Biggs; Sternberg; Kolb; Dunn, Dunn, and Price; and Riding. In contrast to this, within a higher education context the order of the ranking was: Kolb; Biggs; Entwistle; Witkin; Felder; and Soloman. When considering the extent of the influence of styles models outside of this review, many have argued that SAL models have had the most influence within higher education

contexts (Haggis, 2009). The work of Kolb and Dunn, Dunn, and Price, and to a lesser extent, that of Riding have had greater influence in schools (Coffield et al., 2004; Riding & Rayner, 1998).

Research Method and Design

Seventy-nine percent of the articles reviewed feature research methods and design characteristic of a field dominated by positivist methodologies (Cools, Armstrong, & Sadler-Smith, 2010; Evans et al., 2010). Mixed methods were employed in less than 8% of the articles. Examination of the approaches employed within each of the articles reviewed revealed that 15% ($n = 61$) of those empirical papers involving an intervention employed an experimental design. In approximately 52% ($n = 211$) of all empirical articles, measures of reliability were evident and construct validity demonstrated. In 26% ($n = 105$) of articles, tests of reliability and construct validity were not evident, and in a further 22% ($n = 89$) of articles, the reporting of these features was obfuscate.

The majority of articles (>97%) focus on styles from an individual's perspective rather than looking at how styles research can affect team effectiveness. Five percent of studies are cross-cultural in nature and 4% adopt a longitudinal design; the relatively limited number of articles addressing these aspects is a concern and something that has been identified elsewhere (Evans et al., 2010; Zhang & Sternberg, 2009). Eighty-five percent of articles focus on the use of one single style instrument to the exclusion of all others. Of the remaining articles: 12% employed two style instruments; 2% employed three style instruments; and 0.8% employed four or more styles instruments.

The dominance of the use of self-report instruments is evident in over 44% of the articles reviewed. Studies focusing on observation of behaviors and the direct measurement of the impact of interventions featured in 26% of articles. This is comparable with previous reports on the paucity of style studies that have considered the impact of interventions (Rosenfeld & Rosenfeld, 2008). Overall, 8% of the articles reviewed used a wide range of measures involving questionnaires, observations, discussions, and interviews to triangulate findings.

In relation to sample size, there is evidence of a lack of work across disciplines, as well as an underrepresentation of school-aged children within research samples. The mean sample size was 259 (SD = 529.6), covering a wide range from 1 (a case study) to 7,196. The majority of participants were higher education students, with the largest single group being teachers/teacher education students across a range of subjects (12.8%). In addition, a further 11% of studies involved students from a variety of disciplines. Other dominant student groups represented included Business Management (11%), Science (8.6%), Computer Science (8.4%), Medicine (7.6%), and Psychology (6.8%) students. In 68% of the articles, the research was conducted within single subject areas and departments, 18% of them were collaborative across subject areas, 11% collaborative nationally, and 3% collaborative internationally. School-focused studies involved a greater percentage of collaborative national studies (18%) when compared to HEI-focused studies (10%).

THE NATURE AND IMPACT OF STYLES RESEARCH ON EDUCATIONAL INSTRUCTION AND ASSESSMENT

Of the 486 articles included in the first part of the in-depth review, 134 were identified as directly focusing on the application of teaching and learning approaches, including assessment in relation to styles and so formed the content for the further in-depth thematic analysis. Sixty-three (47%) of these articles focused on teaching and learning developments in relation to styles, with an additional 58 articles (43%) focusing on styles and the design and content of e-learning environments, and 13 articles (10%) explicitly addressing modes of assessment in relation to styles. The dominant approach taken in these articles was amending the design of teaching to enhance learning to consider the differential impact of such changes on learners with different styles, rather than using an understanding of styles to inform educational instruction and assessment. Such dominant directionality is an important finding of this review, in that it highlights the need to offer a more balanced research agenda and presentation of alternative perspectives on how a styles pedagogy may be used holistically to the benefit of all learners (Balasooriya, Hughes, & Toohey, 2009a, 2009b; Evans & Waring, 2009; Klein, 2003; Ritter, 2007; Yates, 2000). This work has important implications for program design and especially development of assessment practice which currently is a neglected area of research.

The following in-depth analysis portion of the review is divided into two sections: Styles and Instruction and Styles and Assessment.

Styles and Instruction

From the thematic analysis, five themes were dominant within those articles focusing specifically on styles and instruction. These are: (1) the impact of new interventions on students' approaches to learning and their management of such transitions; (2) issues related to style flexibility; (3) relationships between the learning styles of students and teaching styles of teachers; (4) using styles as a framework to enhance pedagogy; and (5) e-learning environments and styles.

The Impact of New Interventions on Students' Approaches to Learning

The SAL group (which includes the work of Entwistle, Biggs, and Vermunt and their colleagues) has had an influential effect on many higher education practitioners (Haggis, 2009), the value being that they suggest "productive routes of action for staff and students" (Entwistle, 1997, p. 214). Little of this work has, however, permeated into schools. Many of the articles reviewed focused on interventions that were aimed at promoting deeper approaches to learning through the introduction of constructivist learning designs (involving problem/inquiry-based learning, authentic learning activities, collaborative, and discovery/action-learning approaches) reported unintended effects, with learners adopting more surface approaches to learning (Abraham, Vinod, Kamath, Asha, & Ramnarayan, 2008; Baeten, Dochy, &

Struyven, 2008; Balasooriya, Hughes, & Toohey, 2009a, 2009b; Donnon & Hecker, 2008; Gijbels, Segers, & Struyf, 2008; Minasian-Batmanian, Lingard, & Prosser, 2006; Papinczak, Young, Groves, & Haynes, 2008; Struyven, Dochy, Janssens, & Gielen, 2006). Explanations offered to account for this phenomenon included the learner's unfamiliarity with the learning environment, and his/her perceptions of the value of the new teaching approach. The importance of personal and contextual factors such as study habits, workload, nature of teaching materials, assessment, and feedback in determining individual and idiosyncratic approaches to learning situations are highlighted (Papinczak et al. 2008; Struyven et al., 2006, p. 290).

The need to manage student transitions onto programs of study featuring new design elements was a recurring aspect in this literature. Empathetic approaches acknowledging that students learn in different ways were seen as an important part of assisting students in such transitions (Campbell et al., 2001). The possibility of identifying and attending to what is referred to as this transition "time zone" was highlighted by Yang and Tsai (2010) and achieved through an awareness of the need and provision of a period of adjustment to allow learners to adopt a different frame of reference (Yang & Tsai, 2010). Wilson and Fowler (2005) viewed transitions from a different perspective and suggested that there was a limited window of opportunity to impact on students' approaches to learning; hence, a coherent program design from the outset was important. As Karagiannopoulou and Christodoulides (2005) identified, how students are introduced to new experiences, as well as their subsequent induction into them, are important. The need to help students by making them explicitly aware of the purposes of specific learning activities and of modeling good practice in them is essential (Balasooriya et al., 2009a, 2009b; Ellis, Goodyear, Calvo, & Prosser, 2008). The importance of running workshops to raise awareness of styles and to effect changes in learning behavior were highlighted in the work of Evans and Waring (2006, 2007, 2008, 2009, 2011), Kember, Biggs, and Leung (2004), Kember, Leung, and McNaught (2008), Nielsen (2007), and Rosenfeld and Rosenfeld (2008).

Issues Related to Style Flexibility

The need for students to be flexible in their adoption of styles is a prominent feature of several articles. Mainemelis, Boyatzis, and Kolb (2002) have questioned whether or not it is the nature of provision that enables students to be more willing to adjust their styles, while Kozhevnikov (2007) questioned the variability in the extent to which individuals have control over such flexibility. Cano (2007) highlighted the fact that some students may be more adaptive than others, adding that with new approaches, instructors need to consider how students are experiencing learning (i.e., how they conceive subject matter, personal goals and perceptions of teaching quality, and by the type of goals emphasized by instructional practice). Nijhuis, Segers, and Gijselaers (2008) explored learner style flexibility further in terms of the differential influence that the environment has on a student's ability to adopt specific approaches to learning and that it is an important feature to attend to when encouraging deeper learning. By taking this into consideration they were

able to identify "restricted little change" and "adaptive-flexible students" (Mainemelis et al., 2002). By considering students' relative levels of adaptability, Nijhuis et al. (2008) argued it is possible to identify the appropriate approach for each student, which may involve counseling for the former and instruction for the latter. This fits with the Kozhevnikov (2007) view that some learners are capable of greater stylistic flexibility than others. However, we would argue that even in the case of "restricted–little change" students, it should be possible through instruction to help them develop strategies to cope with situations where they are unable to adapt their styles. Following this line of argument, in order for learners to move toward a more self-directed approach to their own learning, more care is needed in the induction of learners to new learning environments. Choi, Lee, and Kang (2009) have argued that learning styles may interact with students' learning experience and outcomes at the very early stage of implementation of a new instructional innovation and that it is important that more attention should be placed on styles when students are facing different transitions in their learning as they embark on a new course of study and/or are confronted with different instructional designs. Once students have become accustomized to such new environments, Choi et al. (2009) contend that, in the longer term, the emphasis should be on developing ways to encourage students to adapt to different learning environments rather than to design adaptive systems. Another dimension to support learners' styles development is raised by Micari and Light (2009), who offers a note of caution over the potentially unhelpful impact of too much variation being introduced into the design of new teaching environments.

Relationships Between the Learning Styles of Students and Teaching Styles of Teachers

It is often assumed within the literature that students will be receptive to those approaches that encourage a deep approach to learning. However, it has been identified that students are often not ready for specific innovative approaches (Schellens & Valcke, 2000) and may not like those teaching approaches that emphasize modes of assessment that require higher-order thinking skills (Baeten et al., 2008), or teaching that encourages active self-regulation (Mather & Champagne, 2008; Sadler-Smith, Allinson, & Hayes, 2000).

A number of articles point to the fact that students prefer teachers who match their styles (Saracho, 2001); however, the evidence as to whether students do actually do better is mixed (Armstrong, 2002, Evans & Sadler-Smith, 2006; Evans & Waring, 2009). In the context of student and teacher preferred styles, Zhang and Sternberg (2006) argued that students and teachers have preferred styles and that their styles matter significantly in their learning and teaching behaviors, respectively. Evans (2004) agrees that cognitive styles do influence teaching styles; however, whether a teacher uses specific styles or indeed teaches in his/her own style is debatable. The work of Zhang and colleagues dominates the literature with its focus on the link between thinking styles and teaching styles, specifically Types I, II, and III styles in relation to the nature of instruction, development of empathetic relationships, and links to performance. Type I styles, as summarized

by Zhang (in press), include the legislative (preference for doing things one's own way), judicial (evaluating people or products), liberal (thinking in new ways), global (thinking with the holistic picture in mind), and hierarchical (distributing attention across multiple prioritized tasks) styles. Type II styles include the executive (implementing tasks with set guidelines), conservative (thinking in traditional ways), local (attending concrete details), and monarchic (focusing on one thing at a time) styles. Type III styles include the oligarchic (distributing attention across multiple tasks without priorities), anarchic (turning attention to whatever task is coming), internal (working independently), and external (working in groups) styles. Zhang (in press) comments: "Evidence is clear and consistent: learning environments (including instruction) can not only change students' thinking styles, but also influence their academic achievement. Such evidence should give teachers enough confidence to make conscious efforts in creating learning environments that are more conducive to effective learning." However, Zhang highlights an educational paradox when noting that despite the fact that students and teachers prefer each other to use Type I styles and the research evidence suggests that Type I styles are predictive of those human attributes deemed to be more beneficial to student developmental outcomes and to teachers' teaching, the majority of studies on the relationship between thinking styles and achievement have shown that it is actually Type II styles that contribute to better academic achievement. In other words, although they may be more relevant for students' future success, Type I styles are not encouraged in practice, particularly in the context of academic achievement (Zhang, 2001, 2003, 2008).

Using Styles as a Framework to Enhance Pedagogy

The articles reviewed highlight and reinforce the need for a clear articulation and understanding of what a styles pedagogy might comprise (Cools et al., 2009; Evans & Cools, 2009; Evans & Graff, 2008; Evans & Sadler-Smith, 2006). Schellens and Valcke (2000) argued that styles can be conceptualized as demands of the environment and not only as the qualities of individuals. In attending to all aspects of the learning environment, Evans and Waring (2009, 2011), through the adoption of a personal learning styles pedagogy (PLSP), have argued a place for styles within pedagogy. They outline how to develop programs using a PLSP to enhance learner awareness and to encourage a deeper approach to learning. In so doing, they acknowledge the need for a careful induction into any new approaches, something which requires negotiation and sensitivity to students' needs. The articles reviewed show how a PLSP has been used in a variety of ways to: enhance student awareness of their own and others' styles to augment their understanding of and sensitivity to learning environments (Evans & Waring, 2006; Nielsen, 2007: Rosenfeld & Rosenfeld, 2008); encourage self-regulation and style flexibility and awareness that some students are capable of greater flexibility than others (Evans & Waring, 2007); use a PLSP within an initial teacher education context with student teachers to examine conceptions of good teaching and to explore understandings of differentiation (Evans & Waring, 2008); examine the (re)design of initial teacher education (Evans & Waring, 2009); consider the nature of assessment and assessment feedback in relation

to student teacher style preferences (Evans & Waring, 2011); and explore the role of contextual variables with style in affecting student teacher assessment feedback preferences (Evans & Waring, 2011).

E-Learning Environments and Styles

Fifty-eight of the articles reviewed considered styles in relation to specific adaptations made to e-learning environments. Thirty-five percent of these articles reported that the interventions had no noticeable effects on those with different style preferences and argue that development of flexible e-learning environments supports diverse styles (Triantafillou, Pomportsis, & Demetriadis, 2003). However, certain cognitive and learning styles may be more affected by e-learning design than others. A great deal of styles research in an e-learning context has focused on the presentation of material, and has investigated the impact of the structure of learning, organization, and nature of materials for learners with differing styles profiles. Thomas and McKay (2010) found that the nature of presentation of materials does matter (text only; text and picture; text and schematic diagram format). Student outcomes were enhanced when instructional material matched student learning styles using object visual; spatial visual; and verbal cognitive styles (see Kozhevnikov, 2007, for details of the instrument). Fan and Zhang (2009) found that the nature of the online task did have a differential impact on students. Those with particular styles did better in some forms of evaluation compared with others. For example, Type I learners did better on analysis, problem solving, and essays; while Type II learners performed better on multiple choice and closed tests. Similarly, Boles, Pillay, and Raj (2009), using Riding's CSA, found certain tasks favored certain styles, as did Salmani-Nodoushan (2007) using Witkin's GEFT instrument. In relation to Witkin's cognitive styles measure, Rittschof (2010) and Handal and Herrington (2004) have provided useful summaries of the impact of different e-learning environments on field-dependent and field-independent styles. Rittschof identified the degree of cognitive overload to be an important variable that may affect certain styles more than others. In our analysis of the review data, 26% of the e-learning articles directly comment on the differing needs of Witkin et al.'s (1971) field-dependent and field-independent cognitive styles, along with those clear implications for the design of e-learning environments. General issues pertaining to the needs of all learners include issues of cognitive overload in design. Ghinea and Chen (2003) found all learners, regardless of style, had difficulty concentrating on multiple sources of different information, although field-dependent learners appear to be more affected by this than are field-independent learners (Ghinea & Chen, 2003; Handal & Herrington, 2004). Higher rates of change between clips (dynamism) had negative impacts on both styles. Much has been made of learner control over different instructional presentation mode; however, Rittschof (2010) argues that this may not always improve learning.

Considering the specific needs of field-independent/field-dependent learners, the order of materials matters (Ford & Chen, 2001; Triantafillou et al., 2003). First, field-dependent learners prefer to move from the general to the specific and field-independent learners prefer depth first and then breadth. Second, the level of

complexity also appears to matter in relation to the nature and volume of representations of information. Field-dependents did better with pictures and no text, whereas field-independents did better in text-only formats. Field-independents did better with complex interactional material such as a mix of video, audio, and text (Ghinea & Chen, 2003: Handal & Herrington, 2004), and field-dependents benefitted from the inclusion of graphics (Handal & Herrington, 2004). Third, the patterns of navigation of field-dependents and field-independents were observed to be different with field-dependents following a more linear pattern and being more likely to follow the structure imposed by the software than field-independents (Handal & Herrington, 2004; Somyurek, Guyer, & Atasoy, 2008). Fourth, field-dependents were identified as wanting more support and feedback within e-learning environments (Summerville, 1999; Zheng, Flygare, & Dahl, 2009). From an instructional design perspective, the key point raised in the articles is that not much modification was required to make a significant difference to performance.

In relation to the interaction between e-learning design and other cognitive and learning styles, the situation is less clear. Results are mixed and inconclusive. Of the remaining articles focusing on e-learning, 23% used Kolb's learning styles, 14% used Riding's CSA styles, 12% used Felder and Soloman's learning styles, and 5% used Entwistle's approaches to studying. In relation to the latter, Richardson (2003) argued that performance was dependent upon students' perceptions of the content, context, and demands of the course rather than on style. Yang and Tsai (2010) also argued that students' conceptions of the e-learning environment are important, while other articles point to students' previous experiences of e-learning as an important variable. Yilmaz-Soylu and Akkoyunlu (2009) argued that it may be the time and place that is more important rather than the type of media being presented. Indeed, 70% of the studies reporting on Kolb's learning styles and e-learning found no differences in outcomes among those of different styles. What is also clear is that observation of student behaviors does highlight the different navigational patterns of students; however, the potential impact on performance in relation to styles is mixed.

Styles and Assessment

The relative absence of research that explicitly considered styles and assessment is astounding. There is very little work exploring the link between assessment type and cognitive style (Evans & Waring, 2009, 2011). Within the cognitive styles field, the work of Evans and Waring (2011) stands alone in looking at cognitive styles and student assessment feedback preferences. The impact of assessment on teaching style has been acknowledged (Evans, 2004) but again, there is little work explicitly exploring this. Most of the articles in this review focused on how the nature of assessment influenced students' adoption of surface, strategic, and/or deep approaches to learning. However, the decision-making process that student teachers use when considering the various pros and cons for the adoption of a specific approach remains unclear (Segers et al., 2008).

The fact that learners with certain preferred styles may favor different forms of assessment is identified by Furnham, Swami, Arteche, and Chamorro-Premuzic

(2008). They noted that surface learners preferred multiple choice and group work, rather than essays/dissertations. In contrast they found that deep learners preferred essay type, oral examinations, and final dissertations. When considering the two-way relationship between assessment and style, Byrne, Flood, and Willis (2009) discovered that assessment type influenced the development of deep and strategic approaches. In-class tests, short assignments, and incremental assessment all favored more achieving orientations, while single assignment and formal end-of-year examinations favored less-achieving orientations. Watters and Watters (2007) also found that authentic problem-solving activities incorporated into a final examination encouraged a deep approach. Adoption of a deep approach is more likely where there are "… reciprocal transactions, involving both the giving (clear and useful explanations, helpful feedback) and seeking (interest in students' opinions and difficulties of information …" (Karagiannopoulou & Christodoulides, 2005, p. 342). Diseth, Pallesen, Hovland, and Larsen (2006), however, argued that assessment methods may not be as important as previously assumed in terms of the adoption of deep or surface approaches to learning, but appropriate feedback is important. Byrne et al. (2009) concurred that the nature of feedback does impact on students' self-regulation skills. However, where impacts were limited, it was found that too much feedback had been focused at the task level rather than at a self-regulation level (Gijbels et al., 2008); the latter was seen as more effective compared with self, task, and process feedback by Hattie and Timperley (2007) in their analysis of powerful feedback. The complexity of the relationship between formative assessment and student adoption of particular styles has been highlighted by Gijbels and Dochy (2006). They found that hands-on experience with formative assessment can lead students to adopting a more surface approach, suggesting a need for scaffolding student training in how to make the most of formative assessment (Evans & Waring, 2011; Rodriguez & Cano, 2006). In addition, inauthentic assessment of students' contributions to new modes of assessment, such as virtual discussions within a virtual learning environment without careful framing, is likely to amplify other factors, such as perceptions of workload, assessment, and relevance of assessment type, which may promote surface or deep approaches (Ellis, Goodyear, Prosser, & O'Hara, 2006, p. 254).

The complex relationships of students' beliefs about assessment and their perceptions of assessment to approaches to learning are evident in the articles reviewed. Student beliefs about the cognitive demands of the assessment were seen to influence their perceptions of the cognitive demands of the overall test. For example, if they perceived the assessment demands to be deep they were more likely to adopt a deep approach (Segers et al., 2008, pp. 761–762). Similarly, Bliuc, Ellis, Goodyear, and Piggott (2010) found that those students who developed cohesive conceptions of learning were more likely to adopt deep approaches. Those with more fragmented conceptions used surface approaches, and those who thought of discussions as a way of deepening their understanding did better in assessments of their learning.

The ongoing debate regarding the lack of a clear relationship between adoption of a deep approach and enhanced performance is evident in the articles reviewed. Cano-Garcia and Hughes (2000) argued that good results depend upon adapting

one's own styles to the assessment methods and teaching styles, arguing that assessment is biased in favor of individual, concrete, executive, and noncreative styles (see Sternberg, 1997, for styles explanations).

Byrne et al. (2009) argued that the lack of a relationship between a deep approach and performance can be explained by the failure of examinations and other assessments to reward a deep approach. Similarly, Donnon and Hecker (2003) argued that assessment needs to be aligned to course goals to encourage a deeper approach in students. Daly and de Moira (2010) argued the importance of learner prior experiences of assessment and suggest that previous success will reinforce the use of a deep approach. Furthermore, Wilson and Fowler (2005) found that students changed to a deeper approach when placed in an action learning environment including project work and learning groups. They also identified that greater expectation of responsibility and interdependency were important in creating a web of accountability: "Students appear to be sensitive to the cultural messages about their role in the learning process that are implicitly structured into the design of courses" (Wilson & Fowler, 2005, p. 98). One of the fundamental messages within the literature is that without clear explication of the value of the form of learning and assessment, students may develop more surface compared with deep approaches to learning. This highlights the need to integrate the teaching of assessment design principles into the overall course design, so that learners have the opportunity to explore their understandings and beliefs regarding different forms of assessment, and in so doing enable the instructor to give explicit guidance, as well as be aware of each learner's different starting point.

IMPLICATIONS

This final section draws together key findings of the review in relation to styles, instruction, and assessment. It then identifies overarching themes that will be important in the development of evidenced-based practice and future research.

The Role of Styles in Educational Instruction and Assessment

There are a great many style models being employed, with substantial evidence of the robust and measured use of "strong versions" of styles models (Sharp et al., 2008) in both HEI and school contexts. There is, however, significantly more published research emanating from an HEI context than a school context. The cultural domination associated with the concentration of styles research in particular countries and the focus on positivistic, experimental, and cross-sectional designs to the relative exclusion of interpretive, cross-cultural, and longitudinal ones are common features of research in the styles field (Cools et al., 2010; Evans et al., 2010; Peterson et al., 2009b; Rosenfeld & Rosenfeld, 2008). Concentration is a key feature associated with a number of dimensions identified in the review, for example, related to: author affiliation (29% from the United States; 16% from the United Kingdom); journal location (10 journals

responsible for 30% of output); journal subject focus (dominance of psychology, technology, science); and evidence of "siloization" (a lack of cross-disciplinary, cross-cultural, and international collaborative work; 84% of the work located within higher education with little school based). Similarly, the use of style instruments reflected not only a concentrated focus on a small number of instruments, but a dominance of approaches to studying measures within the top 10 most used instruments. In addition, 85% of studies focused on the use of only one styles instrument. In terms of research design, while there was a dominance of quantitative research methods (79%), there was evidence of a number of mixed methodologies and qualitative methods being employed. In 15% of articles, experimental designs were employed. Rigor (reliability and validity) was strength in over 50% of the articles. In terms of the foci of the articles, 26% of the articles explicitly considered the impact of interventions in teaching and learning, 62% of which reported positive effects of such interventions. However, it should also be noted that a further 46.4% of studies focused on applying styles to teaching and learning (including e-learning applications). There was little focus on gender and cultural differences in relation to styles and hardly any mention (2.7% of articles) of how an understanding of styles can impact on assessment design. In terms of capacity building, this was evident in 19% of articles; of those articles focusing on the impact of styles on performance, 65% identified a positive relationship.

When considering those articles specifically focusing on innovations in teaching and learning including assessment, the following findings are of particular relevance: first, the need to induct learners into new learning environments by exploring beliefs about learning and assessment; second, the need to be mindful of ways in which style flexibility can be accommodated; third, to not make assumptions about the relationships between cognitive, learning, and teaching styles, and performance given the complexity of any individual's styles make up; fourth, that a styles pedagogy moves considerably beyond the notion of the matching hypothesis; and fifth, that small modifications to the design of e-learning environments can significantly enhance learner access.

Future Directions: Revisiting the Styles Landscape

There are a number of implications of the findings of this review for the development of research and practice that go further than a focus on the unthinking use of styles (Coffield et al., 2004). While there is evidence of strong pragmatic science combining rigor and relevance in that styles research that has been applied to educational instruction and assessment, it certainly needs to be developed further in terms of the foci, extent, and consistency in its quality. Enhancing and furthering the application of styles research to educational instruction and assessment in relation to these requires a number of fundamental aspects to be considered and addressed.

While observation of learners intuitively tells us that individuals do perceive things in different ways and that the nature of instruction/materials used does matter, we need to know to what extent, how, and what part of the variation in performance can be attributed to style(s) (Bloomer & Hodkinson, 2000; Kinchin, Baysan, & Bruce Cabot, 2008; Santo, 2006)? In addition, while explicit evidence of validity and

reliability can be an issue with certain instruments: "This does not invalidate the observation from practice that different students prefer to interact with learning material in different ways . . ." (Kinchin et al., 2008, p. 376). The importance of understanding how styles operate particularly within the broader context of differential psychology is paramount (Moskvina & Kozhevnikov, 2011). As Lonka, Olkinuora, and Makinen (2004, p. 320) have stated ". . . It is time to broaden the research perspective to also grasp some crucial sociological and cultural factors in addition to the variable emphasized by educational psychologists." To promote and enable more critical and informed use of styles research within educational instruction and assessment in schools and higher education, a number of areas need attending to.

Researchers need to work collaboratively to help each other improve existing models and instruments, as well as to develop common definitions of concepts rather than profligate more models. To assist translation into practice, more work is needed on how different constructs relate to one another and which are best suited for which specific context (Santo, 2006). More specifically, we need to ascertain the place for styles within the self-regulated learning framework that considers not only cognitive, but also motivational, affective, and contextual factors (Pintrich, 2000). The relevance of cognitive load theories has been highlighted as one example of this (Klein, 2003; Rittschof, 2010). Seeing styles holistically by working in tandem with other variables to impact on behavior and performance is important: "A single-minded focus on style accommodation may limit the creation of tools and strategies that support the development and improvement in learning-specific cognitive functioning among students" (Rittschof, 2010, p. 110). The complexity of learning within real-life situations needs to be acknowledged and considered further in relation to how students' cognitive strategies, learning approaches, and self-regulatory skills are intertwined. The implementation of more studies that explore the use of several strategies at the same time (Heikkilä & Lonka, 2006), while being mindful of the compounding influence of measures on each other (Ritter, 2007), is to be encouraged. An awareness of the existence of different cognitive styles is essential for effective communication (Moskvina & Kozhevnikov, 2011); the role of styles in enhancing access and use of e-learning environments is pertinent here.

The focus on evidence-based practice achieved through rigorous research design, implementation, and replication across contexts is essential (Mayer, 2009: Pashler et al., 2009). In order to achieve greater consensus, as well as clarification of areas of disagreement in taking styles research forward, efforts require coordination and involvement of practitioners, researchers, and research subjects in each of the different phases of design and implementation of the research process. While the findings reported in this review highlight the dominance of U.S. and U.K. researchers within the styles field, a number of significant research hubs in countries such as Turkey, China (including Hong Kong), Belgium, Netherlands, Greece, and Taiwan are evident. There is a need to identify key brokers within each of these geographical areas to enable greater cross-fertilization of ideas and collaborative enquiry; this also requires coordination (McWilliam, 2009). Through cross-cultural and interdisciplinary research groupings, it may be possible to enable further conceptual and theoretical clarification that is needed within the styles field.

Considerable ongoing cognizance is required by educators to avoid them making those assertions and assumptions regarding a variety of learning or cognitive styles that they often make based upon relatively weak evidence (Curry, 1990; Yates, 2000). Working with school practitioners as co-researchers may address some of the issues, but not all of them. There is a need for clear, accessible, and informed evidence of what styles pedagogy involves, with and without the use of instruments. Those responsible for educational policy need to consult and be working with leading researchers within the styles field to ensure the dissemination of the "strong version of styles" and in so doing limit the appeal and often detrimental impact of popular science (Sharp et al., 2008). More outlets are required for the dissemination of unbiased, independent reviews of styles written by researchers in collaboration with teachers, and at the center of which is the school context. The styles literature needs to be made accessible to teachers and learners. This requires robust research evidence to be translated into explicit pragmatic guidance for teachers on why and how they can effectively use such approaches in real settings and in association with other approaches to enhance learning. Styles approaches can be used as powerful tools in developing self-regulatory practice, but far more work is needed in this area. Matching the styles of the learner to the style of the teacher and vice versa is a concept of limited utility considering the complexity of any one individual's styles profile (Evans & Waring, 2009). What we need to identify are those core principles that will drive the design and implementation of programs in schools and HEIs. Fundamentally, this requires a detailed mapping of styles constructs to other individual learning differences so as to firmly locate styles research within and not outside of cognitive psychology by integrating the research lens and expertise in styles and cognitive psychology.

As part of this mapping exercise, practitioners need to know what styles matter and, importantly, in what context as part of a more functional research agenda (Rayner, 2006). The call for rigor and relevance in styles research (Hodgkinson, Herriot, & Anderson, 2001) is evidenced in this literature review, but there is a need to replicate findings more extensively across contexts.

By encouraging a metacognitive focus that enables learners to be more self-directed in the way they go about learning, styles research has a key role to play in assisting learners in transitions to new programs, new curricula design including assessment, and new e-learning opportunities. The literature highlights the central roles of social and cultural contexts, and the underlying teacher and learner beliefs that need to be addressed to facilitate change (Lindblöm-Ylänne & Lonkam, 1998; Lonka et al., 2004; Pheiffer, Holley, & Andrew, 2005). A clear and substantial body of work is developing which provides practitioners with a much clearer route map as to what a critically informed styles approach within educational instruction and assessment involves. Importantly, it is a body of work that acknowledges the complexity of styles and the redundancy of old frames of reference that focus solely on matching styles of learner to those of instructor (Pashler et al., 2009). The lack of attention to styles in relation to other individual differences and styles' role in supporting student access to assessment designs, including feedback, is an overlooked area of research that has the potential to inform curriculum development; this needs to be taken forward. Finally, in a response to those narrow and less comprehensive reviews, the systematic review of the literature presented in this chapter provides

not only an up-to- date, clear, and accurate assessment of the state of styles research in relation to educational instruction and assessment, but identifies a constructive and positive way forward for the styles field.

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16

Understanding Styles in Organizational Behaviors: A Summary of Insights and Implications

Eva Cools

INTRODUCTION

A major challenge for work and organizational psychology (WOP) and management research is to understand and predict how people behave in organizational settings. To this end, many researchers have examined the impact of individual and situational factors on organizations and people in work settings (D'Amato & Zijlstra, 2008). One individual characteristic studied intensively in this context is cognitive styles, which are in line with the results of a recent Delphi study among international experts in the style field defined as "individual differences in processing that are integrally linked to a person's cognitive system … they are a person's preferred way of processing … they are partly fixed, relatively stable and possibly innate preferences" (Peterson, Rayner, & Armstrong, 2009, p. 11). Although level of interest in the field has waxed and waned over the years (Rayner & Peterson, 2009; Zhang & Sternberg, 2009), interest in styles has been high among applied researchers since the 1970s (Kozhevnikov, 2007) not only in the fields of education and management but also in other fields such as medicine.

Importantly, it is necessary to first clearly delineate what choices were made when writing this review chapter. First, although "intellectual styles" are used as an umbrella term including "thinking styles," "cognitive styles," and "personality styles" "learning styles," and related concepts such as "approaches to learning" and "learning patterns," are excluded from this review. Second, the chapter largely spans a 40-year period because this period is the time over which the number of applied publications grew (Kozhevnikov, 2007). Third, the review mainly considers peer-reviewed journal articles as they represent validated knowledge and have been argued to have the highest impact on a field of study (Podsakoff, MacKenzie, Bachrach, & Podsakoff, 2005). Finally, a broad perspective is taken toward the applied intellectual style frameworks (Armstrong & Cools, 2009; Cools, Armstrong, & Sadler-Smith, 2010), including more established measures that are heavily used within the field of management and business and newly validated instruments in this area.

FRAMEWORK

Streufert and Nogami (1989) argued that cognitive style may be one of the variables that determine whether people are able to respond appropriately across a variety of situations. These authors suggested that cognitive styles can play an important role in clarifying why some people continually perform well even when transferred between jobs or tasks, while others (with equal intelligence, experience, and training) perform well in one situation but fail when placed in another setting. Hayes and Allinson (1994) argued that cognitive styles may be used in organizations to inform and improve the quality of decision making in relation to personnel selection and placement, task and learning performance, internal communication, career guidance and counseling, fit with the organization climate, task design, team composition, conflict management, team building, management style, and training and development. Styles continue to provide a much-needed interface between research on cognition and personality (Sternberg & Grigorenko, 1997) and show a great deal of promise for the future in helping us understand some of the variation in job performance that cannot be accounted for by individual differences in abilities. Scholars agree that cognitive styles can be an important factor to take into account in organizational settings and processes, for instance, in the areas of selection, vocational and occupational preferences, team composition and performance, training and development, and organizational learning (e.g., Armstrong & Cools, 2009; Sadler-Smith, 1998). To get a better view on the assumed relevance of a cognitive style perspective for business and management settings, this chapter aims to provide a focused two-part overview of research on the applications of style in the workplace, the

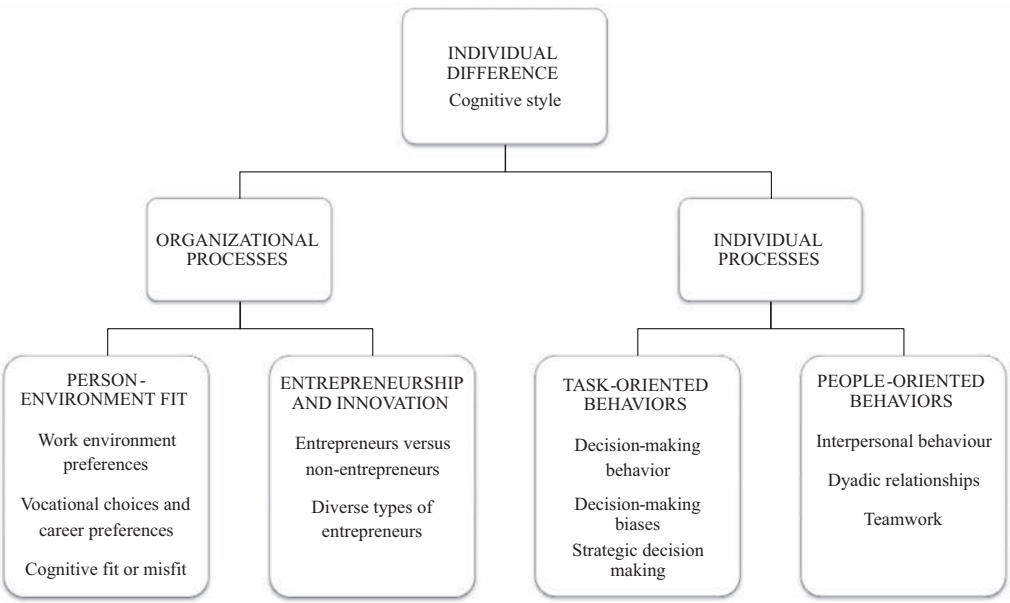

FIGURE 16.1
Chapter framework.

first part looking at the organizational level and the second one at individual behavior (Figure 16.1).

COGNITIVE STYLES AND ORGANIZATIONAL BEHAVIOR

This section focuses specifically on relevant empirical findings in relation to person–environment fit, and entrepreneurship and innovation.

Person–Environment Fit

Research on person–environment (PE) fit, examining the interaction and level of congruence between particular characteristics of the employee and characteristics of the work context or organization, has always been very popular (Ehrhart & Ziegert, 2005). Also in the field of cognitive styles, a great deal of attention has been paid to understanding the work environment preferences and career choices of people with diverse cognitive styles as well as the consequences of what is called cognitive fit or misfit, as will be clear in the subsequent overview.

Work Environment Preferences

Work environments differ in terms of the information-processing requirements that are placed on individuals (Hayes & Allinson, 1998). As cognitive styles are individual preferences in information processing, researchers investigated whether or not they influence people's work environment preferences (e.g., Clapp & De Ciantis, 1989; Whooten, Barner, & Silver, 1994). Existing research in this area using the Kirton Adaption–Innovation (KAI) Inventory (Kirton, 1976, 2003), the Cognitive Style Index (CSI; Allinson & Hayes, 1996), and the Myers-Briggs-Type Indicator (MBTI; Gardner & Martinko, 1996; Myers, McCaulley, Quenk, & Hammer, 2003) clearly indicates that analytical thinkers prefer to work in well-defined, stable, structured, ordered, and relatively impersonal situations in which they can function within existing rules and procedures and prevailing structures. People with an intuitive style favor unstructured, changing, highly involving, innovative, flexible, dynamic, relatively personalized environments, in which they can work autonomously.

Vocational Choices and Career Preferences

In addition to empirical studies on work environment preferences, scholars have examined the link between cognitive styles and occupation type or career orientation (e.g., Järlström, 2000; Nordvik, 1996). These studies have sought insights into how individual style differences influenced career decision making and vocational development. Hayes and Allinson (1998) suggested that, due to self-selection, people within many groups in organizations will share a similar cognitive style, also

called cognitive climates in organizations (Kirton & de Ciantis, 1994; Kirton & McCarthy, 1988). Studies in this area have focused specifically on accountants, artists, engineers, nurses, scientists, bankers, teachers, managers, and IT professionals, and on diverse types of students (e.g., Bennett, Pietri, & Moak, 1998; Collins, White, & O'Brien, 1992; Cools, Vanderheyden, & Horlait, 2009a; Doucette, Kelleher, Murphy, & Young, 1998; Gul, 1986; Murphy, Casey, Day, & Young, 1997) as a way to identify the cognitive profile of a broad variety of occupations (also see below for a more specific focus on entrepreneurs).

Interestingly, this research clearly demonstrates a significant relationship between people's cognitive styles and their vocational activities. For instance, using the Group Embedded Figures Test (GEFT; Witkin, Oltman, Raskin, & Karp, 1971), Witkin, Moore, Goodenough, and Cox (1977) observed that field independents (i.e., analytical thinkers) appeared to be drawn to professions such as chemistry, engineering, and architecture; field dependents (i.e., intuitive thinkers) tended to be drawn to occupations such as social work, teaching, sales, and personnel management (see also Alvi, Khan, Hussain, & Baig, 1988). To summarize, existing research with diverse types of cognitive style measures (i.e., KAI, CSI, MBTI, Thinking Style Inventory [TSI; Sternberg, 1997]) found that people who work within a structured environment and are expected to work within prescribed rules, plans, and hierarchy (e.g., accountants, engineers, or bankers) score higher, on average, on analytical thinking. On the contrary, people whose jobs give them more freedom of action and who function within less structure have been found to be more intuitive thinkers, such as strategic planners, artists, or personnel managers (see Allinson & Hayes, 1996; Foxall & Hackett, 1994; Gridley, 2007; Kirton, 2003). Cools, Van den Broeck, and Bouckenooghe (2009b), taking a multidimensional style perspective and using the recently developed Cognitive Style Indicator (CoSI; Cools & Van den Broeck, 2007), identified a knowing-oriented cognitive climate in finance, information technology, and research and development functions; a planning-oriented cognitive climate in administrative and technical and production functions; and a creating-oriented cognitive climate in sales and marketing functions and in general management.

Cognitive Fit or Misfit

Following the wide attention for PE fit in other research domains, Chan (1996) introduced the concept of cognitive misfit within the cognitive style field, which he defined as the degree of mismatch between an individual's cognitive style and the predominant style demands of the work context. A match between one's cognitive style and the job demands is expected to yield positive outcomes (e.g., job satisfaction, organizational commitment, career success), whereas a mismatch is expected to lead to negative outcomes (e.g., increased turnover, less motivation, higher levels of work-related stress, interpersonal conflicts). In contrast to the large emphasis on the importance of cognitive fit in theoretical works, few studies have investigated empirically whether or not cognitive (mis)fit actually leads to these expected outcomes.

Within the styles field, six studies were found in the area of cognitive (mis)fit. Chilton, Hardgrave, and Armstrong (2005) found that performance decreased and stress levels increased as the gap between software developers' cognitive styles (measured with the KAI) and the perceived environment demands became wider. Mitchell and Cahill (2005) observed that plebes who voluntarily withdrew from a preparatory training program of the U.S. Naval Academy before completion scored significantly higher on innovation (as assessed by the KAI) than the ones who stayed, which they attributed to the presumably lower compatibility of this style with the military environment. In a recent study with entrepreneurs, Brigham, De Castro, and Shepherd (2007) found that cognitive misfit (using the CSI) led to lower levels of satisfaction with the work environment and higher levels of intention to exit and actual turnover. In a study with engineering functions, Chan (1996) concluded that cognitive misfit (KAI) provided significant contribution to predict actual turnover, but it was uncorrelated with employee performance. Chang, Choi, and Kim (2008), studying turnover among R&D professionals, did not find support for their hypothesis that R&D professionals with an innovative cognitive style (using the KAI) would show less turnover than adaptive (i.e., analytical) types. Cools et al. (2009b) examined the impact of cognitive fit on job satisfaction, intention to leave, and job search behavior in a wide range of occupations. In contrast to expectations, they found limited support for the hypotheses that people in cognitive fit (using the CoSI) are more satisfied with their jobs on the one hand, and that they show less intention to leave and less job search behavior than people in cognitive misfit on the other hand. However, they did find that people with a creating style show more job search behavior and intention to leave than people with a planning style, irrespective of the cognitive climate they are working in.

Conclusion and Implications

The substantial interest in person–environment fit in the intellectual style field is unsurprising, as a better understanding of the reasons why people leave their jobs and what satisfies them is crucial to improve selection and retention efforts and can lead to cost savings. Two major conclusions can be drawn from this review.

First, there are many studies that aim to illuminate the work environment and vocational preferences of people with diverse cognitive profiles. These studies use a wide range of style measures and look at people who are already employed as well as at diverse types of students who still need to make their career choices. In terms of future research, it might be interesting to replicate the findings of previous investigations, preferably using a different style measure than the one used in the original study or even better a composite measure combining diverse style instruments, as some studies reported inconsistent findings. These inconsistent research findings from past research might be due to the wide range of style measures used in this type of research or alternatively to the unclear conceptualization of what a specific job or function implies (e.g., Cools et al., 2009b; Hicks, Bagg, Doyle, & Young, 2007). With regard to the latter aspect, Kirton (2003) claimed that there are not only differences between functional groups within organizations, but also within the

boundaries of jobs, implying that functions can contain differing cognitive style orientations within them depending on the style demands of the job (e.g., production engineer vs. R&D engineer), which is also an area that needs further investigation.

Second, with regard to cognitive (mis)fit, it is striking that five of the six studies discussed focused on one specific occupation (except for Cools et al., 2009b) and that four of these studies used the KAI to measure cognitive styles, hence adhering to a unidimensional perspective on cognitive styles. Further studies in this area need to (1) take into account different occupational groups in their design and (2) consider multidimensional style perspectives, which is in line with more recent conceptual developments in the style field (e.g., the application of dual-process theory; see Sadler-Smith, 2009). In addition, the PE fit field in general recently conceptualized PE fit as a multidimensional construct that evolves over time and that is composed of fit with the vocation, organization, job, group, and other people (Jansen & Kristof-Brown, 2006). Moreover, research on the effects of PE fit on work attitudes, behavioral outcomes, and job performance has produced mixed results due to the various ways fit has been conceptualized and measured (Hoffman & Woehr, 2006; Verquer, Beehr, & Wagner, 2003), which was also apparent in the cognitive style studies in this area. In this sense, future cognitive misfit studies also need more complex models in which more individual and environmental factors, a longitudinal perspective, and multiple levels are taken into account. It is, for instance, possible that with the increased use of cross-functional teams in organizations it is more useful to involve person–team fit in addition to fit with the functional domain in these studies.

Entrepreneurship and Innovation

As the business environment in which many entrepreneurs operate is increasingly complex, unpredictable, and unstable, the information-processing demands that are placed on business leaders are enormous. This may clarify why entrepreneurship research has recently started to lay more emphasis on a cognitive rather than a trait perspective (Baron, 2004). The current economic situation makes this kind of research even more valuable. Two broad streams of research on entrepreneurship and innovation can be distinguished within the cognitive style field, one stream focusing on characterizing the cognitive profile of entrepreneurs, and a second stream looking at the implications of diverse types of cognitive profiles on the entrepreneurial process and firm performance.

Entrepreneurs Versus Non-entrepreneurs

Several scholars compared entrepreneurs and non-entrepreneurs to investigate whether or not they differ in their cognitive profile. Goldsmith and Kerr (1991), for instance, reported a higher score on an innovative cognitive style (as assessed by the KAI) for students following an entrepreneurship class. Similarly, Cools et al.

(2009a) found that final year students with a CoSI creating style showed a preference to be self-employed (rather than being organizationally employed), while the planning style showed a negative correlation with entrepreneurial intention. Buttner and Gryskiewicz (1993) and Stewart, Watson, Carland, and Carland (1998) found a more innovative cognitive style (using the KAI) among entrepreneurs than among managers in large established organizations; the latter tended to have a more adaptive cognitive style. Armstrong and Hird (2009) found that entrepreneurs tended to be more intuitive (as measured with the CSI) and less analytic than non-entrepreneurs; more intuitive entrepreneurs also exhibited higher levels of entrepreneurial drive.

Allinson, Chell, and Hayes (2000) observed that entrepreneurs had a more intuitive style (using the CSI) than the general population of managers, but did not differ in their cognitive style from the senior managers and executives in their samples. This finding seems to confirm the belief that intuition increases with hierarchical level, as managers on higher levels like entrepreneurs also face uncertainty, time pressure, ambiguity, and incomplete information, which requires of them a more intuitive problem-solving approach (Allinson & Hayes, 1996; Sadler-Smith, 2004). Similarly, Cools and Van den Broeck (2008a) did not find a significant difference in their study between entrepreneurs and health care managers for the CoSI creating style. However, these groups did differ on the knowing and the planning style, with a significantly higher score for the non-entrepreneurs on these two styles.

Following these partially inconsistent findings of previous research in this area, Groves, Vance, Choi, and Mendez (2008) investigated whether entrepreneurs score higher on nonlinear thinking (measured with the recently developed Linear/Non-linear Thinking Styles Profile [LNTSP]; Vance, Groves, Paik, & Kindler, 2007), as found in most earlier studies, or whether they show a balance between linear and non-linear thinking, arguing that entrepreneurs need to perform many different tasks that are both analytical and intuitive in nature. As they predicted, the entrepreneurs showed a greater balance in linear/non-linear thinking style than the professional actors (who scored higher on non-linear thinking) and accountants (scoring higher on linear thinking) in their study. They concluded that successful entrepreneurs apparently strive for a balance between linear and non-linear thinking in their entrepreneurial activities.

Diverse Types of Entrepreneurs

Within the second stream of entrepreneurship research in the cognitive style field, style differences have been studied in relation to the business opportunity identification process, trying to answer the question as to why some types of entrepreneurs are better able to discover and exploit particular entrepreneurial opportunities than others and how diverse types of entrepreneurs differ in their entrepreneurial processes (e.g., Dimov, 2007; Hmieleski & Corbett, 2006; Walsh & Anderson, 1995). Buttner and Gryskiewicz (1993), for instance, found that innovative entrepreneurs (using the KAI) tended to start more ventures than adaptive entrepreneurs

and that adaptive entrepreneurs spent more time than innovative ones in administrative activities. Barbosa, Gerhardt, and Kickul (2007) examined whether or not entrepreneurs with diverse cognitive styles and risk preferences differ in their entrepreneurial intentions and self-efficacy. Interestingly, they found that intuitives and analysts (assessed by the CSI) differed in their entrepreneurial self-efficacy, with intuitive entrepreneurs showing lower perceived self-efficacy concerning the establishment of relationship with investors (relationship self-efficacy), the economic management of the new venture (managerial self-efficacy), and their capacity to tolerate ambiguity and stress (tolerance self-efficacy). However, intuitive entrepreneurs who also had a high-risk preference demonstrated higher levels of opportunity identification self-efficacy. Finally, in their longitudinal qualitative study on cognitive style and growth intentions, Dutta and Thornbill (2008) found that more holistic, intuitive entrepreneurs had a wider variety of growth intentions relative to analytic entrepreneurs and also showed bigger (upward or downward) adaptations in their growth intentions when the competitive conditions changed. Analytic entrepreneurs tended to stay closer to their initial growth intentions and made only relatively small changes over time.

Other studies within this stream of research focused on the link between cognitive styles and firm growth and performance, drawing a comparison between the cognitive profiles of entrepreneurs from high performing and low performing firms. Ginn and Sexton (1990) found cognitive profile differences (as measured with the MBTI) between founders of rapid-growth versus slower-growth firms, with founders of rapid-growth firms showing a stronger preference for an intuitive approach when gathering information. Sadler-Smith (2004) found that the intuitive cognitive style (using the General Decision-Making Style questionnaire [GDMS]; Scott & Bruce, 1995) showed a positive relationship with financial (sales growth) as well as nonfinancial (efficiency of operations, public image and good will, and quality of products and services) firm performance. Finally, investigating the role of cognitive styles in innovation, Ko (2008) found that only the TSI liberal cognitive style (i.e., a preference for dealing with tasks that show novelty and ambiguity) was positively related to innovation.

Conclusion and Implications

In relation to the recently established cognitive approach within the entrepreneurship field, research on the cognitive profile of entrepreneurs is of potential economic value. Rather than looking at those stable, dispositional traits that characterize entrepreneurs and distinguish them from non-entrepreneurs, the cognitive perspective looks at those aspects of entrepreneurial cognition that are relevant in the entrepreneurial process and focuses on detecting knowledge structures and mental models that entrepreneurs use to make assessments, judgments, or decisions involving opportunity evaluation, venture creation, and growth (Mitchell et al., 2002). Two major conclusions can be drawn in this area.

First, it can be concluded from this stream of style-related entrepreneurship research that entrepreneurs seem to differ from certain types of non-entrepreneurs

(e.g., managers of large organizations). However, these findings are inconsistent across all studies reported, with some authors claiming that entrepreneurs do not necessarily score higher on a more intuitive style, but rather show a balance between intuition and analysis (e.g., Groves et al., 2008). In parallel with the earlier suggestions made in relation to PE fit research, a multidimensional perspective, in contrast to a unidimensional style perspective, needs to be encouraged in future research to get a clearer view on the cognitive profile of entrepreneurs.

Second, it is clear from the cognitive style studies in the entrepreneurship field that entrepreneurs do not constitute a homogeneous group. Interesting differences have been found between entrepreneurs with different cognitive styles in terms of entrepreneurial processes, firm performance, and growth. Overall, these results seem to be consistent with Olson's (1985) original idea that particular information-processing approaches are effective at different phases of the entrepreneurial life-cycle. He expected individuals with a more intuitive cognitive style to be more effective in the initiation phase of the entrepreneurial process (i.e., the stage in which new ideas are generated), whereas individuals with a more analytical style would be better in the implementation phase (i.e., the stage in which ideas are put in practice). Further research is this area, using diverse or integrated cognitive style measures as well as a broad range of performance indicators in a longitudinal way, is particularly valuable to stimulate evidence-based practice. For instance, results of these types of studies can provide clear input to avoid governmental policies that treat firms with a "one-size-fits-all" approach.

COGNITIVE STYLES AND BEHAVIOR IN ORGANIZATIONS

How people actually execute their organizational commitments depends upon many factors. In addition to situational factors, such as the organizational culture and structure, individual characteristics play an important role in determining individual behavior and performance (Buttner, Gryskiewicz, & Hidore, 1999). Armstrong and Priola (2001) described cognitive styles as a potential crucial factor for effective decision making and for successful interpersonal relationships, and as such they can have an important influence on how people develop their organizational role (Church & Waclawski, 1998). This section focuses first on empirical results with regard to decision making as an aspect of task-oriented behaviors, then on interpersonal relationships and teamwork as relevant people-oriented behaviors.

Task-Oriented Behaviors

The relationship between cognitive styles and decision making has aroused significant interest among researchers, as cognitive styles may help explain why people with similar skills and abilities come to different decisions. Research within this domain can be divided in the following categories: decision-making behavior, decision-making biases, and strategic decision making.

Decision-Making Behavior

Studies on decision-making behavior clearly show that the courses of action in decision making are expressive of decision makers' cognitive styles (e.g., Antonietti & Gioletta, 1995; Betsch & Kunz, 2008; Hunt, Krzystofiak, Meindl, & Yousry, 1989). Research with the MBTI found clear differences in managers' decision-making approaches according to their cognitive styles (e.g., Blaylock, 1985; Gardner & Martinko, 1996; Myers et al., 2003). Sensing managers favored concrete and actual data in their decision processes, while intuitive types preferred relying on heuristics and hunches. Thinking types liked to use objective information and preferred a logical and impersonal decision-making approach. In contrast, feeling managers were more affective and personal, relying also on subjective information. Managers with a preference for judgment favored a structured and planned approach, while perceiving managers relied more on spontaneity, flexibility, and creativity.

Leonard, Scholl, and Kowalski (1999), using diverse cognitive style measures, found that people with an analytical style make decisions on the basis of abstract thinking, logic, and careful analysis. Kirton (2003) concluded that adaptors (using the KAI) tend to take the problems as given and focus on generating ways to develop better solutions for immediate high efficiency. Innovators focus on redefining problems and producing multiple, nonobvious ideas. Quantitative and qualitative research with the CoSI also confirms that people with different cognitive styles use different problem-solving strategies and demonstrate various decision-making behaviors (Cools & Van den Broeck, 2007, 2008b). Individuals with a knowing style preferred a logical, rational, and impersonal decision-making approach, while planners favored an objective, structured, conventional, and efficient problem-solving approach, and creating people had a preference for a creative, unconventional, flexible way of decision making. Knowing and creating types were focused on the content of decision making (taking facts-based or creative decisions, respectively), whereas planning people mostly referred to the decision-making process as such.

Apart from these studies on the preferred decision-making approaches of people with diverse cognitive profiles, some scholars looked at further applications in particular decision-making situations. Gul (1983, 1984), for instance, observed a statistically significant, albeit weak, relationship between field dependence (using the GEFT) and decision confidence. Field-dependent accountants made more confident decisions than field-independent accountants when exposed to ambiguous accounting information. In a study of resource allocation decisions, Chenhall and Morris (1991) found that MBTI intuitive managers tended to incorporate broader opportunity costs into their economic decisions, whereas sensing managers tended to perceive expenditure as incurred and justified for other projects and hence irrelevant to the current project. Sensing types did not identify opportunity costs, which is a potential shortcoming that could lead to misspecification in the treatment of a firm's existing assets. Martinsen (1993, 1995), using Kaufmann's (1979) assimilator–explorer styles inventory, found that explorers (i.e., intuitive style) performed better in creative problem solving when

prior experience was low (i.e., there was high task novelty), and assimilators (i.e., analytical style) performed better when prior experience was high (i.e., low task novelty).

Decision-Making Biases

Rational models of decision making often ignored the influence of individual differences, assuming that people process information and arrive at judgments in a similar, rational way (Rajagopalan, Rasheed, & Datta, 1993). The following studies on cognitive biases, escalation of commitment, and framing effects clearly show that decision making does not always follow this rational process. People tend to engage in diverse irrational decision-making practices, which have been shown to vary according to cognitive style differences. For instance, Hayley and Stumpf's (1989) study with senior and middle managers revealed that different MBTI types habitually use distinct heuristics to gather data and evaluate alternatives in strategic decision making. While many Sensing-Feeling (SF) types manifested availability biases (focusing mainly on value-latent or emotional information), a majority of Intuiting-Feeling (NF) types exhibited vividness biases (focusing mainly on idiosyncratic and memorable information). In a later study, Stumpf and Dunbar (1991) also found that Intuiting–Thinking (NT) types were prone to a positivity bias (i.e., emphasis on opportunities and low attention to threat), Sensing–Feelers were prone to a social desirability bias (i.e., conformance to socially acceptable business practices), and Intuiting–Feelers were prone to a reasoning-by-analogy bias (i.e., novel actions for target organization based on comparison to situation in some other organization).

The tendency for a person to increase commitment to a previously chosen course of action when the outcome of one's previous decision is negative is referred to as escalation of commitment, a phenomenon that has significant implications for organizational decision making (Fox & Straw, 1979). While Singer (1990) did not find a significant association between escalation of commitment and cognitive style (as assessed by the KAI), Wong, Kwong, and Ng (2008) reported trivial, albeit statistically significant, correlations between the rationality component of the Rational–Experiential Inventory (REI; Epstein, Pacini, Denes-Raj, & Heier, 1996) and escalation of commitment.

As far as framing effects are concerned, McElroy and Seta (2003) found that holists were especially likely to be influenced by the way in which a decision was framed (conforming to the predictions of prospect theory, which expect risk aversion for gains and risk seeking for losses), while analytics were not likely to be influenced (conforming to the predictions of expected utility theory, which expect that the way in which the decision is framed does not change the expected utility of the risk-seeking or risk-averse options). Similarly, McIntosh (2005) found that individuals scoring highly on the REI experientiality scale were more likely to be more swayed by the way in which problems were framed (conforming to predictions of prospect theory). Shiloh, Salton, and Sharabi (2002) observed a three-way interaction of intuitive × rational × framing (using the REI), indicating that high rational/high

intuitive and low rational/low intuitive style combinations were most prone to framing effects.

Strategic Decision Making

A number of studies have used the MBTI to explore the effects of cognitive styles on strategic decision-making processes and outcomes, assuming top managers' strategic choices reflect their style preferences (e.g., Berr, Church, & Waclawski, 2000; Gallén, 1997, 2006; Hough & Ogilvie, 2005). Hough and Ogilvie (2005), for instance, found that NT executives used intuition to make cognitive leaps based on objective information and crafted more decisions of higher quality; SF executives took time to seek socially acceptable decisions, made the lowest number of decisions, and made decisions of lowest perceived effectiveness. In a study of 70 senior managers in the spa industry, Gallén (2006) found that Sensing–Thinking (ST) and SF types more often described the defender strategy as the most viable option (i.e., offering a stable set of products and competing mainly based on price, quality, service, and delivery), while NT executives preferred a prospector firm strategy (i.e., having a broad product definition, striving to be first in the market, and focusing on change and innovation). Hodgkinson and Clarke (2007) outlined an alternative two-dimensional framework to investigate the impact of individual differences in cognitive styles on organizational strategizing, distinguishing four broad types depending upon an individual's preference for analysis (low/high) or intuition (low/high). People occupying the low/low, low/high, high/low, high/high preferences with regard to analysis and intuition, respectively, are labeled "nondiscerning," "big picture conscious," "detail conscious," and "cognitively versatile."

Different studies also explicitly focused on risk perception of people with diverse cognitive profiles in the context of strategic decision making, which all show that cognitive style differences are an important factor in explaining the likelihood of taking strategic action and the perceived risk seen in this action. Henderson and Nutt (1980) and Nutt (1990) concluded that ST types perceived highest levels of risk and were reluctant to adopt projects; SF were risk tolerant and more likely to adopt projects. Risk aversion was also found to be related to MBTI styles in a study by Filbeck, Hatfield, and Horvath (2005). Individuals with a preference for thinking tended to be more risk tolerant than those with a preference for feeling. Sensing types are willing to tolerate more upside or downside potential than those with a preference for intuition.

Conclusion and Implications

Mohammed and Schwall (2009), in their review study on decision making, recently concluded that there has been a lack of systematic research on individual differences in the decision-making context, although this does not seem to be the case for cognitive styles, as they have been extensively studied in the area of decision making (Hough & Ogilvie, 2005; Leonard et al., 1999). Overall, these studies focused on the

impact of cognitive style differences on general and specific decision-making behaviors, diverse types of decision-making biases, escalation of commitment effects, framing effects, strategic decision-making practices, and risk perception. It is striking that most research in this area has been conducted using the MBTI as a cognitive style measure. Further research with diverse cognitive style measures is needed to cross-validate findings of previous research and in this sense can help to gain further insight into the impact of cognitive styles on particular aspects of information processing and decision making, as also suggested by Leonard et al. (1999).

People-Oriented Behaviors

Given the strong focus on the people aspect of organizational behavior and management (e.g., Kouzes & Posner, 2002) and the increased use of teams in organizations to answer the ever more competitive challenges in the global marketplace, a good understanding of how cognitive styles influence interpersonal relationships is highly valuable. A number of studies have examined cognitive styles in relation to various aspects of people-oriented behavior and teamwork, including interpersonal behavior, dyadic relationships, team dynamics and processes, team role preferences, and team performance.

Interpersonal Behavior

Starting from the premise that cognitive style differences may fundamentally affect the nature of interpersonal relationships, researchers looked at cognitive styles in the context of interpersonal behavior. Research with the CSI found that people with a more analytical style tended to be more task oriented, relatively less friendly, more impersonal, and more self-controlling in their emotional behavior. Intuitive people were more interpersonally oriented, expressive, relatively friendly, warm toward others, and serving more psychosocial functions during interpersonal relationships (for an overview of these findings, see Armstrong, 2000; Armstrong & Priola, 2001; Priola, Smith, & Armstrong, 2004). In their qualitative study on the link between cognitive styles (using the CoSI) and managerial behavior, Cools and Van den Broeck (2008b) found that people with a knowing and planning style both preferred a rational and straightforward way to deal with others, although planners were more inclined to handle conflicts and to give feedback in a diplomatic way, whereas knowers purely focused on the rationality and logic of the situation. People with a creating style tended to be more emotionally involved, using a personal approach in handling conflicts and feedback situations.

Dyadic Relationships

Several researchers examined the influence of style (dis)congruence on dyadic relationships (e.g., student–supervisor, mentor–protégé) (e.g., Allinson, Armstrong, & Hayes, 2001; Armstrong, Allinson, & Hayes, 1997, 2002, 2004; Witkin &

Goodenough, 1977). Cognitive similarity is expected to yield smoother interactions and positive mutual feelings among people due to shared interests, common personality characteristics, and similar ways of communicating (Witkin & Goodenough, 1977), whereas cognitive dissimilarity may result in conflict because style differences lead to different interests, values, and problem-solving approaches. Some studies indeed found that cognitive style congruence led to satisfaction with the relationship, high performance, mutual understanding and liking, effective interpersonal relations, and good communication (for an overview of these studies, see Allinson et al., 2001; Armstrong, 2000), although other studies observed opposite results. Armstrong et al. (2002), for instance, found only partial support for the congruence hypothesis, and Armstrong et al. (1997) did not find support in their study for the beneficial impact of style congruence (using the CSI) on the quality of the relationship between students and supervisors in an educational context. Cheng, Luckett, and Schulz (2003) found higher performance on a complex decision task for dissimilar dyads than for dyads with a similar cognitive style (measured with the MBTI). These latter studies suggest that dissimilarity between people may, under particular circumstances, lead to more positive outcomes than similarity.

Other researchers focused specifically on the relationships between cognitive style and leader–subordinate relations. Atwater and Yammarino (1993) found that MBTI feeling-type leaders were rated more highly on transformational and transactional leadership by both superiors and subordinates than thinking types. Allinson et al. (2001) found intuitive leaders (assessed by the CSI) to be less domineering and more nurturing in leader–member exchange (LMX) relationships than analytic leaders. Intuitive leaders were also better liked and more respected by analytic members than analytic leaders were by intuitive members. In contrast, Suazo, Turnley, and Mai-Dalton (2008) found that congruence of style is associated with higher-quality leader–subordinate relationships, with concomitant effects on interactions and communications reducing the likelihood of subordinates believing that psychological contracts have been violated.

Teamwork

Three types of studies have been conducted on cognitive styles in teams. These include the influence of cognitive-based team composition on the team processes and dynamics, its impact on the team's performance, and the relation between cognitive styles and team role preferences.

With regard to the link between cognitive styles and team behavior, Armstrong and Priola (2001) found that intuitive team members (using the CSI) in self-managed work teams contributed more socioemotional-oriented (i.e., interactions concerned with group solidarity and attraction between members) and more task-oriented acts (i.e., interactions focused on task attainment) than analytical team members did. As the latter aspect was contrary to their hypothesis, they attributed this to the nature of the task facing the teams, which was relatively unstructured and organic. Priola et al. (2004) tested this assumption further, using a more structured and mechanistic task. They found that intuitive individuals (using the CSI) could

neither relate to the task nor find a solution; analytics implemented the logical process necessary to solve the problem, while intuitives focused on maintaining group cohesiveness and the integrity.

Looking at the link between cognitive styles and team outcomes, Basadur and Head (2001) concluded that heterogeneity in cognitive styles had a positive effect on team performance in a creative problem-solving task and homogeneity of cognitive styles in a team led to less time needed to complete the task. In a study using project teams composed of different MBTI types, White (1984) also concluded that the more heterogeneous teams (i.e., containing four different types) were more successful than the less heterogeneous teams (i.e., containing two different types) in their systems development activities. Volkema and Gorman (1998) found no main effect of cognitive-based team composition (i.e., four-person homogeneous or heterogeneous teams with regard to cognitive styles) on decision performance. However, they did find that teams that were composed of diverse MBTI styles contributed significantly more and diverse types of objectives within the problem-formulation phase than homogeneous teams, which had a positive impact on team performance. In contrast, Hammerschmidt (1996) found that eight-person teams with a large cognitive gap (i.e., cognitive style differences of more than 20 KAI points between the four-person planning subteam and the four-person implementing subteam in his perspective) had lower success rates than more homogeneous teams. Karn, Syed-Abdullah, Cowling, and Holcombe's (2007) study of team cohesion and performance in software engineering teams found highest-performing teams to be predominantly MBTI intuitive–thinking types (typical for engineers), and stylistically heterogeneous teams experienced more conflict and performed significantly worse than homogeneous teams.

Two studies explored the relationship between Belbin's (1981) Team Role Preferences Inventory (BTRPI) and Kirton's (1976) Adaption–Innovation Inventory. Fisher, Macrossan, and Wong (1998) hypothesized a correlation matrix with each of the Kirton subscales (sufficiency vs. proliferation of originality; efficiency; rule/group conformity) and the overall KAI score. Only 13 out of 24 subscale relationships were supported. In a later study, Aritzeta, Senior, and Swailes (2005) demonstrated stronger convergent validity between the KAI and the BTRPI. KAI subscale correlations were much more coherent than those reported by Fisher et al. (1998) and this was probably due to a misinterpretation of innovative and adaptive subscale scores on the part of these previous authors. Aritzeta et al. (2005) concluded that implementers, completer-finishers, team workers, and specialists will display an adaptive style; monitor evaluators and coordinators will act as bridges (moderating tensions occurring between high adaptors and innovators); and plants, shapers, and resource investigators will display an innovative cognitive style.

Conclusion and Implications

According to Berr et al. (2000), there is currently considerable interest in the potential impact of individual dispositions and preferences on organizational behavior and effectiveness. In terms of the relation between cognitive styles and people-oriented

organizational behavior, it is clear that cognitive styles influence how people relate to others. However, the implications for dyadic relations or teamwork processes and performance, given the unequivocal findings of the research reported, are far less clear. Parallel with the increased popularity of teams in organizations, research interest in team characteristics contributing to their effectiveness has grown strongly (Mathieu, Maynard, Rapp, & Gilson, 2008). The aim of this kind of research was to gain insight into the determinants of team effectiveness and ultimately to formulate recommendations for the design of high-performing teams. Despite a long-standing research history, no consensus has been achieved yet about whether team diversity has beneficial or hampering effects on team performance (van Knippenberg & Schippers, 2007). This inconsistency is also notable in the cognitive style research in this area, as there are no clear results about the effects of congruence or heterogeneity on dyadic relationships or teamwork in diverse contexts. Further research is needed to enhance our understanding of cognitive styles in interpersonal relationships, investigating socioemotional effects as well task-related performance (Allinson et al., 2001; Armstrong, 2000). Armstrong et al. (2004, p. 43) wrote: "Although cognitive style may indeed significantly affect the success of interpersonal dyadic relationships, the idea that these effects can be reduced to a straightforward matching hypothesis may be too simplistic when considered across different contexts." In this sense, the nature of the task the team has to perform or the nature of the relation (e.g., leader–member or mentor–protégé) seems to be very important to be taken into account in this type of research.

GENERAL CONCLUSION

Obviously, how people behave in their job and organization depends not only upon their intellectual styles but also on environmental factors and the interaction between their styles and environmental conditions. In this sense, many empirical studies within the intellectual styles domain have been concerned with investigating some kind of congruence or fit and its consequences for performance, as styles cannot be studied in isolation. These studies have, for instance, examined the impact of style (dis)similarity within interpersonal relationships, the effects of homogeneous versus heterogeneous cognitive-based teams, or the consequences of cognitive fit or misfit in terms of occupations and work demand. Altogether, these studies aim to increase our understanding of how to use cognitive styles effectively in practice. Suedfeld and Tetlock argued that despite the criticism on some theories of cognitive styles and the wide diversity of models there is "widespread recognition that attention to individual differences could help us to understand variation that otherwise had to be consigned to the category of noise'" (Suedfeld & Tetlock, 2001, p. 285).

However, on the downside, the results of styles research are not consistent and not conclusive in different areas, as a result of (1) the use of different cognitive style measures (with a predominance of the KAI in cognitive fit research, the MBTI in decision-making research, and the CSI in interpersonal research); (2) a lack of qualitative and longitudinal research; and (3) a lack of contextualization. Hence, considering the overall research base of this review chapter and the above encouraging

quote of Suedfeld and Tetlock (2001), following general recommendations to further improve the rigor and relevance of future style research in the area of WOP and management can be made: (1) increase the number of qualitative and mixed-method studies in this field of study, (2) stimulate a longitudinal perspective to examine the malleability and impact of styles in occupational settings, (3) encourage a better contextualization of style research through field research and international comparative studies, and (4) replicate and extend findings of previous research using different style instruments. Moreover, further theoretical developments are also particularly important to come to conceptual integration within the "intellectual styles" field, as this will lead to a more coherent and justified field of study within the broader context of individual differences psychology in general and WOP in particular. In this sense, the work of Zhang and Sternberg (2005) about types of thinking styles, of Sadler-Smith (2009) about dual-processing theory, and of Rayner and Peterson (2009) about a four-layered model of individuals' learning performance represent recent efforts to develop integrated style models and need to be encouraged. Together, these recommendations can stimulate further insights into the impact of the context on people with diverse cognitive styles, acting individually or in interaction with others, in diverse settings.

ACKNOWLEDGMENT

Special thanks to Jana Deprez, Marc Buelens, Eugene Sadler-Smith, and the three book editors for their helpful comments on earlier versions of this review.

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17

Intellectual Styles in Members of Different Professions

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Intellectual style has attracted the interest of applied fields (such as education, management, or vocational guidance) due to its predictive power of an individual's success on real-life tasks in organizational, educational, and professional settings (e.g., Bernardo, Zhang, & Callueng, 2002; Cools, Van den Broeck, & Bouckenooghe, 2009; Sadler-Smith & Badger, 1998; Streufert & Nogami, 1989; Zhang & Sternberg, 2006). However, there is still a lack of theoretical perspective and systematic empirical evidence on the relationship between intellectual style and professional specialization. This chapter will review research examining the relationship between different dimensions of intellectual style and professional specialization.

The term "intellectual styles" is defined as "individuals' preferred ways of processing information" (Zhang & Sternberg, 2005), and includes constructs such as learning styles, thinking styles, and cognitive styles. The current chapter focuses specifically on *cognitive style*, which has traditionally referred to a psychological dimension representing consistencies in an individual's cognitive functioning, particularly with respect to perceiving, acquiring, and processing information (Ausburn & Ausburn, 1978). Studies on cognitive styles have accumulated evidence regarding the connection between an individual's style and the requirements of different social groups from parent–child relationships (Witkin, 1954) to professional societies (Agor, 1989; Kirton, 1989; Kolb, Boyatzis, & Mainemelis, 2001; Zhang & Sternberg, 2006) suggesting that cognitive styles, although relatively stable, are malleable, and can be modified through adaptation to changing environmental and situational demands (Klein, 1951). Recent reviews on cognitive styles (e.g., Kozhevnikov, 2007; Moskvina & Kozhevnikov, 2011) have suggested refining the previous definitions of cognitive styles to account for requirements imposed by social–cultural environments, including educational and professional groups as well as by a larger-scale sociocultural environment in general (e.g., Agor, 1989; Alloy et al., 1999; Kirton, 1989; Peterson et al., 1982). Thus, the definition of cognitive style was expanded to "a relatively stable complex of patterns in an individual's cognitive functioning, which develops as an interaction between an individual's characteristics (e.g., general intelligence, personality) and the environment (e.g., education, formal/informal training, cultural and social settings)" (Kozhevnikov, 2007, p. 477).

The "environmental layers" that affect the formation of cognitive style, according to cognitive style research are: (1) familial (Witkin, 1954), which represents the influence of an individual's immediate surroundings on his or her cognitive style; (2) educational (Frank, 1986; Saracho, 1997), which represents influences of different educational systems and social groups on an individual's patterns of information processing; (3) professional, which represents the influence of professional environments on an individual's cognitive processing (Agor, 1989; Hayes & Allinson, 1998); and (4) sociocultural (Varnum, Grossmann, Kitayama, & Nisbett, 2010; Vygotsky, 1984), which represents the influence of global cultural context on cognitive functioning. The goal of this chapter is to examine how different aspects of cognitive style relate to professional specialization. Professional specialization has been chosen as the focus of this chapter because it reflects environmental factors transcending culture, facilitates certain types of information processing, and promotes common problem-solving techniques within professional groups.

The chapter will review previous research and present new evidence that compares the cognitive styles of members of different professions and will discuss key differences in cognitive style characteristics between members of different professional fields across different cognitive style dimensions. Although there are some research data that show that level of professional training has a significant impact on the formation of cognitive styles of members of different professions (e.g., Hayes & Allinson, 1998; Kolb et al., 2001; Sofman, Hajosy, & Vojtisek, 1976), a systematic investigation of the relationship between professional specialization and cognitive style is yet to be conducted. Currently, there are almost no studies that systematically examine interactions between cognitive style and professional environment. Research on the relationship between cognitive styles and professional specializations has generally proven quite challenging due to problems in the theory and measurement of both of these constructs. As several major reviews on cognitive styles have pointed out (Kozhevnikov, 2007; Sternberg & Grigorenko, 1997), the field is still lacking a coherent unifying theory, and there is no consensus in the literature as to how different cognitive style dimensions should be classified. Likewise, the classifications and definitions of various professional disciplines and their borders are debatable and inconsistent across theoretical taxonomical approaches or academic divisions, so that classifications of professional fields are often based on convenience, convention, or tradition (e.g., the Standard Occupational Classification System used in the United States and some other countries), all of which may differ depending upon culture, training, or niche within a field or institution.

Previous research has proposed theories regarding the relationship between one's chosen profession and cognitive styles; for example, Holland's (1973) theory of vocational choice proposed an occupational classification system that described six career personality types congruent with certain sets of work environments, suggesting that individuals achieve the greatest overall success when their cognitive style is matched with the preferred processing domain of their field of choice. However, this theory has been criticized for lacking generalizability and cross-cultural validity (Elosua, 2007; Leong, Austin, Sekaran, & Komarraju, 1998; Long & Tracey, 2006). Another popular approach is to provide vocational guidance based on personality/cognitive style characteristics based on the Myers-Briggs's Type

Indicator (Myers, McCaulley, Quenk, & Hammer, 1998). However, the inventory was also criticized for its lack of generalizability to different settings, such as sociocultural environments, and for its construct validity (Bess & Harvey, 2002; Boyle, 1995; Nowack, 1996). Overall, the apparent weaknesses of previous research on the relationship between cognitive styles and professional specialization are that it lacks a theory consistent with contemporary cognitive science approaches. Furthermore, such research has often been conducted only within single, narrow professional groups, such as different types of managers (Plovnick, 1975), engineering students (Felder, Felder & Dietz, 2002), or subspecializations of medical or teaching students (Frank, 1986; Riding & Wheeler, 1995), which limits the generalizability of these results, and thus hinders the production of a general theory with strong predictive value.

This chapter uses an approach for selection and classification of the professional groups based on contemporary information-processing theories that distinguish among three distinct processing systems: *verbal* (comprehension and production of spoken and written language), *visual object* (processing of visual appearance of objects and scenes in terms of their shape, color, and texture), and *visual spatial* (processing of location, movement, spatial relationships, and transformations). These systems encode and process information in fundamentally different ways, and are neurologically underpinned by different brain areas (Cabeza & Nyberg, 2000; Farah, Hammond, Levine, & Calvanio, 1988; Kosslyn, Ganis, & Thompson, 2001; Levine, Warach, & Farah, 1985; Mazard, Tzourio-Mazoyer, Crivello, Mazoyer, & Mellet, 2004). Recent research indicates that visual artists tend to predominantly rely on visual–object information processing, scientists tend to predominantly rely on visual–spatial information processing, and humanities specialists tend to predominantly rely on verbal processing (Blazhenkova & Kozhevnikov, 2010; Blazhenkova & Kozhevnikov, 2009; Kozhevnikov, Blazhenkova, & Becker, 2010; Kozhevnikov, Kosslyn, & Shephard, 2005).

Consistent with the above cognitive theories, this chapter classifies professions into three broad categories, which reflect the different modes of information processing (i.e., visual–object, visual–spatial, and verbal). The chapter will focus on the following three specialization fields: *visual and performing art*s (e.g., visual art, design, film, and theater); *natural science and technology* (e.g., natural science, computer science, and engineering); and *humanities and social sciences* (e.g., philosophy, history, linguistics, and journalism). Because this approach is based on cognitive sciences theories, this chapter is primarily interested in specialization fields that reflect fundamental ways of knowing or modes of thought, such as academic disciplines that encompass core branches of human knowledge and creative advances (i.e., art, science, and humanities), rather than specific or applied professional and nonacademic fields (e.g., management, administration, military service, social or clerical work, sales).

The cognitive styles of these professional groups will be examined from the perspective of Nosal's cognitive style model, which appears to be one of the most promising existing models of cognitive style in that it takes into account the complex structure and multidimensionality of the cognitive style construct, and is based on an information-processing approach. This hierarchical, multidimensional model suggests that cognitive styles can be grouped into overarching cross-dimensions

that represent consistencies in cognitive functioning operating at different levels of information processing. Since the 1980s several attempts have been made to systematize the variety of cognitive styles into unifying models aiming to identify structural relationships among different cognitive style dimensions (Grigorenko & Sternberg, 1997; Allinson & Hayes, 1996; Miller, 1987, 1991; Riding & Cheema, 1991; see also Kozhevnikov, 2007; Zhang & Sternberg, 2005, for reviews). For example, Allinson and Hayes (1996) proposed that the different dimensions of cognitive style can be considered as variations of an overarching analytical–intuitive dimension. Others characterize cognitive style as consisting of two orthogonal dimensions, such as holistic–analytical versus visualizer–verbalizer (Hodgkinson & Sadler-Smith, 2003; Riding & Cheema, 1991). However, these models of cognitive style were too simplistic; they tried to reduce cognitive style to a limited number of dimensions rather than build a theory that systematizes known styles into a multidimensional structure. Sternberg's multidimensional model of mental self-government (Sternberg, 1997) was one of the first models that attempted to account for the complexity of the cognitive style construct, as well as its hierarchical structure. However, Sternberg's model was not explicitly based on an information-processing approach, and proposed new cognitive style dimensions rather than systematizing existing cognitive style dimensions. Generally, models of cognitive style do not consider cognitive style in the context of information-processing theories; neither do they attempt to relate cognitive styles to other psychological theories, nor fully account for the complexity of the cognitive style construct. Miller (1987, 1991) was the first to consider cognitive style in the context of information processing, and proposed that cognitive style consisted of a horizontal analytical–holistic dimension and a vertical dimension representing different stages and levels of information processing, such as perception, memory (representation, organization, and retrieval), and thought. However, Miller's model has been criticized for its lack of empirical support, and that the placement of cognitive style dimensions into the model is based more on convenience than on research (Messick, 1994; Zhang & Sternberg, 2005).

Finally, Nosal (1990) proposed a multidimensional hierarchical model of cognitive style that systematized cognitive style dimensions based on cognitive science theories. Specifically, the model proposes that the variety of cognitive styles can be arranged into a matrix (Figure 17.1). The horizontal axis of the matrix represents

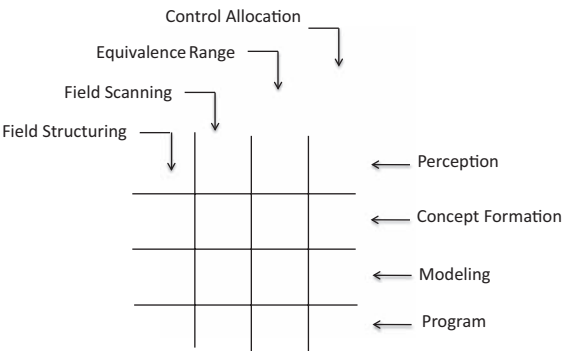

FIGURE 17.1
Nosal's model of cognitive style.

four hierarchical levels of information processing: *perception* (processing of primary/early perceptual information), *concept formation* (formation of conceptual representations in the form of symbolic, semantic, and abstract structures), *modeling* (organizing personal experiences into "models" or "theories"), and *program* (goal-directed activity and metacognitive approaches used for complex decision-making and behavioral programming. The vertical axis represents four major types of stylistic cross-dimensions that reflect different kinds of regulative mechanisms, and represents the major clusters around which all cognitive style dimensions can be placed. The four cross-dimensions of Nosal's model are (1) *"eld structuring (context dependent vs. context independent)*, which describes a tendency to shift attention to perceiving events as separate versus inseparable from their context; (2) *"eld scanning (rule-driven vs. intuitive)*, which describes a tendency for directed, driven by rules, versus aleatoric, driven by salient stimuli, information scanning; (3) *equivalence range (compartmentalization vs. integration)*, which represents a tendency to process information as global units (simultaneous) or part by part (sequential), and (4) *control allocation (internal vs. external locus of processing)*, which describes methods of self-monitoring and regulation of cognitive activity (locating criteria for processing at the internal vs. external center).

In this chapter, we describe characteristic cognitive styles differences found among artists, scientists, and humanities professionals at each of the four cross-dimensions of Nosal.

DIFFERENCES BETWEEN MEMBERS OF DIFFERENT PROFESSIONS IN FIELD STRUCTURING (CONTEXT INDEPENDENCE VS. CONTEXT DEPENDENCE)

Field structuring, according to Nosal's theory, describes a bipolar dimension in which individuals tend to perceive events as separate versus inseparable from their physical, temporal, or even semantic contexts. For example, on the perceptual level, field structuring is reflected by the *"eld-dependence (FD) versus "eld-independence (FI)* dimension, which corresponds to the level to which an individual's perception is influenced by the surrounding context; it is often measured using the Embedded Figures Test (EFT) (Witkin, Oltman, Raskin, & Karp, 1971).

There is a large body of research that demonstrates the relationship between FI and specialization in science, indicating that *scientists tend to be more FI* than humanities and social science professionals (Frank, 1986; Leo-Rhynie, 1985; Rai & Prakash, 1987; Sofman et al., 1976; Verma, 1984; Witkin, Moore, Goodenough, & Cox, 1977a; Witkin et al., 1977b). For example, Witkin et al. (1997a) reported that FI students' choices of college majors and graduate/professional school concentrations tended to favor domains requiring cognitive restructuring skills, such as the sciences, while FD students tended to select domains that do not emphasize such skills, such as elementary school education. Rai and Prakash (1987) studied the relationship between FD and FI cognitive styles and choice of major using the EFT, and found a positive relationship between an FI cognitive style and choice of a natural science major, while an FD cognitive style was prevalent among social science majors. Similarly, Morgan (1997) noted that FI students tend to select fields of study in the

sciences, while FD students tend to select fields in human services, such as teaching and social work.

Research comparing scientists and artists along the FD/FI independence dimension revealed a significant difference on the EFT, favoring scientists (e.g., Verma, 1984). Leo-Rhynie (1985) investigated differences between students who select science or arts courses, and showed that the science-emphasis group obtained significantly higher scores on the EFT than the arts-emphasis group. Nevertheless, despite the fact that scientists seem to be, as a group, higher in FI than members of other professional groups, and higher than artists in particular, artists have shown higher FI than some other professional groups. For example, Jia, Jian-Nong, Hui-Bo, and Fu-Quan (2006) found differences in FI between children enrolled in art classes and those not enrolled in art classes, with the art group scoring higher in FI. The same study also reported differences between groups with more versus less experience in art (Grade 3 art students had higher scores than Grade 1 art students), and concluded that level of art education tends to foster FI. Also, Leo-Rhynie demonstrated that FI was related to A-level success, regardless of whether students pursued arts- or science-intensive courses, and Fergusson (1992, 1993) found that FI scores were correlated with artistic ability and grade point average (GPA). Copeland (1983) found that art appreciation students with higher EFT scores received higher course grades than students with lower EFT scores. Similarly, in other artistic domains, such as music, Ellis (1995) found that FI nonmusic majors were significantly more accurate on discriminating between various musical textures. In summary, the results of the above studies indicate that field independence may be related to both scientific and artistic specializations, and is affected by an individual's level of experience in the field.

Data from a recent qualitative interview study reported in Blazhenkova and Kozhevnikov (2010) provide evidence that scientists tend to be context independent not only in perception (as in the case of the FI/FD style) but also at the higher levels of information processing (e.g., concept formation, modeling). For example, scientists are usually able to withstand or ignore the influence of context during their professional problem solving: "I want to make everything clear, and to think without being distracted by unrelated concepts" (physicist). As for visual artists, the results of the interviews indicate that although they are also able to discriminate events and objects from their context, they may allow context to influence their perception and art production, while being attentive to both context and events: "I can vividly see in my mind what I want to do, but the material itself can tell me what to do . . . For example, if I work with woods, the texture and curves modify what I have in mind." Overall, it appears that visual artists and scientists have *qualitatively different* attitudes toward context: While scientists attempt to control for contextual confounds and rule out the influence of context, visual artists use the context as a source of inspiration for their work and are open to change their work depending on the context.

As for humanities professionals, although the evidence from FI/FD studies suggests that they show more context dependence at the perceptual level, the evidence from qualitative interviews (Blazhenkova & Kozhevnikov, 2010) suggests that humanities professionals, as a group, may also have different attitudes toward

context, depending upon the goal of the task at hand and their specific field. In particular, more artistically oriented humanities professionals, such as creative writers, poets, or journalists may exhibit context dependence, for example, "Context details play an enormous role, you never know how your storyline may turn out . . . it may be that some detail on the background became a main plot" (journalist). Conversely, scientifically oriented humanities professionals, such as linguists, historians, or philosophers seem to demonstrate greater context independence, for example, "If you can't see the forest for the trees, you can't understand material and can't structure your ideas" (historian).

Overall, the data from the reviewed studies suggest that, while scientists tend to be context independent at all levels of information processing, and even consciously ensure that they "separate the wheat from the chaff," visual artists, at the highest levels of information processing (modeling, programming), may be able to intentionally allow or prevent context from leading their works, while being consciously aware of contextual influence. As for humanities professionals, although they are usually found to be context dependent on perceptual tasks, they may appear at either pole of this dimension at higher levels of information processing, depending upon their exact specialization.

DIFFERENCES BETWEEN MEMBERS OF DIFFERENT PROFESSIONS IN FIELD SCANNING (RULE-DRIVEN VS. INTUITIVE INFORMATION SCANNING)

This cross-dimension describes an individual's tendency toward directed (driven by rules) versus aleatoric (driven by salient characteristics or relying on heuristic evidence) information scanning. *Extensive versus limited range of scanning* (Gardner, 1953) is an example of this cross-dimension operating at the perceptual level, and refers to a preference for attending solely to a narrow bandwidth of relevant information, or to a broad, even "incidental" bandwidth, attending to many facets of the environment, including those that may not be relevant. At the higher levels of information processing (concept-formation, modeling), this cross-dimension reflects traditional cognitive style dimensions such as *convergent versus divergent* (Hudson, 1966), *rational versus experiential* (Epstein, Norris, & Pacini, 1995), and *systemizing versus empathizing* (Baron-Cohen, Knickmeyer, & Belmonte, 2005) as well as *intuition analysis* (Allinson & Hayes, 1996) cognitive styles. Ultimately, this cross-dimension describes two opposite cognitive profiles that manifest themselves on a number of related styles: an intuitive (divergent, experiential, empathizing) approach that relies more on more experiential heuristic evidence, involves sensitivity to one own and others' thoughts, and a rule-driven (rational, analytic, systematizing, convergent) approach that relies on reason and logic.

Traditionally, science has been thought of as favoring analytic methods and art as favoring intuitive methods. In fact, the review of the previous cognitive style research indicate that the cognitive styles of artists have usually been characterized as perceiving and intuitive rather than judging (Csikszentmihalyi, 1996; Dewey, 1958; Gridley, 2006), while scientists were often viewed as primarily analytical thinkers (Galton, 1880). This distinction has been supported by empirical

evidence: Billington, Baron-Cohen, and Wheelwright (2007) found that the systemizing versus empathizing cognitive style predicted entry into either physical sciences or humanities, respectively. Zeyer (2010) found a correlation between the motivation to learn science and the systemizing cognitive style, but no correlation between the motivation to learn science and the empathizing style. Hudson (1966) found differences between professionals in convergent/divergent cognitive styles: There were more convergers (3–4 per diverger) in the physical sciences, including mathematics, physics, and chemistry, and the opposite (3–4 divergers per converger) in the case of humanities and art specializations (including arts, history, English literature, modern languages), while a relatively equal proportion of divergers and convergers was found in biology, geography, and economics.

The data from a qualitative interview study, partially reported in Blazhenkova and Kozhevnikov (2010), provided further support for the above findings and indicate that scientists tend to scan information more analytically, while artists scan information in a more aleatoric and intuitive way. Blazhenkova and Kozhevnikov suggested that visual artists intentionally experiment with their works, using their mental imagery to understand meaning. However, artistic experimentation is not rule driven, but is largely based on intuition and subjective aesthetical feeling, rather than on a logical, rational approach. For example: "My work is getting transformed if I don't feel it right . . . I need to catch the feeling what it should and then I can draw" (visual artist). The reports of scientists are very different and often emphasize a logical rule-based approach: "The emotional images may only distract from work, I need pure clearness in my mind in order to think logically" (physicist).

Despite the reported differences between the analytical, rule-based approach style adopted by scientists and the intuitive style adopted by artists, there is also substantial evidence suggesting the great role of intuition in scientific work, especially for discovery and for establishing a global view of a problem, as demonstrated by the words of many prominent scientists: "I believe in intuition and inspiration . . . At times I feel certain I am right while not knowing the reason"; "The intuitive mind is a sacred gift and the rational mind is a faithful servant. We have created a society that honors the servant and has forgotten the gift" (Albert Einstein); "It is by logic that we prove, but by intuition that we discover" (Henri Poincaré). Indeed, Miller (1996) described how different scientists may come to the same discovery using analytical or intuitive methods, thus suggesting that these methods may be equally important in science.

As for humanities professionals, the data of Blazhenkova and Kozhevnikov (2010) showed that they employ either analytical or intuitive approaches, depending upon their specialization and the task at hand. "I have a good intuition how to write and what about to write, and of course when I write about travel it helps a lot to vividly imagine this place, but if I write about something more boring I need to concentrate on the correct reasoning" (journalist). Also, other studies report that humanities professionals who engage in creative writing admit the great role of intuition in their work; for example, "One of the amazing things about what I do is, you don't know when you're going to be hit by an idea. You don't know where it comes from, I think it has to do with language" (poet Mark Strand, cited in Csikszentmihalyi,

1996). Additionally, research on cognitive style in organizational settings suggests that there is there is a positive relationship between the use of intuitive judgments and experience (Leybourne & Sadler-Smith, 2006), and that experienced managers are more likely to use an intuitive cognitive style. Moreover, experienced managers can make appropriate shifts in their style to fit the problem at hand (Robey & Taggart, 1981), and they are more likely to switch between analytic and intuitive processing strategies, depending upon the situation (Armstrong & Cools, 2009), reflecting an awareness of the optimal strategy for solving a particular problem.

Overall, the differences between professionals in the field scanning cross-dimension indicate that, although visual artists and scientists tend to occupy opposite poles of this cognitive style cross-dimension (artists appear to be intuitive/emotional and scientists appear to be rule-driven/rational), at the highest levels of information processing (e.g., programming), when scientists engage in a scientific discovery, or artists engage in art creation, or writers write a poem, an intuitive approach might be equally employed by all. Indeed, intuition may play a great role for scientists, especially for nonroutine or creative tasks, which require a global understanding of a problem. As for humanities professionals, they may belong to either (or occupy an intermediate) position on field scanning style poles, and may rely on more intuitive/rational processing, depending upon their specialization and current task (e.g., fiction or poetry vs. linguistics or philosophy). Thus, scientists and humanities professionals appear to be more flexible on the higher levels of information processing and may rely on both, or select between, analytical and intuitive approaches, while visual artists seem to rely on intuitive processing at all levels of information processing.

DIFFERENCES BETWEEN MEMBERS OF DIFFERENT PROFESSIONS IN EQUIVALENCE RANGE (COMPARTMENTALIZATION VS. INTEGRATION)

Equivalence range represents a tendency to prefer an integrative/synthesis approach versus a compartmentalized/analytical approach to information processing. This cross-dimension taps such cognitive styles as *leveling versus sharpening*, which reflects a tendency to exaggerate (sharpener) or minimalize (leveler) differences between stimuli (Klein, 1951) and operates on the perceptual level, and a number of other styles operating at the higher levels of information processing, such as *global versus local* (Kimchi, 1992), or *holism versus serialism* (Pask, 1972), which reflects a tendency to process information as discrete global units versus as sequences of parts. A preference for an integrative approach may facilitate faster information processing and depend upon broad, inclusive categorization (simultaneous), while part-by-part (sequential, compartmentalized) processing may operate slower and depend on narrow, discriminative categorization.

To our knowledge, there has still not been much research on professional differences along the styles in this cross-dimension. There is some research evidence that suggests the links between holistic processing and emotional processing. Understanding emotions was found to predict scores for scholastic achievement in art (Downey, Mountstephen, Lloyd, Hansen, & Stough, 2008). Visual artists are usually

more skilled in emotional processing of pictures than scientists or humanities professionals (Blazhenkova & Kozhevnikov, 2010), suggesting that they might rely more on holistic information processing beneficial for perceiving emotions. More direct research evidence on the differences between members of different professions of this cross-dimension was reported by Kozhevnikov et al. (2005), who found that visual artists were more accurate on tasks tapping visual–object ability as object recognition in a background of visual noise (e.g., recognizing the global shape of an object in a noisy picture) while scientists were better on tasks that require sequential spatial transformations (e.g., mental paper folding). Furthermore, Blazhenkova and Kozhevnikov (2010) demonstrated that visual artists were faster than scientists across a range of visual tasks, which might be explained by their holistic approach to visual information processing. In contrast, scientists apply a more sequential visual–spatial processing approach, and generate images part by part, so that their response time was usually longer than that of artists, but their images were more flexible.

Furthermore, a number of studies (Blazhenkova & Kozhevnikov, 2010; Kozhevnikov et al., 2005) indicate that differences between visual artists and scientists along the sequential versus holistic dimension appear not only at the perceptual level, but also extend to complex problem solving, such as abstract conceptual processing and approaches implemented in professional creative work. Kozhevnikov et al. found that visual artists tend to interpret abstract kinematics graphs (position vs. time) as holistic pictorial illustrations of an objects' motion, and when describing the actual motion of the object depicted by a graph, tend to use the *global shape* of the graph itself to describe the object's trajectory. In contrast, scientists were able to interpret graphs as abstract representations, considering them part by part, and analyzing the depicted motion in a stepwise fashion. Furthermore, Blazhenkova and Kozhevnikov (2010) demonstrated that visual artists and scientists tend to implement similar sequential versus holistic processing approaches, respectively, when interpreting abstract art. In contrast to the visual–spatial domain, in which a holistic approach hinders the processing of abstract visual–spatial information, in the visual–object domain, visual artists benefited from employing a global–holistic approach when interpreting abstract art. As a result, visual artists provide more comprehensive and abstract interpretation of abstract art (e.g., "crash and liberation, breakthrough and extreme tension") than scientists or humanities professionals, who used a sequential approach and described abstract art pieces as conglomerations of local features without making sense of the whole (e.g., "different colors: blue, black, red, yellow, white; sharp edges in red" or "some shapes, no order").

Blazhenkova and Kozhevnikov (2010) further supported the differences in holistic versus sequential processing between artists and scientists, by demonstrating that visual artists describe their processing in terms of discrete units with complete structures that convey the entirety of a concept or image. For example, "The image comes right away I see the apartment, it is immediately decided. I see how it would overall look like in the beginning" (interior designer) or "Image comes in flash, it's almost a little muse, so real you just have to grab the idea and visualize it" (visual artist). Some artists even reported that when they generate an image as a whole with all its properties, their processing is holistic to the degree that details

may even include a specific type of media (e.g., specific types of paint, wood/stone) in which the piece might be created. For example, "When I think of a future sculpture, I already know the type of stone that I am going to use, it appears in the form of specific material from the beginning in my mind" (sculptor). In contrast, scientists tend to process information sequentially, part by part. Unlike visual artists, scientists reported difficulty in processing their images and concepts holistically. For example, "When I work on assembling different optical units, I imagine how to assemble and fix them and put them on the optical table, how to tune them and it goes to more and more details, and sometimes I realize it is impossible to do. I don't see the whole thing from the beginning, actually I was thinking about separate parts, one after another" (physicist) or "I see a sequence of images, like a recipe for cooking soup" (physicist).

Humanities professionals mostly reported sequential strategies in information processing (Blazhenkova & Kozhevnikov, 2010). For example, "If I read some analytical text I imagine structural schemas . . . I imagine arrows that connect different parts" (linguist) or "When I read a historical text I imagine the epoch, the image appears immediately, but not very bright, though, like a background . . . and if I have to analyze the text, I investigate the historical periods, so I see images part by part. There are images of logical structure, like square boxes and connecting lines" (historian). However, despite the sequential nature of the text, humanities specialists in some cases may report using nonsequential approaches: "When I write, I don't always write one sentence after another and so on . . . from the begging to the end . . . actually, I have the overall global idea, so I can jump to different places of my text while keeping this idea in mind. And while idea develops I can move parts around, and in when finalizing, I can also jump from one place to another to refine the wording" (journalist); such a strategy is similar to visual artists' characteristic strategy of drawing from different noncanonical parts of a picture, which can be governed by a holistic idea or image (Winner & Martino, 2003).

Overall, research demonstrates significant differences between artists and scientists *at all levels* of information processing; while visual artists tend to prefer global, holistic, integrative information processing, scientists tend to process in a compartmentalized way (Blazhenkova & Kozhevnikov 2010; Kozhevnikov et al., 2005). This substantial difference may be largely determined by the prevalent types of processing in these domains: visual–spatial and visual–object. Research on visual imagery (Kozhevnikov et al., 2005) suggested that object representations are formed on the basis of individual *holistic* perceptual units stored in visual memory, whereas spatial representations are formed by using spatial representations to arrange components *sequentially*. Furthermore, on a larger scale, the differences between art and sciences as disciplines of knowledge support the distinction between integrative versus compartmentalizing approach of artists and scientists; since every piece of art is a single complete holistic and valuable entity by itself, whereas scientific work is just a link in the chain of the preceding and subsequent works of many authors.

Verbal representations were suggested to rely a sequential processing approach due to the *sequential* structure of human speech (Paivio, 1971), and this would explain why humanities professionals prefer sequential over holistic processing. However, as it was mentioned, although humanities professionals may process information

more sequentially during routine reading and writing (as governed by the sequential nature of language), they may have more holistic processing depending on the context and task (e.g., when writing poems or recalling inspiring scenes), and appear to be more flexible in the choice of strategy on the higher levels of processing.

DIFFERENCES BETWEEN MEMBERS OF DIFFERENT PROFESSIONS IN CONTROL ALLOCATION (INTERNAL VS. EXTERNAL LOCUS OF PROCESSING)

Control allocation describes methods of monitoring and regulation of cognitive activity (locating metacriteria for processing at the internal vs. external center), and includes cognitive style dimensions such as *re"exivity versus impulsivity* at the perceptual level, which is defined as the preference to make fast but error-prone judgments, or slow, reflective, and error-resistant judgments as well as *internal versus external locus of control* (Rotter, 1966), which operates primarily at the program level, and reflects the tendency of an individual to attribute the cause of events as originating within or beyond his or her agency. Together, the cognitive style dimensions that fall into this cross-dimension reflect an overall distinction between "external" versus "internal" control allocation. An "external" control allocation style reflects a tendency to perceive events as happening outside of one's realm of influence. The information processing in external styles is often "set" upon its generation, and is resistant to manipulation by the individual. In contrast, an "internal" control allocation style reflects an individual's tendency to realize his or her influence on the environment, and to attribute events as caused by himself/herself. Individuals with an internal control allocation style find their thoughts and concepts easy to manipulate, as they are generated by, and are fully under the control of, that individual.

Most research on control allocation in different specializations has examined students of various academic majors and their differences in locus of control, the highest-order style within this cross-dimension (Coperthwaite, 1994; Light, Purcell, & Martin, 1986). Overall, internal locus of control has been associated with interest and achievement in science, as well as being recommended as a teaching strategy for science educators (Scharmann, 1988). Moreover, using science activities has been suggested to promote the development of an internal locus of control in educational contexts (Rowland, 1990). However, most of the above studies were conducted within narrow professional groups, and lack generalizability to other domains. For example, Madsen and Goins (2002) investigated the relationship between locus of control (internal vs. external) and chosen field of music specialization (music therapy majors, music education majors, applied music majors, and nonmusic majors who also had previous music background and were currently enrolled in a formal college music performance organization). Their results indicate that music therapy and music performance majors had a significantly lower internal locus of control compared to music education majors and nonmajors. Additional evidence on the relationship between locus of control and specialization comes from research on personality: Boone, van Olffen, and Roijakkers (2004) considered locus of control as a personality trait, and found that it predicted different levels of rationality in the educational choice process leading to different prospective professional

careers. They suggested that the locus of control personality trait is crucial because of its direct relevance in both content and process of choice.

The analyses of different professionals' qualitative interviews (Blazhenkova & Kozhevnikov, 2010) indicate differences in *control allocation* among visual artists, scientists, and humanities professionals. Most visual artists attributed the conception of their work-related thoughts as spontaneous, uncontrolled, outside of, or even against their own conscious wills. They reported that inspiration can come to them almost constantly, and may be triggered by their life and work events, emotional experiences, and visual experiences. Many visual artists feel that the visual images they use for work are generated not of their own volition, and that their images come from an independent objective reality an "image-space" that persists beyond and independently of the individual. For example, "There are images that come from nowhere …" (visual artist), "I never really forget about my first idea. So … I always have this image in my head of what I want to do, or this feeling that I want to express. I always have a visual image in my head, no matter what like … it's just, it's always there" (visual artist). In contrast, scientists reported that they were in complete control of working with their ideas, in terms of both frequency/time of occurrence and content. Because the scientists' use of information processing involves performance of routine work-related tasks, it is not surprising that they are in control of both the occurrence and content of their thoughts. Humanities professionals reported having mixed or external locus of control, depending upon the situation and the task at hand; e.g., "Pictures just happen to jump into my mind as a result of thinking of something … When I need to think about structure of my lecture, I purposefully imagine something like a schematical outline of a lecture" (historian).

Overall, the reviewed data suggest significant differences between members of different professions in control allocation at all levels of information processing; artists' cognitive styles can be characterized as "external" (external locus of control), while scientists' styles can be categorized as "internal" (internal locus of control). Humanities professionals can have mixed, either external or internal, styles while processing information. Overall, the collected evidence on control allocation suggests that described differences in internal/external control of professionals persist through all levels of information processing, especially between artists and scientists. The robust difference between artists and scientists may result from the difference in their sources of inspiration and target of their work: While scientists in their work intend to realize and control their influence on the environment (e.g., during experiments or analytical problem solving) and they have to attribute events as caused by their manipulations, visual artists tend to perceive events as happening outside of one's realm of control, even if those events take place within their individual minds.

SUMMARY

Overall, the review suggests that with respect to Nosal's model, visual artists and scientists tend to exhibit certain differences along all four cognitive style cross-dimensions. In particular, in the field structuring dimension, visual artists tend to

be more context dependent and scientists more context independent; in the field scanning dimension, visual artists tend to be more intuitive, and scientists more rule driven; in the equivalence range dimension, visual artists tend to process information as global units (integrative) while scientists tend to rely on a part-by-part (compartmentalized) approach, and in the control allocation dimension, visual artists tend to have more external while scientists have a more internal locus of processing. Furthermore, humanities professionals, as a group, seem to have a less determined style, and can fall into different positions at each of these cross-dimensions (i.e., individuals with a verbal processing style may perform a wide range of professional tasks), indicating that the style profiles of humanities professionals may depend on finer specific specializations (i.e., philosophers, historians, linguists may be closer in style to scientists, while journalists and creative writers may be closer in style to visual artists). Thus, it may be more difficult to use cognitive styles to predict professional specialization in the humanities. Indeed, research (Shea, Lubinski, & Benbow, 2001; Webb, Lubinski, & Benbow, 2007) has criticized the existing system of identification of giftedness and talent search programs (e.g., based on Scholastic Aptitude Test) that is mainly restricted to verbal and mathematical ability, and noted that verbal and quantitative abilities lack predictive validity in educational–vocational life choices, as compared to nonverbal visual–spatial ability that provides greater discriminative power.

Although the review indicates that there are differences in Nosal's cross-dimensions exhibited by artists and scientists, especially at the lower, perceptual levels of information processing, the differences between professional groups become less pronounced at the higher levels of information processing at the field structuring and field scanning cross-dimensions. In the field structuring dimension, similar to scientists, who clearly demonstrate high context independency, visual artists are also capable of being context independent (i.e., they are aware of contexts, attend to them, and may consciously decide to use or not use contextual features, or to let context drive or not drive their work). As for the field scanning dimension, similar to visual artists who demonstrate a clear preference for intuitive styles, scientists might exhibit intuitive style while performing higher-level tasks, such as catalyzing scientific discovery.

In contrast to the field structuring and field scanning cross-dimensions, more robust differences between visual artists and scientists were observed in the equivalence range dimension, in which artists consistently exhibited integrative styles while scientists consistently exhibited compartmentalizing styles across all levels of information processing. These more robust differences can be explained by the differences in the dominant representations underlying information processing in visual art and science domains (visual–object and visual–spatial). For example, visual–spatial representations that rely on comprehending the structure of a scene sequentially, part by part, may be beneficial for spatial tasks that are common for scientific work but not for visual art. In contrast, visual–object representations that are encoded as single, global, and inseparable perceptual units rich in pictorial information may benefit artists but hinder scientific thought. Thus, scientists might consistently rely on visual–spatial sequential information processing, while artists might develop consistent global information-processing approaches. For humanities

professionals, reliance on verbal representations seems to allow a greater degree of flexibility in choosing the "most appropriate," either sequential or global, approach. This may be explained in the light of Vygotsky's theory on mediated cognition (Vygotsky, 1986) that indicates that verbal thinking is mediated by immaterial concepts that allow more control and flexibility in manipulation of these representations as compared to visual representations that are more immediate and more limited by their physical properties.

The differences between the members of different professions in the "control allocation" dimension were also significant. This can be explained by the differences in inspiration sources to propel information processing; visual artists rely on sudden "flashes," subjectively perceived as coming from outside, unintentionally changing or persisting, and governed by media in which art piece is being created, while scientists depend upon more internal resources, governed by conscious control. Preference for an external control style may present certain advantages in art; for example, it may allow for certain freedoms in subject matter, or encourage the surfacing of subtle associations, which relates to artists' preference for context-dependent information processing. In contrast, confidence in self-generated, rational information processing is crucial for science domains, in which the individual must be aware of his or her own thought process to the point of being able to describe it in detail for a third-party reader.

Overall, the current review demonstrated evidence of the relationship between professional specialization and cognitive styles. Also, the current review demonstrates the information-processing approach as potentially fruitful for investigating the relationship between cognitive style and profession, and furthermore, it highlights promising directions for future research, such as (1) filling out the gaps in the knowledge about professionals' differences at all levels and all cross-dimensions of cognitive style, (2) expanding the range of professional specializations, while following the categorization based on an information-processing approach, and (3) investigating how external environmental factors (such as profession, education, and culture) dynamically shape individuals' cognitive style throughout an individual's life.

The current review presents the first attempt to systematically examine the subject matter based on an information-processing approach and evidence from cognitive science research. However, it should be acknowledged that current review presents very limited and largely qualitative evidence that needs to be experimentally validated in future studies, and rigorous empirical verification is still needed to support some of our claims. Overall, despite the promising practical applications and theoretical advances for cognitive science, the current state of the field has serious limitations, theoretical and methodological difficulties, as well as a problematic scarcity of empirical evidence.

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18

Intellectual Styles of Exceptional Learners

David W. Chan

INTRODUCTION

In the discourse on the intellectual styles of exceptional learners, three specific issues readily present themselves. The first issue is the diversity of exceptional learners. By exceptional learners, one refers to a heterogeneous group of learners that includes, among others, learners with dyslexia, learners with attention deficit/hyperactivity disorder (ADHD), learners with autism spectrum disorder, and highly able or gifted learners. The question is whether there are distinct intellectual styles or profiles of styles for distinct groups of exceptional learners. The second issue has to do with the connection between abilities and styles. Perhaps what set exceptional learners apart from normal nonexceptional learners are their profiles of marked strengths and weaknesses, which are likely to correspond to their areas of giftedness and deficits. It is likely that there is a possibly stronger ability–style connection among exceptional learners, given that exceptionality is often defined in terms of abilities (talents) or disabilities (deficits). The question is whether or not exceptional learners are predisposed to prefer specific intellectual styles in line with their abilities and disabilities. The third issue is the role of intellectual styles in the teaching and learning of exceptional learners. Given the possibly stronger ability–style connection, the question is whether or not instruction matching intellectual styles of exceptional learners should assume greater importance in the effective teaching and learning of these more able and more vulnerable learners.

THE DIVERSITY OF EXCEPTIONAL LEARNERS

In education, exceptional learners are generally used to refer to those who require special education and related services to allow them to learn effectively and to realize their full human potential (Hallahan, Kauffman, & Pullen, 2009). They require special education services because they are markedly different from most (typical, average, or nonexceptional) students in one or more ways that are relevant to their education or their effective learning (e.g., Kauffman & Konold, 2007; Stichter, Conroy, & Kauffman, 2008). Specifically, exceptional learners may have intellectual disabilities, learning or attention disabilities, emotional or behavioral disorders,

physical disabilities, disorders of communication, autism spectrum disorder, traumatic brain injury, impaired hearing, impaired sight, or special gifts or talents.

Among the different types of exceptional learners, some types are more commonly encountered than others (Stichter et al., 2008). For example, learning disabilities, communication (speech and language) disorders, emotional disturbance, and mild intellectual disabilities are among those usually considered high-incidence exceptionalities. In contrast, other types, such as low vision and blindness, deafness, deaf-blindness, and severe intellectual disabilities, occur relatively rarely and are considered low-incidence exceptionalities. Although autism spectrum disorder has been considered a low-incidence category, there has been an observed dramatic increase in its identification since 1995 (see Hallahan et al., 2009). This increase in the occurrence of autism spectrum disorder probably represents improved identification procedures and the identification of milder cases of autism.

Exceptional learners might not only be of different types, but might also have more than one type of exceptionality. Thus, a learner with dyslexia and with ADHD, and a gifted learner with Asperger syndrome (AS, an autism spectrum disorder) are learners with dual exceptionality. The former is often referred to as a condition of comorbidity (see Brown, 2000), and the latter is often referred to as a condition of twice-exceptionality where the learner is both gifted and has a disability (see Baum, 2004; Lupart & Toy, 2009).

Research interests on the intellectual styles of exceptional learners usually focus on students with learning disabilities, especially dyslexia, students with ADHD, students with autism spectrum disorder, students with special gifts and talents, and twice-exceptional students (Hallahan et al., 2009; Pritchard, 2009). This chapter will confine itself to the discussion of the intellectual styles of these distinct groups of exceptional learners. Prior to the discussion of intellectual styles, a brief description of each of these groups of exceptional learners is in order.

Learners With Dyslexia

Children with dyslexia represent a heterogeneous group of exceptional learners characterized by learning difficulties. There are different definitions of dyslexia, and the diversity suggests disagreement reflecting the different contextual purposes of the definitions and the causal theory and research that underlie these definitions. For example, one definition offered by the Orton Dyslexia Society (now the International Dyslexia Association) views dyslexia as one of the several distinct learning disabilities, and as "a specific language disorder of constitutional origin characterized by difficulties in single word decoding, usually reflecting insufficient phonological processing" (Orton Dyslexia Society, 1994, p. 5). The difficulties manifested by dyslexics are "variable difficulty with different forms of language, often including, in addition to problems with reading, a conspicuous problem with acquiring proficiency in writing and spelling" (Orton Dyslexia Society, 1994, p. 5).

A more education-oriented definition offered by the British Dyslexia Association views dyslexia as "a combination of abilities and difficulties that affect the learning process in one or more of reading, spelling, writing. Accompanying

weaknesses may be identified in areas of speed of processing, short-term memory, sequencing and organization, auditory and/or visual perception, spoken language and motor skills" (British Dyslexia Association, 2002, p. 67).

This definition goes beyond the earlier focus on dyslexia as being simply a difficulty with phonological processing or mastering symbolic materials, and provides a clearer picture of the range of difficulties experienced. In parallel, research studies have also moved beyond the limited definition of dyslexia as an unexpected difficulty with literacy and the focus on dyslexia as purely a phonological processing difficulty to the focus on multiple deficits that include magnocellular deficit and cerebellar deficit (see Mortimore, 2008). Dyslexia is now viewed as causing a wide range of differences in information processing, and the dyslexic cognitive profile involves strengths as well as limitations.

Learners With ADHD

ADHD is a syndrome that interferes with an individual's ability to focus (inattention), regulate activity level (hyperactivity), and inhibit behavior (impulsivity) (Hallahan et al., 2009). ADHD often occurs alongside behavioral and emotional disorders and low academic achievement in relation to intellectual ability (Barkley, 1998). Interestingly, it has been suggested that there might be a link between high levels of creativity and ADHD (see Leroux & Levitt-Perlman, 2000; Robertson, 2002). Although many children with ADHD do not exhibit the same literacy difficulties as those with dyslexia, some of them do seem to share some similarities in the profiles in that children with ADHD may also have trouble with working memory, have difficulty in sustaining concentration, and exhibit inappropriate behaviors.

Learners With Autism Spectrum Disorder

Autism spectrum disorder is the broad term under which are collected a group of pervasive developmental disorders that are characterized by impairments in communication skills, social interactions, and repetitive and stereotyped patterns of behavior (Hallahan et al., 2009). By far, the most prevalent disorders on the spectrum are autism and AS. Autism has an early onset, and is characterized by extreme social withdrawal and impairment in communication, and stereotyped movements. Because of the severe cognitive deficits, autism is rarely the disorder of interest to researchers on intellectual styles. Instead, interests are often directed to what might be considered the milder form of autism, AS, which is characterized by primary problems in social interaction without significant impairments in language and cognition.

Gifted Learners

Although the term exceptional is often used to describe vulnerable learners or children with learning difficulties, it is an appropriate term when referring to gifted children as being different from the regular school population. However,

giftedness means different things to different people. For example, giftedness has meant genius or prodigious accomplishment in a particular field of endeavor. It has meant a high IQ score above a specific cutoff (e.g., 130) on an intelligence test, but generally not a score reaching what one would regard as genius-level IQ. Different investigators have also provided different definitions. For example, Winner (1996) defined giftedness as precocity, a passion or a rage to learn, and an insistence on marching to one's own drummer. The Columbus Group defined giftedness as asynchronous development in which advanced cognitive ability and heightened intensity combine to create qualitatively different inner experiences and awareness, which require modifications in parenting, teaching, and counseling to meet the needs of the gifted (see Morelock, 1996). Here, for the purpose of understanding intellectual styles of gifted learners, a broad and inclusive definition of giftedness is appropriate. Gifted learners may be defined as those who demonstrate (or have the potential for demonstrating) an exceptionally high level of performance in one or more areas of human endeavor. They learn faster, in more depth, and with greater complexity than other learners. Although researchers and educators are undoubtedly interested in the intellectual styles of these gifted learners, they are also greatly interested in the intellectual styles of the groups of twice-exceptional learners who are both gifted and disabled (i.e., gifted with dyslexia, with ADHD, or with AS).

Twice-Exceptional Learners

Twice-exceptional learners can be hard to identify because their disabilities and abilities might mask each other (Montgomery, 2004). In addition, teachers might be biased against referring students with disabilities to gifted programs, and students in special education programs may be less exposed to activities that would highlight their gifts and talents (Bianco, 2005). While they generally possess certain characteristics of their specific disabled group, it is said that their giftedness in specific domains might set them apart from their disabled peers (see Lupart & Toy, 2009). Gifted students with learning disabilities such as dyslexia, for example, often, like their gifted peers, appear intelligent and excel in one or more areas, but they have major difficulties in other areas such as reading and writing. Thus, they may be bright, but they are often underachieving and have negative self-images (Shevitz, Weinfeld, Jeweler, & Barnes-Robinson, 2003). Gifted students with ADHD, unlike their disabled peers who exhibit problem behaviors in all settings and perform inconsistently, exhibit problem behaviors only under specific situations and maintain consistent effort and high standards in the quality of performance when they are intellectually challenged and when they are engaged in an area about which they are passionate (see Leroux & Levitt-Perlman, 2000; Moon, Zentall, Grskovic, Hall, & Stormont, 2001). Students with autism and one area of giftedness are typically referred to as autistic savants, and their giftedness may be manifested in areas that include calendar calculating, lightning calculating, visual arts, music, mechanical abilities, and spatial skills (Little, 2001). While students with AS are often seen as egocentric and unable to

see others' point of view, thus risking failure in interactions with others, gifted students with AS may be more aware of how their behaviors affect others (Little, 2002). In general, twice-exceptional learners share characteristics of both their gifted and disabled peers.

THE COMPLEXITY OF INTELLECTUAL STYLES

In relating intellectual styles to exceptional learners, it is noted that diversity is not confined to exceptional learners. Over the years, investigators have reported many style constructs (see Messick, 1996; Sternberg & Grigorenko, 2001). Very often, these researchers develop their own measuring instruments for assessing their constructs in their own contexts, and they inevitably give their own labels to the styles they study with little reference to the work of others. This has produced a situation that gives the impression that there are many different styles. Some researchers also distinguish cognitive style from learning style. In general, cognitive style is seen as an individual's characteristic and relatively consistent way of processing incoming information from the environment, and learning style is seen more in terms of applying cognitive style or adopting related learning strategies to cope with learning tasks and situations (Allport, 1937; Riding & Rayner, 1998; Schmeck, 1988). In addition, the particular learning style arising from and reflecting the particular cognitive style is seen as more amenable to change. In teaching and learning, conceptualizations of learning styles have also highlighted the need for differentiated instruction for different types of learners, including exceptional learners.

In part as a response to the situation of a proliferation of styles, researchers have come to realize that many style labels are only different conceptions of the same style dimensions, and that the diversity of constructs may have little practical value for education unless there is conceptual integration that could simplify the complexity for applications. Grigorenko and Sternberg (1995), for example, saw that different studies on styles could be classified into three approaches. The cognition-centered approach views styles as resembling abilities, the personality-centered approach views styles as resembling personality traits or types, and the activity-centered approach treats styles as mediators of activities that arise from cognition and personality, and is thus more closely associated with learning strategies (see also Sternberg & Grigorenko, 2001).

To bring some consistency and economy to the diverse formulations of styles, some researchers have attempted classification and conceptual integration of style constructs. For example, in stressing that there are commonalities among extant style constructs, Zhang and Sternberg (2005, 2006) used the general term of intellectual style to encompass the variety of style constructs in past studies. These constructs include cognitive style, conceptual tempo, decision-making and problem-solving styles, learning style, mind style, perceptual style, and thinking style. On this basis, they developed a comprehensive model of intellectual styles by empirically classifying extant style constructs into Type I, Type II, and Type III intellectual styles, corresponding to the Type I, Type II, and Type III thinking styles (see Zhang, 2002)

based on the original 13 thinking styles first proposed by Sternberg (1997) in his theory of mental self-government. This model is perhaps currently the most comprehensive model with potentials yet to be explored for applications to exceptional learners.

Despite the diversity of intellectual style models, many of which could be highly relevant to the education of exceptional learners, education practitioners have rarely explored the use of these models and their accompanying standardized assessment instruments to address their concerns of differentiated instruction for exceptional learners. Rather, they have generally relied on using simple conceptualizations based on sensory modalities and ad hoc measures to classify and understand exceptional learners. Therefore, in the following, some of these simple conceptualizations of intellectual styles are introduced to set the stage for the discussion of intellectual styles of distinct groups of exceptional learners.

From Sensory Modalities to Brain Dominance

In search of a simple model that could help in grouping students for differentiated instruction, education practitioners have found the model based on sensory pathways to information processing and memory most appealing (see Rose & Nicholl, 1997; Smith, 1998). This model, often called the Visual–Auditory–Kinesthetic (VAK) system, has been popularized by Neuro-Linguistic Programming, which is concerned with how we communicate and how this could generate changes in our interactions, learning, and therapy (Bandler & Grinder, 1979). Accordingly, it is suggested that learners could fall into one of the three learning styles (visual, auditory, and kinesthetic). Visual learners prefer to use images, diagrams, charts, and other visual information as aids to learning, such as color, texture, maps, and pictures. Auditory learners prefer to use aural communication, sounds, dialogue, discussion, rhythmic patterns, and reading materials. Kinesthetic learners are likely to be active learners who prefer to do practical tasks and activities.

The VAK system appeals greatly to education practitioners teaching and counseling the more vulnerable exceptional learners (e.g., Lisle, 2007). Some support for the application of the VAK system has come from the reported success of using the multisensory approach to teaching and learning students with learning difficulties (e.g., Joshi, Dahlgren, & Boulware-Gooden, 2002; Shaywitz et al., 2004). Although each individual learner prefers to operate in one modality more than the others, he or she will use elements of all three learning styles, and will use different modalities for different information learning tasks. However, it is understood that exceptional learners with their weaknesses or deficits might be more restricted in their choice of preferences for certain modalities. Nonetheless, for enhanced learning, teachers should encourage students (exceptional or nonexceptional students alike) to use their preferred primary modality and develop their less used secondary modalities, helping more students to experience multimodal learning.

Practitioners advocating the VAK system of learning styles or modality preferences have looked for and found theoretical support in the system's connection with

theories of human abilities and with research studies on brain functioning. For example, Gardner's (1983, 1993) theory of multiple intelligences could be viewed as one of the first to focus on the learning process to discover how individuals process information in line with their abilities. Gardner suggested that intelligence is not a single unitary entity but is made up of multiple abilities or intelligences, including verbal–linguistic, visual–spatial, logical–mathematical, bodily–kinesthetic, musical, intrapersonal, interpersonal, and naturalist intelligences. Three of these intelligences are related to the VAK modalities, that is, verbal–linguistic (auditory), visual–spatial (visual), and bodily–kinesthetic (kinesthetic). Teaching and learning through multiple intelligences is to emphasize the well-developed or preferred intelligences and to strengthen the less developed intelligences in the teaching and learning process (Campbell, Campbell, & Dickinson, 2004). Efforts have also been made to integrate learning styles with multiple intelligences so that effective teaching could reach different types of learners (e.g., Silver, Strong, & Perini, 2000).

The VAK system of typing learners into visual, auditory, and kinesthetic learners has also been tied to the notion of brain dominance or hemispheric specialization. The theory of hemispheric specialization is based on the neurophysiological research of Sperry and Gazzaniga (see Sperry, 1982) on split-brained patients, and is popularized by Ornstein (1972). The theory suggests that the two halves of the brain deal with information in diametrically opposite ways. In the majority of individuals, the left hemisphere is usually more specialized for language performance and will analyze information in a sequential manner. In contrast, the right hemisphere is usually more specialized for visual–spatial and mathematical tasks and will process any incoming stimulus as an integrated whole. A number of researchers such as West (1997) suggested that there are links between a particular learning style and an individual's tendency to favor a particular hemisphere when processing information. The left hemisphere is said to favor the verbal, analytical, abstract, temporal, and digital style (the auditory learners) while the right hemisphere the nonverbal, holistic, concrete, spatial, creative, and intuitive style (the visual learners).

The notion of different brain functioning is said to be supported by brain-imaging techniques, such as positron emission tomography (PET), which have confirmed, through pictures, that the left side of the brain is more active during language tasks and the right side more active during mathematical tasks (see Sousa, 2003, 2006, 2007). However, these pictures also show that many areas of the brain are involved in performing most tasks, including reading and listening tasks, and that one hemisphere is just as efficient as the other in performing certain functions (Woolfolk, 2007). Perhaps the labels of right brained or left brained, which are sometimes applied to learners or types of learning/teaching, are an oversimplification (see, e.g., Blakemore & Frith, 2005; Dimond, 1972; Goswami, 2004), and should not be taken as literal representations of the underlying brain activity but more as the shorthand for the two types of learning approaches (Mortimore, 2008; Pritchard, 2009). Nonetheless, the conceptualization of the VAK system integrated with notions of brain dominance perhaps provides currently the most popular way of typing exceptional learners.

Two Basic Cognitive Style Dimensions

Incorporating the approaches of both sensory modalities and brain dominance, and after reviewing the descriptions, correlates, methods of assessment, and effects on behaviors of more than 30 style constructs, Riding and Cheema (1991) proposed that there are two fundamental cognitive style dimensions describing an individual's preferred and habitual approach to processing, organizing, and representing information (see also Riding & Rayner, 1998). The distinction of the two basic dimensions, the holist–analytic and the verbal–imagery dimensions, has received support from other studies (e.g., Riding & Mathias, 1991; Schmeck, 1988). Specifically, the holist–analytic dimension encompasses the family of styles that includes field dependence–independence (e.g., Witkin, Oltman, Raskin, & Karp, 1971), leveling–sharpening (Klein, 1954), and impulsivity–reflectivity (Kagan, Rosman, Day, Albert, & Philips, 1964). The verbal–imagery dimension encompasses the family of styles that include abstract–concrete (Harvey, Hunt, & Schroder, 1961) and verbalizer–visualizer (Pavio, 1971).

To assess an individual's two cognitive style dimensions, Riding (1991) has developed the Cognitive Styles Analysis (CSA) as a computer-presented performance-based assessment using a number of simple tasks. The holist–analytic dimension of the CSA assesses the balance between the ability to see a figure as a whole and the ability to disembed or see it divided into parts. This reflects how far an individual takes a broadly based inclusive approach or one that is sharply focused. The verbal–imagery dimension of the CSA assesses the balance between verbal and imagery representation by comparing the ease and speed at which an individual responds to a statement that requires a verbal judgment versus one that is based on a mental image. Taken together, these two scores will yield an individual profile that suggests the individual's preference for structure (tendency to process information in wholes or in parts) and preference for mode of presentation or expression (tendency to represent information by thinking verbally or in mental pictures).

Accordingly, a person's cognitive style as a combination of his or her position on the two dimensions could be put into one of the four style groups, holist–verbalizer, holist–imager, analytic–verbalizer, or analytic–imager. The dimensional characteristics of a person may either complement or duplicate one another, depending upon the characteristics. For example, the holist–imager only has a whole facility and thus is in the unitary style group. Similarly, the analytic–verbalizer is in the unitary group because he or she only has an analysis facility. In contrast, the analytic–imager and the wholist–verbalizer are in the complementary style group. This is because for the analytic–imager, although the analytic aspect of his or her style does not provide an overview of a situation, he or she could attempt to use the whole-view aspect of imagery to supply it. Similarly, for the holist–verbalizer, although the holist facility does not support analysis, he or she might use the analytic property of verbalization as a substitute. The four style groups have also been expanded to nine style groups by accommodating an intermediate group in the holist–analytic dimension, and a bimodal group in the verbal–imagery dimension (Riding, 2001; Riding & Rayner, 1998).

In summary, the conceptualization of the two basic dimensions in the Riding–Cheema model is largely consistent with the notions of the VAK system and those of brain dominance. The more formal assessment measure provided by the CSA in the Riding–Cheema model, however, could raise the studies on intellectual styles of exceptional learners to a higher level of scientific rigor, considering that comparisons across studies that employ ad hoc measures could be difficult.

Six Basic Learning Style Areas

Focusing on student learning and learning styles to account for individual differences in performance on learning tasks, Dunn and Dunn (1992, 1993) recognized that there are important areas relevant to learning in addition to the cognitive dimensions. They developed the Learning Style Inventory (LSI; Dunn, Dunn, & Price, 1985) to assess learning preferences in terms of individual student reactions to elements of instructional environments under five areas or domains of experience. One of the five areas, the psychological (global/analytical, left/right, impulsive/reflective) corresponds precisely to the cognitive wholist–analytic dimension. The other four areas are environmental, emotional, social, and physical. More recently, Dunn and Prashnig (Prashnig, 2008) developed the Learning Style Analysis (LSA) that incorporates the sensory modalities as a basic area in addition to the five basic areas of the original LSI. There are now 49 individual elements in six basic areas. The four areas of natural or biological elements are brain dominance (psychological in LSI; information processing, thinking style), sensory modalities (auditory, visual, tactile, kinesthetic), physical needs (mobility, intake, time of day), and environment (sound, light, temperature, study area). The two areas of conditioned or learned elements are social groupings (study groups, authority) and attitudes (emotional in LSI; motivation, persistence, conformity, responsibility, structure/guidance, variety). The natural elements are said to describe learning preferences that are relatively stable and enduring, and are best matched for learning success, whereas the learned elements are said to describe learning preferences that are less stable and more amenable to change for learning effectiveness.

The LSI has been widely used in North America and extensively studied in classroom settings for average learners with much reported success (see Given & Reid, 1999). Despite its popularity, it has been criticized because of its length and its attempt to cover too wide a range of learning situations, making it less reliable as students' preferences could vary from situation to situation (Burns, Johnson, & Gable, 1998). However, the inventory has also been applied to the gifted populations in and outside of North America (Milgram, Dunn, & Price, 1993). Dunn (2003) also suggested that the attendance to specifics might be well suited for vulnerable learners as they might be deeply affected by minor changes in learning environments. In addition, with the revised LSA that incorporates sensory modalities as a basic area, it is anticipated that this Dunn and Dunn model will appeal more to education practitioners teaching and counseling exceptional learners.

INTELLECTUAL STYLES OF SPECIFIC GROUPS OF EXCEPTIONAL LEARNERS

Bearing in mind the diversity of exceptional learners and the complexity in conceptualizing intellectual styles relevant to exceptional learners, we will describe briefly what we know about the intellectual styles of a few distinct groups of exceptional learners: gifted learners, learners with dyslexia, learners with ADHD, and learners with autism spectrum disorder. Twice-exceptional learners are also described in the respective vulnerable exceptional learner groups.

Gifted Learners

Anecdotally, many eminent individuals are said to be visual–spatial learners. For example, West (1997) described scientists (Michael Faraday, James Clerk Maxwell, Albert Einstein), inventors (Nikola Tesla, Thomas Edison, Leonardo da Vinci), mathematicians (Henri Poincare), poets (William Butler Yeats), and national leaders (Winston Churchill, George S. Patton) who were especially gifted with visual–spatial thinking. Visual–spatial thinking is also said to occur most often in music and art where artists use visual–spatial thinking in their work. Mozart is said to have seen the entire movement of a symphony in his mind before he wrote a note (Silverman, 2002). On the other hand, many eminent people have been creative using an auditory or verbal style. For example, Sigmund Freud, Margaret Mead, Eleanor Roosevelt, Martin Luther King, Jr., Clarence Darrow, and William Jennings Bryan all are known for their facility with words (Silverman, 2002). These people might also have strong visual–spatial skills, but their auditory or verbal skills have been predominantly strong and they could persuade people to listen to their ideas.

Perhaps, the preference for visual thinking or verbal thinking or both could be better understood through interpreting the following study. Benbow and Minor (1990), in their study on verbally and mathematically talented youths, those who did exceptionally well when taking the Scholastic Aptitude Tests (SATs) before age 13, suggested that the two groups might differ in cognitive or learning styles. Comparing the two groups, mathematically precocious students scored higher on spatial ability, nonverbal reasoning, speed, memory, and mechanical ability while verbally precocious students scored higher on verbal reasoning, general information, and written expression. Interestingly, they also found that most of the verbally precocious students also scored high on mathematics (over 500) on the SAT, but mathematically precocious students did not score high verbally in general. The findings suggested that verbally gifted students tend to be more even in cognitive development, and to have learning preferences that more fully utilize styles of visual–spatial and auditory–sequential thinking, while mathematically gifted students tend to be more spatially, rather than verbally, talented.

In a study that investigated how different thinking styles in gifted students affect their academic performance, Grigorenko and Sternberg (1997) found that there were no differences in thinking styles among groups of students at different ability levels, suggesting that styles are distinct from abilities. They also found that certain thinking styles contribute significantly to prediction of academic

performance, the contribution independent of the type of instruction the students were given. Another interesting finding was that gifted students perform best on assessment procedures that closely match their thinking styles, suggesting that teachers should vary their assessment to meet the needs of students of different thinking styles.

Thus, it is likely that some gifted children prefer visual–spatial thinking or learning and other gifted children prefer auditory–sequential thinking or learning. Their preferences might have to do with the domains of their cognitive strengths or talents. Nonetheless, it is also likely that many gifted children are flexible learners of both types, and can easily integrate both auditory and visual aspects of experience. In addition, being able to use one's preferred intellectual styles in line with one's talents certainly have a positive effect on learning outcomes.

Learners With Dyslexia

Based on anecdotal evidence, it has been suggested that learners with dyslexia tend to be visual–spatial thinkers. West (1997), for example, provided information that some highly talented individuals in the fields of science and the arts had many of the classic signs of dyslexia, such as difficulty with processing written and sometimes spoken language, disorganization, and forgetfulness, along with a gift in using visual imagination. He cited comments from friends and historians referring to Faraday and Maxwell's habit of thinking in terms of physical pictures. He also quoted extensively from letters, diaries, and lectures about Einstein's poor memory for words. West (1997) described how visual thinking, pattern recognition, creativity, thinking in visual images, holistic thinking, and spatial intelligence could combine to yield dyslexia. Thus, to him, dyslexia could be a mixed disorder with positive attributes (visual strengths that allow wonderful nonverbal reasoning) as well as negative attributes (deficits in language functioning). However, one should exercise caution that anecdote does not constitute hard quantitative evidence for a strong and consistent link between dyslexia and creative visual thinking.

From the realm of neuroscience, there is some evidence indicating the presence of competition between the verbal and visual pathways in the brain. Specifically, Robertson (2002) stated that studies on both normal individuals and stroke victims have established that imagery and verbalization tend to take part in separate areas of the brain. One might interpret this to mean that words damage images and the language system interferes with the visual processing systems. This also leads to the conjecture that an impaired language system (as in dyslexia) might contribute to heightened visual–spatial skills or preference (see also Snowling & Stackhouse, 2006). However, Robertson (2002) only cited the small study by Miller and his colleagues on the development of new visual artistic talents in some Alzheimer patients with left hemisphere language degeneration to support this conjecture. In the same connection, some researchers have also suggested that this preference for visual–spatial skills can often be a factor in learning difficulties, and the verbal–sequential phonological deficits may result from a locking onto a visual–spatial model of

cognitive processing with insufficient flexibility to adapt to the requirements of different learning tasks (see Whyte, 1989).

Despite the conjecture that there is a link between dyslexia and visual–spatial style preference, there is no compelling evidence from research studies comparing the performance of individuals with dyslexia with those without dyslexia on visual–spatial tasks. However, although there is no evidence of superior visual–spatial talents in the dyslexic group in some studies (e.g., Winner, von Karolyi, & Malinsky, 2000), there is some suggestive evidence that the dyslexic group performed better in the recognition of impossible figures task that demands speed and global visual processing in a series of subsequent studies (e.g., von Karolyi, 2001; von Karolyi & Winner, 2004; von Karolyi, Winner, Gray, & Sherman, 2003; Winner et al., 2001). The interesting connection is that the performance on the impossible figures task has been found to be associated with visual–spatial talents (see Chan, 2008).

Although there is no direct strong empirical evidence supporting the view that learners with dyslexia have predominant learning styles, Mortimore (2008) suggested that these learners might tend toward, in terms of the Riding–Cheema model, a holist or imaging style either due to memory difficulties and weakness in processing verbal information that force them to rely on the visual–spatial channels or due to innate strengths in these areas. In addition, these learners as holist–imagers might have a less flexible unitary style, which leaves them with difficulties responding to verbal details, given their problems with concentration, attention span, working memory or automaticity. Thus, these learners will have difficulties in learning when teaching presentation does not match their preferred styles. Both research and experience suggest that students with dyslexia are more likely to succeed when teaching is multisensory and all channels to reinforce learning are used in teaching and learning.

Nonetheless, learners with dyslexia do seem to bring increased visualization and creativity to their learning strategies (see Pollak, 2005). In visual or spatial professions, such as art, engineering, or architecture, there does seem to be a disproportionate number of people with dyslexia (Geschwind & Galaburda, 1987). Perhaps, they enter these professions by default because they, with difficulties in the verbal field, might like to avoid professions that require facility with language or extensive reading. Taken together, it could be suggested that the effect of dyslexia on some people may make them prefer visual–spatial learning styles and professions in which they then become very proficient.

Learners With ADHD

Hallowell and Ratey (1994) suggested that individuals with ADHD are more right than left brain in learning and thinking preferences. These learners prefer holistic thinking to logic and linear reasoning. However, Hallowell and Ratey (1994) also believed that many with ADHD cannot articulate the holistic ideas and insights that come to them because they seem to be trapped in their right-brain thinking. To produce and express their ideas to others would involve a transfer to more left-brain thinking in which logic, details, and analysis are involved.

Lovecky (2004), in her work with twice-exceptional children at the Gifted Resource Center of New England, also maintained that gifted children with ADHD, who are visual–spatial learners, are less able to articulate their holistic ideas and pictures than do other visual–spatial learners because of their executive function deficits. She also observed that some of these children are so impulsive and stimulus-driven that they never form an accurate big picture. Inevitably, they get the gist of something by focusing on one part that is novel or most stimulating, and base their conclusion on that part rather than on the whole. Thus, although they form wholes readily as other visual–spatial learners, they are mistaken in what they perceived.

Lovecky (2004) also observed that although gifted children with ADHD frequently show a preference for visual–spatial learning, some of them are such slow processors of information that they do not think holistically. Rather, they form partial wholes or wholes based on erroneous information. These children will find it difficult to perform tasks that require holding materials in mind for operation or dealing with complex materials in several sensory modalities.

There is yet another group of gifted children with ADHD described by Lovecky (2004). They might have some visual–spatial deficits, and thus they could be auditory learners, but they might not be sequential. They are said to have a mixed learning pattern in which they fail to get the big picture, and have trouble with using parts to build the whole. These children often find it difficult to complete work because getting to the solution by steps and the sequential skills involved are too difficult for them.

Thus, with the attention on gifted learners with ADHD, this group of twice-exceptional learners seems to be restricted in their preferences due to their executive function deficits. They might be visual learners, but holistic thinking does not seem to describe them; they might be auditory learners, but sequential thinking does not seem to describe them.

Learners With Autism Spectrum Disorder

Again, Lovecky (2004) provided the best information mainly through her work with twice-exceptional children. Gifted children with AS and autism are described as visual thinkers. They hear words as a series of pictures, and they think in pictures. The find it hard to understand materials not translatable to pictures, and are often good at visual tasks involving maps, puzzles, and visualizing systems like subways and highways. Lovecky (2004) cited Temple Grandin as her example of a brilliant woman with AS, describing her thinking processes as almost entirely visual (see Grandin, 1995). She was described as creative and capable of seeing her designs displayed at a distance, and seeing the different aspects by rotating them in her mind. She also experiences her own memory as a videotape that can be replayed.

According to Lovecky (2004), gifted learners with AS, unlike other visual–spatial thinkers, appear to lack holistic thinking. They may be excellent at visualization, but they are not very good at constructing the whole from its parts, and they see

the parts without seeing them as a whole. One explanation is their weak central coherence, the reduced ability to draw together diverse information to construct a higher level of meaning (Frith & Happe, 1994). Their difficulties with facial recognition could be an example of their difficulty with visualization of wholes. They are slower in recognizing faces because they have to put the parts together. Translated into the social realm, a problem with the visualization of wholes becomes a problem with forming whole social pictures or understanding how social and emotional aspects of experience interrelate. For them, the expressions on faces, the nonverbal body language, and the tone of voice are irrelevant in making social decisions. Instead, what is most striking to them forms the basis of their social decisions.

In working with these twice-exceptional learners, Lovecky (2004) also suggested that some gifted children with AS could be described as auditory learners. However, they are poor at picking out the main points, and cannot decide what is important and what is subordinate. Their extreme difficulty with part-to-whole relationships makes it difficult for them to assess relevancy when they do not know how parts are related to each other or what the big picture is. Thus, they are poor at school subjects that require organization of content, such as mathematics and written expression.

Thus, like gifted learners with ADHD, gifted learners with AS might be restricted in their style preferences due to their weaknesses in central coherence. They might be visual or auditory learners, but their weakness in holistic thinking might predispose them to choose focusing on parts or details.

Distinct Profiles of Exceptional Learners

Our descriptions of the selected groups of exceptional (including twice-exceptional) learners suggest that they do seem to have distinct profiles of intellectual styles related to their strengths or compensations for their weaknesses, although the evidence is largely anecdotal and through observations of education practitioners. In general, the descriptions of these exceptional learners also share certain similarities. Often, they are described in terms of the sensory modalities as visual or auditory learners, corresponding nicely to the conceptualization of the VAK system. Specifically, gifted learners could be auditory or visual learners depending upon their dominant strengths, but are more likely to be both as they adapt readily to different learning tasks. Dyslexic learners, because of their difficulty in language functioning, tend to be visual learners with strengths in global or holistic processing. Thus, they could be described as falling into the holist–imager style group in the framework of the Riding–Cheema conceptualization, and could be limited by their less flexible and unitary intellectual style. Regarding learners with ADHD and those with AS, the attention is usually on the twice-exceptional learners, and these learners tend to be mostly visual learners but could also be auditory learners. These visual learners, however, are poor in global or holistic processing because of their executive function deficits as in the case of learners with ADHD and because of their weakness in central coherence as in the case of learners with AS. Interestingly, although the distinct profiles of these exceptional learners are described by education practitioners

without formal reference to the VAK system or the Riding–Cheema basic dimensions, and standardized instruments such as the CSA or the LSA are not employed in profile mapping, conceptual consistency calls for the need to integrate practice-oriented profile mapping with rigorous research using more standardized instruments. Such efforts will be valuable and necessary if matching instruction with intellectual styles is seriously considered in the teaching and learning of exceptional learners.

TEACHING AND LEARNING THROUGH LEARNING STYLES AND PREFERENCES

All educators have the vision that all students can learn. Yet, schools often run counter to this vision and treat most students as if they can learn the same way. Accordingly, classes are organized in year cohorts and classroom interactions are didactically oriented with little space for individuality. The understanding that there are different intellectual or learning styles among different learners has served to shine a spotlight onto the nature of learning, forcing us to acknowledge that there are different ways of learning the same information, and that traditional class organization and classroom interactions might be less beneficial to learning. More importantly, it is understood that no one style or approach is in itself necessarily more or less effective than any other. What might be more crucial is whether the style is suited to the particular learning task that the learner encounters. Perhaps, it is only when a learner is placed within an educational context with the pressure to retain and utilize information to perform that he or she may begin to find that his or her preferred style could be less well suited or even inappropriate to handle the way in which information is structured and presented in the particular task.

Matching Instruction to Students' Intellectual Styles

Thus, it seems that, as a learner, knowing one's preferred styles and flexibility in adopting styles that are judged appropriate to the task are important. As a teacher, knowing different learners' preferred styles and being able to accommodate different ways of making academic information more accessible to the diverse groups of learners despite one's preferred teaching styles seem to be equally important. In any way, one would expect that effective teaching and learning will take place when students' intellectual or learning styles are acknowledged and are matched with teachers' instruction modes. This is precisely what is being proposed in the matching hypothesis (Dunn, 1995; Riding & Rayner, 1998).

The matching hypothesis has received support from some research studies. Riding and Rayner (1998), for example, summarized a number of studies that indicate that style matching leads to successful learning outcomes and that students spontaneously choose the type of materials that reflect or echo their cognitive style preferences. They also concluded that the learning performance of students is affected not only by their cognitive styles but by the interaction between cognitive styles and

aspects of the study materials (the structure of the materials, the modes of presentation, and the types of content).

Perhaps, a good example in promoting differentiated instruction through matching to intellectual styles of diverse groups of learners and curriculum development is the DISCOVER/TASC approach (Wallace & Maker, 2009). This framework incorporates the approaches of DISCOVER (Discovering Strengths and Capabilities while Observing Varied Ethnic Responses) and TASC (Thinking Actively in a Social Context) developed, respectively, by Maker (2001) and Wallace and Adams (1993). The framework defines 10 human abilities (expanded and elaborated from Gardner's eight intelligences to suit the educational context) and a continuum of six problem types, and maintains that potentials are essentially developed by the processes used in problem solving. Teachers can audit their teaching activities and learning experiences to determine their usual patterns of teaching in the matrix of abilities and problem types, and to design new options and choices to better meet students' learning preferences.

However, the matching hypothesis has not gone unchallenged. Stellwagen (2001), for example, suggested that there is little reliable empirical evidence and stated that matching presentation to style is a teacher-centered concept that should be superseded as students are being encouraged to take responsibility for their own learning processes.

Admittedly, it is difficult to attribute effective teaching and learning or learning success to a simple match between style preference and presentation, given that there is a host of other influences in the classroom, including, among others, teaching skills, group dynamic, and student motivation. This is precisely why environment, physical needs, social groupings, and attitudes are included in the assessment of learning preferences in addition to the two basic verbal–imagery and wholist–analytic dimensions in the broad Dunn–Prashnig conceptualization of learning styles (see Prashnig, 2008). However, despite the presence of a range of causal factors, anecdotal reports from practitioners and students continue to give credence to the matching hypothesis, and there is sufficient, if not incontestable, evidence of success being achieved through matching instruction to learning style, which warrants continuing exploration in future studies (e.g., Mortimore, 2008).

"Dual Differentiation": Enrichment and Remediation

Arguably, teaching exceptional learners should be no different from teaching nonexceptional learners in that they also have their preferred intellectual or learning styles. However, because of their particular weaknesses or deficits, exceptional learners might be more restricted in their range of preferences, and might even be locked into their dominant styles and could exercise limited flexibility in their choice of styles in facing different learning tasks. It is therefore useful for teachers of vulnerable students to ensure that they do not persistently use one style of teaching or demand the same style of response from their students so as to avoid any serious mismatch that could disadvantage vulnerable students who often find it hard to adapt their learning styles to different tasks and situations.

On the part of the vulnerable students, it is believed that if they can be made aware of their style preferences, they will then become more able to recognize their strengths, become sensitive to their weaknesses, and become more aware of the demands of a particular context. They can also be led to take more responsibility for ensuring that they either use their preferred style or find strategies to compensate for the mismatch.

The notion of matching also leads teachers to adopt a strength-based instead of a deficit-based view of students, recognizing that every exceptional student is a learner with a particular style and that the added vulnerability of the person in the learning situation makes it even more important that this should be recognized and supported. Thus, the student's strengths and learning style preference and the teacher's teaching or presentation style should first be identified and discussed. Students should then be allowed to try out a range of presentational and study styles to develop self-awareness of what works for them. Teachers should also use a range of styles to accommodate the range of styles of students in the specific vulnerable group, ensuring that all sensory channels are utilized to reinforce learning. From this strength-based perspective, it can also be argued that the traditional emphasis on remediation in special education programs for vulnerable students is no longer tenable and needs to be replaced by a new emphasis on both enrichment and remediation (e.g., Nielsen, 2002). In this practice of "dual differentiation," remedial activities directed at areas of deficiency are addressed in the context of enrichment activities, and compensatory strategies for bypassing areas of difficulty are encouraged, and students are allowed to excel in their areas of strengths and remediate their weaknesses (Baum, Cooper, & Neu, 2001). Although "dual differentiation" was initially developed to address the needs of twice-exceptional students, it should be well suited to apply to all groups of exceptional learners.

The general strength-based approach is in line with the approach of celebrating diversity of learners and learning styles as strengths (e.g., Prashnig, 2008; Sprenger, 2008), and is completely consistent with the notion of teaching and learning through multiple intelligences (e.g., Campbell et al., 2004). More specifically, this strength-based approach also resonates strongly with the multisensory approach that has been applied successfully with learners with dyslexia and could be made more accessible to all exceptional (including twice-exceptional) learners (Ott, 2007; Pumfrey & Reason, 1998; Schneider & Crombie, 2003).

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19

Conclusion: Back to the Future

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INTRODUCTION

At the beginning of this book, we introduced some of the major challenges facing researchers in the field of intellectual styles. These included: first, a lack of identity of the field; second, contested theory exemplified in a debate around the existence of the "triple controversies" in the styles construct, involving concerns for style overlap, style malleability, and for style value; and lastly, the confusion brought by critical reviews that were destructive rather than constructive in content, tone, and approach. Indeed, it has been a challenging period during the past three decades for serious research of style differences in the psychology of human performance.

We have considered the implications of this criticism much more closely in the first chapter. The case for intellectual styles is also clearly developed and stated in the collection of work presented in this handbook. It is furthermore related to a number of areas of work, encompassing the study of applied, cognitive, organizational, and educational psychology. We would now, therefore, agree with Sadler-Smith, that

> . . . not only are reports of the death of styles greatly exaggerated; style has much to contribute to the continuous improvement of teaching and learning practices in a way that is intellectually rigorous and satisfying.
>
> *Sadler-Smith, 2011, p. xii*

To reinforce what we hope is a positive response to the constructive aspects of this criticism and our preferred approach to developing a consensus in styles theory, together with further consideration of theory-building research, we consider more fully in this final chapter the idea of an "intellectual styles paradigm" and the need for managing "paradigm shift" in the future work of researchers in the field.

As argued by Rayner and Peterson (2009), and subsequently by Rayner and Cools (2011b), the idea of a knowledge community or paradigm is important in the evolution of theory, in the development of research, and in the continuing growth of a knowledge domain. In the following discussion, we address continuing concern for a strategic attempt at developing the identity of the field, thereby encouraging greater clarity of purpose and understanding in the modeling of the style differences concept. Moreover, we will emphasize the importance of producing new and improved psychometric assessment; even more crucially, we call for new

versions of complementary research methodology to enable the continuing development of intellectual styles theory; moreover, we argue that these developments need to support further applied and basic research within the paradigm. Finally, we consider the future by examining how the work in this handbook signals priorities, markers, and directions for practitioners contributing to the work of researching and applying the concept of intellectual styles in the world of human performance. We end by presenting a proposed agenda aimed at paradigm shift in the intellectual styles field.

THE CONTRIBUTION OF THIS HANDBOOK

The work reported in this handbook brings new and developing perspectives to the discourse found in the styles research literature. The dialogue created in this work arguably moves us further forward in seeking consensus and a clearer idea of what it is we mean when talking about intellectual styles. In many ways, these contributions have collectively addressed some of the key topics identified both in the introductory and concluding chapters of this handbook. Key themes we have identified (and these represent a few of many), which we think emerge as front-runners for helping to shape a paradigm shift and establish a research agenda for the field, include the following steps in a program of focused research.

Producing an Integrated Model for the Psychology of the Individual and/or Individuality

This requires building upon the work reported in this handbook to further develop an understanding of differences within the individual, as well as differences between groups of individuals; basic research should usefully be aimed at further developing a "grand theory" as argued by Rayner, Roodenburg, and Roodenburg in Chapter 3. The theory associated with an integrated styles model should ideally contain an explanation for how the self as a regulating system combines core psychological constructs, namely, personality, ability, affect, and cognition. Intellectual styles represents a leading aspect in this structure, but we argue that this needs to be further understood in relation to these constructs, as a factorial model corresponding with the behavior of individuals engaged in a range of human performance. This work, therefore, needs to combine researching styles in other complementary areas of mainstream psychology. An example of this approach is reflected in Chapter 11, in which Roodenburg, Roodenburg, and Rayner explore approaches to the modeling of an individual's personal psychology and the interrelationship between intellectual styles and personality in the construction of a self-system.

Another alternative account of styles, but one which again attempts at better developing an integrated model of styles described as a bounded dynamic phenomenon, is presented by Mandelman and Grigorenko in Chapter 5. Their discussion draws upon a new understanding of the etiology of styles, located in a mix of intelligence and personality. Furnham, in Chapter 9, also argues for more work

investigating the mediating function of styles in an integrated model of the person. He concludes that we need to know more about how styles moderate as well as mediate the functions of ability and personality, and the extent to which they may account for incremental validity in cross-sectional research. Moreover, Furnham argues that this model should also seek to include researching the interrelationship between ability-based intellectual styles and other psychological aspects of the individual's self. One example of this kind of research, but with a focus upon differences between groups of individuals, is reported by Blazhenkova and Kozhevnikov in Chapter 17. Their work investigates series of interactions and establishes levels of significance in the measured effect between dimensions of cognitive controls identified as stylistic features found in separate groups of individuals reflecting differing professional specialization. The implications of this work take us back to the question of an individual's personal psychology. It also links more or less directly to earlier experimental research investigating cognitive controls and processes, and a model of cognitive styles as features in an information-processing faculty organized along four dimensions: context dependence versus context independence; rule-based versus intuitive information scanning; integration versus compartmentalization; and external versus internal control allocation, operating at different levels of a hierarchical information-processing system (perceptual, concept formation, modeling, and metacognition/program).

Furthermore, as we have proposed that new research should include complementary methodologies specifically designed for further developing an integrated model or account, we strongly suggest that some research should be particularly focused on examining second-order psychological processes and controls implicated in the development of the self as a learner; this should especially include work investigating metacognitive and related self-regulating constructs that interact with and are possibly "served" by styles, as well as "channeling" core process-based dimensions of the self-system such as personality, emotion, and ability. Many of the contributors in this handbook refer to these second-order processes, and call for further research into the interrelationship between the mediating effects of intellectual styles and these aspects of mental function. There are specific chapters that offer a very useful set of markers for use in designing further research of this kind. For example, several authors consider the leading role of intelligence and ability in shaping frameworks and models of styles as part of the person's individual psychology:

- In Chapter 2, Nielsen draws upon an historical review to identify ability-based styles predominating in much of the styles research reported over the past several decades. Zhang and Sternberg in Chapter 7 confirm the ability-based nature of the threefold model of intellectual styles in research that also explores the interrelationship between different cultural contexts and types of intellectual styles. Similarly, in Chapter 12, academic attainment is examined by Fan and He, and the validities of most intellectual styles for predicting academic success are largely supported in different educational domains and at different levels.
- In Chapter 8, Sadler-Smith's thoughtful analysis of metacognition shows that when adopting the perspective of intellectual styles, metacognition can be identified as

possessing compensatory, anticipatory, and moderating functions in learning processes. He adds that these functions are transferable and integrative, but at the same time imperfect, with implications for learner development that suggest no robust development of metacognitive strategies can take place in the individual without involvement of an awareness of styles.

- Cools, in Chapter 16, adopts an alternative approach to examining these same second-order processes located within the larger holistic model of a person's individual psychology. She seeks to examine the behaviors associated with distinctive sets of decision making, while identifying the important mental function of decision making as a distinguishing event in the organizational psychology of a workplace. The complexity of interactions between styles and cognition is repeated, as Cools makes a case for adopting a multidimensional style perspective in order to clarify the cognitive profile of entrepreneurs and entrepreneurial work.

Lastly, and in a sense, extending the approach adopted by Cools in the previous example, there is a need for work integrating ability-based intellectual styles with other aspects of an individual's stylistic performance across a range of context: this research should deliberately target the interaction of intellectual styles with "less context-sensitive" personality-based mental functioning, such as personality, intelligence, and ability, as well as "more context-sensitive" cognitive systems of the self, such as language, creativity, motivation, decision-making, and problem-solving. For example:

- Hartley and Plucker in Chapter 10 address the way in which intellectual styles and second-order cognitive processes, particularly, problem-solving preferences, contribute to levels of creativity shown by the individual. They argue that everyone has the capacity for creativity but this differs in how one prefers to go about being creative. There is, the authors argue, an immediate relevance for studies aimed at extending our understanding of creativity and problem-solving styles employed by individuals in contexts ranging from the classroom to the boardroom.
- In Chapter 6, Fer supports the view introduced by the editors in the Chapter 1 that intellectual styles as defined by the threefold model (Zhang & Sternberg, 2005) are malleable and when examined in relation to demographic differences (age, gender, academic discipline, and educational or school class level), reveal significant series of relationships between intellectual styles and demographic characteristics. The authors argue that their research suggests that intellectual styles as a function of four demographic characteristics can be socialized and thus can be changed.
- Gebbia and Honigsfeld in Chapter 13 present a similar account of how past styles research has often been principally used to predict academic attainment. They offer an alternative focus upon potential impact on life-long learners as individuals ideally develop into contributing members of society. Their work reports significant relationships of intellectual styles to academic and developmental outcomes among learners of all ages.

Lastly, and with a distinctive emphasis on moving toward yet greater levels of clarity and consensus when modeling and explaining a psychology of the individual

self, it is important that the kind of "notional conceptual geography reflecting the relative position of the variant style constructs" described by Cassidy (Chapter 4) is mapped, verified, and sustained. In a similar reference to the geography of domain creation, Rayner and Peterson (2009) suggested that choices facing the field of style research involve contributing to either the existing knowledge diaspora of individual differences psychology or working toward the development of a global paradigm.

Producing a Bespoke Series of Research Methodologies to Help Develop and Validate an Integrated Model of Individuality

This is work aimed at enabling further investigation in/and validation of a proposed model of self-individual constructs as has appeared in this handbook. For example, most chapters deal with the ways intellectual styles relate to the psychological processes identified in the previous section, in terms of conceptual geography (intelligences, ability, personality, creativity, giftedness, culture, and academic performance). This research, however, should quite crucially include developing new forms of research design that will offer a better "fit for purpose" investigation of the style construct and related psychological processes. Again, and as Cassidy argues in Chapter 4, we should aim to develop frameworks and research designs that utilize a better form of methodology. There is a great need to secure the future development of intellectual styles research by engaging in practice that follows a trajectory which, as stated by Cassidy, "... is more cohesive, consensual, aligned, transparent, accessible and methodologically robust path."

There are several instances of different authors similarly commenting upon the importance of methodological fit and a carefully established transparency in terms of psychometric methods employed in any research experiment. The inference is that perhaps too much has been taken for granted in the past when designing and then reporting experimental or cross-sectional research design and the way in which self-reporting assessment is repeated. For example, several authors call for longitudinal research designs (Furnham, in Chapter 9; Cassidy in Chapter 4; and Cools in Chapter 16). Furnham points out the paucity of longitudinal studies of "change in style" over time while commenting upon the greater reportage of studies of changes over time in both personality and intelligence. Nielsen also criticizes the lack of robust control in data analysis, citing several cases of poorly managed statistical treatments, a lack of independent measures of behavior change in effect studies, and the lack of control for interaction or confounding variables. More generally, Nielsen also questions reliance upon a common feature across the field, that is, single test research and poorly supported generalization from this research design, as well as a lack of sustained replication of previously reported research.

The same levels of critique can be found in a recent debate in the wider arena of educational research questioning the ways in which experimental and observational data are adopted and reported in research aimed at revealing causal effects. In criticizing styles research, Pashler et al. (2008) argued that more research is needed to generate conclusive evidence of style effects, and stated that this requires experimental designs and consistent robust use of the assessment treatment intervention

design. Schneider, Carnoy, Kilpatrick, Schmidt, and Shavelson (2007) provided a similar argument around the use of observational data and randomized control tests. They commented that

> A common concern expressed by those deeply engaged with the educational enterprise, as well as those outside education, revolves around the design of and methods used in education research, which many claim have resulted in fragmented and often unreliable findings . . .
>
> *Schneider et al., 2007, p. 2*

While the immediacy of gain to be made by better demonstrating the significance of styles in terms of effect sizes related to experimental and quasi-experimental designs is clearly evident, there is also a need for cautious consideration of design. Messick (1994) sometime ago pointed out the complexities of defining and measuring styles and how this might be interpreted as indicating that modeling the styles construct involved a more fluid "bridging variable" at work than was previously thought. Messick (1994, p. 133), as a consequence, asked if there is a need for developing a new research paradigm to enable evidencing the way in which styles may simultaneously embody personality and cognition. At the least, we would counter, there is need for further developing forms of research methodology fit for a widening purpose in styles research. Furnham, in Chapter 9, makes a very similar argument for ensuring that research design involves a careful fit between question or aim and method employed. Finally, as indeed is the case in educational research more generally (Schneider et al., 2007), and in mainstream psychology (Boon & Gozna, 2009; Meier, 1994; Prieler, 2007), there is a continuing debate on the development of new and more appropriate forms of research methodology for eliciting both causal effects and a better understanding of human performance.

Publishing a Reliable and Valid Set of Intellectual Style Assessment Tools

Such a publication would serve the stated purpose of providing a reference book and collection of tests for use by practitioners in the school and workplace contexts. This publication should be based upon a clearly stated set of inclusion criteria and warrants providing a guarantee of quality. Both Nielsen and Cassidy in Chapters 2 and 4, respectively, describe the need for this kind of publication. They also point out, however, that such a publication needs to be predicated upon a very clearly stated theory of intellectual styles. As Nielsen comments, the topic of quality in measurement is equally important ". . . because measurement is at the basis of all activities in the field." The use of style assessment and its quality matter a great deal. Testing is to date the primary means of identifying and defining styles, although self-report questionnaires are often substituted as a psychometric tool, are not validated, and therefore are often not reliable. A similar concern for the role of assessment and the ensurance of valid theory, relevant modeling, and reliable tools for use in both research and pedagogy is made by Furnham (Chapter 9) and Rayner, Roodenburg, and Roodenburg (Chapter 3).

A second "wave" of contributions, sharing concerns about the validity, reliability, and relevance of style-based assessment may be found in several chapters

referring to the utility of intellectual styles in the applied context. The practitioners' use of this assessment is anticipated as, first, focusing upon educational contexts as described by Gebbia and Honigsfeld in Chapter 13, and then, as equally relevant in the workplace for career decision making (described by Armstrong et al. in Chapter 14) and in person–environment fit (identified by Cools in Chapter 16). Finally, as argued by Cassidy, and a point worth repeating, the use of psychometric modeling and methodology must be used to realize "... a more cohesive, consensual, aligned, transparent, accessible and methodologically robust path, than has previously been the case." This kind of project would therefore by necessity, and as argued by Rayner, Roodenburg, and Roodenburg (Chapter 3), involve a further consideration of psychometric methodology, further work in the area of the construct validity of assessment tools, and the developing epistemology of research (test construction, modeling, and measurement) in the field.

Reinforcing and Deepening Educational Implications for the Work of the Field

This is an aspect of the ongoing work of the styles field that is perhaps the most extensively documented, yet remains the focus of continuing controversy as described by several authors and closely scrutinized by the editors in Chapter 1. Several contributors provide us with very useful platforms for building more sharply focused research agenda for field development. A number of important educational issues cluster in this area; these include, first, establishing new approaches to setting up and managing the assessment of students' intellectual styles, instruction, and assessment; second, designing and developing robust and meaningful approaches to managing personal and social diversity in the educational community; third, developing and making provision for specific groups of learners, including those who are talented and/or gifted, those who are exceptional learners, some with learning difficulties and disabilities; and, finally, using assessment to promote style-aware interventions across a range of interdisciplinary areas, involving, for example, creativity, problem solving, and decision making. We have referred to the latter aspects of intellectual performance previously, but it is important that practical interventions and related pedagogical and curriculum-based developments are more fully considered. These should focus upon developing new approaches to instruction and training.

Evans and Waring in Chapter 15 present a thorough systematic review to this whole area of educational instruction and assessment in schools and higher education institutions (HEIs), together with an analytic description of the nature and impact of styles research on and across a variety of context. They conclude that "... [what] we need to identify are those core principles that will drive the design and implementation of programs in schools and HEIs. Fundamentally this requires a detailed mapping of styles constructs to other individual learning differences so as to firmly locate styles research within and not outside of cognitive psychology by integrating the research lens and expertise in styles and cognitive psychology." The notion of a learner's awareness of metacognitive tactics and strategies in an approach to self-governing practice plays an increasingly greater part in the rationale

underpinning their approach to developing a style-led pedagogy. This reinforces the idea of a personal learning style previously developed in work reported by Evans and Waring (2009), and previously, Rayner (2000).

Such an approach to style-based interventions in learning and instruction contrasts with but is not entirely dissimilar to that described by Gebbia and Honigsfeld (Chapter 13) and Armstrong et al. (Chapter 14). The former maps out a taxonomy of style models for use by practitioners and concludes that

> It is our hope that the presence of a comprehensive theoretical model for styles research on mental self-government will allow researchers in the future to investigate many pertinent variables in the same study and include more diverse aspects of academic, social, emotional, and health outcomes in their models. In the past, the focus of styles research has been on understanding and predicting academic success.

As in the argument presented by Evans and Waring (Chapter 15), the desire for a "universal model" and related tests for styles is again repeated albeit from the practitioner perspective.

Armstrong et al. adopt a similar approach in bringing together a "group" of style measures, and then describing a way of using this assessment to set out a range of "theory-to-practice steps in developing a style-led programme of intervention in a wide range of management activity." This program includes selection, vocational choice, and career success; diversity, group processes, and conflict management; intuition and emotion in the workplace; training and development; styles' profiling; and career management in global organizations. Again, the authors conclude that the education and training of individuals in respect to their intellectual styles was a useful and appropriate way of enabling individuals to manage their careers more successfully and develop in appropriate directions.

Wider-ranging educational issues that also attract practitioners interested in accessing and better meeting learning needs associated with the individual differences of learners in the educational setting form an important part of this proposed direction for research activity. Ways of differentiating provision to cater better to exceptional learners is described by Chan in Chapter 18, and is seen as offering ways in which teachers can be more effective by capitalizing on knowledge of the intellectual style preferences of exceptional learners. Fer (Chapter 6) reaches a similar conclusion after reporting on the application of several models of intellectual styles. The idea proposed is that if individuals are made more aware of styles, and they realize why they prefer using certain styles rather than others, they will better adapt to diverse environments, and this may improve an individual's sense of autonomy and enhance their positive attitudes toward tasks and environment.

A second piece of research investigating diversity in the educational community is presented by Zhang and Sternberg (Chapter 7). The association of structural patterns revealed in an analysis using Hofstede's cultural dimensions and six major style constructs encompassed in Zhang and Sternberg's Threefold Model of Intellectual Styles shows that culture is an important factor in the formation of styles. This research also offers a useful example of integrating styles research with a complementary area of psychology, in this instance, the social psychology of culture. Again, a

notion of the utility of "style awareness" as a feature of pedagogic intervention and management of educational diversity is argued. An awareness of the relationship between culture and styles for teachers when dealing with students from diverse cultures may enrich levels of cultural sensitivity to students with diverse cultural backgrounds. Zhang and Sternberg go further and press for this awareness to lead to developing a variety of style-led instructional designs as well as pedagogic skills development in the areas of interpersonal interactions with students, and finally, further development of teaching styles and methods of assessment.

Reinforcing and Deepening the Implications of Intellectual Styles in a Range of Organizational and Workplace Settings for the Work of the Field

In a similar way to the previously proposed step, this activity needs to focus on generating a program of applied research that should both inform and determine approaches to new knowledge production and a codeterminant development of practice. The discussions presented by Armstrong et al. (Chapter 14) and Cools (Chapter 16) offer a very useful starting point for developing this aspect of work. What is imperative, however, is a shared understanding of the conceptual framework being brought to bear upon the context being researched. This important principle of methodological transparency and theoretical fit in research design is again reemphasizing the previous argument presented at various points throughout this book, and demonstrates why it is so necessary that the field realize a far greater theoretical consensus in the area described in the first three themes presented here.

Reinforcing and Deepening Vocational and Career Choice Implications for the Work of the Field

This particular consideration of impact is what in fact motivated a great deal of early research in the field as exemplified by that of Witkin, Moore, Goodenough, & Cox's (1977), and more particularly by that of Kolb's (1984). It is closely linked to the previous theme and forms the content in Chapter 14 (Armstrong et al.). Given the increasing emphasis on student destination in university education, and concern for exploiting educational achievements in the workplace and economy, there is a vital contribution to be played by styles research. The greater and more deliberate use of style awareness as part of self-knowledge can arguably facilitate effective and appropriate decision making in the personal choices made by students or workers in following their career path.

A final catch-all theme pervading this handbook and made clearly explicit at its beginning is that of establishing a shared "language" and "consensual theory." The desire for greater levels of coherence and clarity in terms of key concepts, core constructs, and their place in relation to a psychological theory is paramount. The position at the moment is one in which there are several theoretical frameworks influencing the field, including the specific model of mental governance tied to the development of the threefold model of intellectual styles. Furthermore, a great deal

of this handbook has concerned itself with using the term "intellectual styles" to build a common rubric for style theory and research.

We do not as yet suggest that this is in itself sufficient for setting out a "final solution" and any definitive version of style differences as they might feature in the psychology of the individual and/or individuality. It may very well turn out to be the case, but for the moment we have made a good start in asking this question. The implications of this work for future knowledge production in the styles field lead us more directly next to consider the idea of paradigm shift and raise the questions of how best to manage this "paradigm shift" and engage with the "politics" of knowledge production and researcher community practice.

A PARADIGM TRACK: MILESTONES ALONG THE WAY

In the following section, we attempt to describe the process of the development of the field as a paradigm track spanning more than 50 years. We adopt the strategy of identifying a series of works published and devoted to styles that appear in several distinctive periods of paradigm shift. A snapshot summary is provided here in a brief explanation for identifying these particular works and their place in the development of the paradigm. Each represents a milestone in the movement of new knowledge production and the continuing growth of the domain.

Several contributors to this volume have provided their own grouping of valid and reliable models of styles that they argue stand the test of "quality assurance" criteria. Each of these in its own right remains persuasive, and in particular, the review leading to a ranking table of most frequently used models compiled by Evans and Waring in Chapter 15 makes for interesting reading. We would, furthermore, suggest the milestones identified here are positioned in relation to these groupings made by the contributors in this volume. At the least, further consideration of these might help contribute to meeting "Item Three" in our previously stated research agenda for the paradigm. What we hope to do here, however, is to identify markers that trace the development of the field and so make a case for yet more deliberative action on the part of the knowledge community if "paradigm shift" is not to lapse into "paradigm drift."

The first period we identify is from 1945 to 1985. The styles milestone publications we have selected from this period include work from the following researchers: Messick, Entwistle, Biggs, Witkin and Goodenough, Myers-Briggs, and Kolb. This period reflected five distinctive and separate streams of research reflecting different sources of theory applied to the idea of individual differences and cognitive or learning styles. The following summaries describe this work:

1. The study of cognitive controls and cognitive processes led to the publication of *Individuality in Learning: Implications of Cognitive Styles and Creativity for Human Development* (edited by S. Messick, 1976). The book marked a collection of essays that involved early contributions from several leading researchers in the field. These included Messick's own work on cognitive controls and processes together with his continuing effort in developing a theory of cognitive styles.

2. The study of perceptual process and information-processing led to the publication of a book titled *Cognitive Style: Essence and Origins* by H. A. Witkin and D. R. Goodenough (1981). Witkin was the architect of a theory of perceptual styles and introduced the concept of field-dependency versus field-independency. Witkin and colleagues further developed research exploring the implications of "cognitive" styles upon the behavior and attitudes of people in a range of social activity.
3. The idea of learning styles developed by Kolb constructed around a dynamic model of learning based on a cycle of learning with four learning modes Concrete Experience, Reflective Observation, Abstract Conceptualization, and Active Experimentation. The model and its related assessment are firmly located in a well-developed theory of experiential learning, and led to the seminal publication titled *Experiential Learning: Experience as the Source of Learning and Development* by D. A. Kolb (1984).
4. The notion of orientations to study involving constructions of learning determining typical approaches to study in higher education was developed by a group of European and Australian researchers. A lead researcher in Europe was Entwistle, who in 1981 published a book titled *Styles of Learning and Teaching*. In this book, he rehearsed a theory of deep and shallow approaches to study. A second related development taking at place at the same time led by Biggs combined this work with a consideration of motivation and produced an important publication in 1979 titled "Individual Differences in Study Processes and the Quality of Learning Outcomes," which appeared in *Higher Education* (Volume 8, pp. 381–394).
5. The cognition-based psychology that more generally led to a theory of cognitive styles located in a study of personality traits focused upon the notion of psychological types as defined in Jungian theory. The Myers-Briggs's Type Indicator became a very widely used test for assessing personality-based styles and Myers published a seminal work titled *Gifts Differing: Understanding Personality Type* (1980). This model was extensively used by practitioners in business management and workplace.

A second period in style paradigm movement spans from 1985 to 2000. This period is identified by Kozhevnikov (2007) as a time in which the field began to attempt to unify the theory of styles (cognitive, learning, and personal). She describes how some of these researchers contributed to a trend toward conceptual reductionism. Much of the work appeared to be aimed at systematizing styles and establishing a series of structural relations among them. A significant implication of this period for Kozhevnikov (2007, p. 473) is, "... the confirmation of a hierarchical organization of style dimensions, consisting of at least two subordinate dimensions, one related to low-level information processing and another related to more complex cognitive activities, and of one super ordinate dimension related to executive cognitive functioning." Kozhevnikov identifies one significant departure from this trend toward systematizing existing cognitive styles, with the introduction of a multidimensional system of thinking styles described by Sternberg (1997). A second stand-alone development during the same period, and which was also located in the United States,

involved the continuing work of Dunn and Dunn (with many colleagues) and the production of the learning styles inventory.

The styles milestone publications we have selected from this period include work from the following researchers: Schmeck, Riding, Kirton, and Sternberg.

1. Schmeck's edited book represented a transitional point, reflecting a stated attempt to integrate much of the work around learning styles and strategies. It is titled *Learning Strategies and Learning Styles* (1988). Models of styles included in this work were both process based and trait based in structure. A clearly stated attempt was also made to distinguish between stylistic features and cognitive/learning strategies in the individual's approach to learning.
2. Riding's work introduced a conceptual model of cognitive styles presented as a unifying structure comprising two orthogonal dimensions of cognitive style embedded in an individual's mental functioning. An early publication in 1981 titled *Cognitive Styles Analysis* presented a computerized assessment as part of this model. A subsequent book published in 1998, titled *Cognitive Styles and Learning Strategies*, authored by Riding and Rayner, considered some of the theoretical implications of the model as well as an analytic review of the field and the reporting of a decade of associated empirical research.
3. A third milestone in this period, looking at creativity and problem solving in the workplace and organizational settings, was introduced by Kirton and colleagues. A seminal text published in 1989 titled *Adaptors and Innovators: Styles of Creativity and Problem-Solving* laid the foundations for ongoing work on a model of style called the KAI. This was structured in a similar way to Riding's style model, but comprising orthogonal dimensions labeled "adaptor" and "innovator."
4. Dunn and Dunn led a separate and distinct movement in this period, originating in the task force project led by Keefe (1989), on the part of the North American Association of Secondary School Principals, to develop a comprehensive assessment for learning styles. Dunn and Dunn led a sustained approach to refining an assessment and locating this assessment in a practical approach to developing styles-led pedagogy. The theory underpinning this work described learning styles as a composite model of sensory modal and cognition-based processes forming an individual's preferred ways of learning. The seminal books published by these authors marking the development of their learning styles theory were, in 1989, a book titled *Learning Styles Inventory* authored by Dunn, Dunn, and Price, and in 2000, a book titled *Practical Approaches to Using Learning Styles in Higher Education* edited by Dunn and Griggs.
5. Sternberg provided us with a final milestone contribution to this period in the form of a book published in 1997 titled *Thinking Styles*. As previously stated, Kozhevnikov described this model of styles separate and distinct in its development. This is not strictly accurate, as the previous work by Grigorenko and Sternberg (1995) synthesized existing styles theory producing a styles classification comprising cognition-based, personality-based, and activity-based models of style, and Sternberg building upon this and other work developed a framework of mental self-governance and the new theory of thinking styles. A stream of research continued in an emerging body of empirical evidence collated in

support of the thinking styles model (e.g., Sternberg, 1988, 1994; Zhang, 1999), validating the theory and measures of thinking styles, and which has been carried over into the next period of paradigm development.

A third and contemporary period in this account of a styles paradigm spans 2000 to the present day. This period is yet to be fully evaluated, but as described by Kozhevnikov (2007), it has included renewed research interest in the phenomena of styles and ideally should be associated with the kind of paradigm shift discussed in this chapter. We suggest that the following work reflects an early formation in markers that may become milestones for this new period of field development.

In 2001, Sternberg and Zhang published an edited book, *Perspectives on Thinking, Learning, and Cognitive Styles*. The strongest motivation for this book was the existence of the voluminous research evidence challenging the traditional belief held by many psychologists and educators that people's successes and failures are attributable mainly to individual differences in abilities. With contributions from nine groups of the world's leading scholars in the field, this book argued that styles are not abilities, but rather preferences in the use of abilities. According to this view, styles could also be distinguished from other attributes such as interests and personalities. However, the scope of this book did not allow for a collaborative effort in addressing some of the equally fundamental issues regarding styles. It was most apparent that the three controversial issues concerning the nature of styles needed to be systematically explored. Ultimately, such a need served as an important impetus for Zhang and Sternberg in writing the book *The Nature of Intellectual Styles* (Zhang & Sternberg, 2006). In this book, the authors argued that (a) styles are value laden, or at least value differentiated, but not value free; (b) styles are malleable; and (c) although styles are similar constructs with different style labels, each style construct makes its unique contributions.

However, there are many bases for further debate regarding the nature of intellectual styles. For example, at the conceptual level, Zhang and Sternberg's view of intellectual styles is just one of many possible views, and their approach to addressing these issues is but one of many possible approaches. Where do other key players in the field stand with respect to these controversial issues? From what perspectives would they deal with these issues? Moreover, are there other topics of importance from the perspectives of other scholars? Zhang and Sternberg's (2009b) edited volume, *Perspectives on the Nature of Intellectual Styles*, provided its contributors with a platform for addressing these questions. At a practical level, although Zhang and Sternberg (2006a) discussed several major implications of their positions on the three controversial issues for educational practice in general, more specific strategies needed to be proposed to make the notion of intellectual styles more applicable to the education arena. By the same token, Zhang and Sternberg's discussion of the implications of recognizing individual differences in styles for business settings was restricted, mainly due to the limited scope of the book. Again, to overcome these limitations, Zhang and Sternberg's (2009b) edited volume showcased their contributors' perspectives on the applications of styles to educational and business settings. It would be hard for anyone to dispute that Zhang and Sternberg's (2009b) book symbolizes an unprecedented effort in systematically addressing the major challenges

that have been repeatedly mentioned in this chapter. Given such importance, this book warrants more detailed discussion here.

In the Epilogue of the book, Zhang and Sternberg (2009a) argued how its content collectively addressed some of the challenges previously identified. For our purposes here, we elaborate on three prominent themes in the book, each aiming to address one particular challenge of the field. The first is with respect to contributors' efforts in building a common language and in operating within a common conceptual framework for styles. One of the accomplishments of Zhang and Sternberg's (2009b) edited volume is clearly reflected in the contributors' various attempts to build a common language and to operate within a general conceptual framework. The second concerns the three controversial issues surrounding styles. After examining the dialogues in these chapters, Zhang and Sternberg (2009a) concluded that the three long-standing controversial issues (i.e., style overlap, style malleability, and style value) are still largely open to debate. The third pertains to locating the styles literature within the larger context of the psychological, educational, and business literature. An unambiguous attempt to link the styles literature to other literatures was shown in each of the 10 chapters in Zhang and Sternberg's (2009b) edited book. Undoubtedly, Zhang and Sternberg's (2009b) edited volume can be regarded as what Mayer (2009) called "Another valiant attempt to resuscitate intellectual styles as a field of study," and that this attempt can be largely considered a success. However, there is one major limitation to the book. The chapters were intended to present the perspectives of each of the individual contributors, rather than to provide systematic and comprehensive overviews of each of the various aspects of the field. The present handbook aims at accomplishing the latter task.

Apart from the above book trilogy advancing the field by addressing the aforesaid challenges, Rayner and Cools in 2011 published an edited volume titled *Style Differences in Cognition, Learning, and Management*. This work marked a deliberate attempt to strengthen the identity of the field of styles as a domain of knowledge located in the psychology of individual differences. With the aim of presenting "a clearly stated, reliable, and coherent articulation of the state of the science in the field of style research" (Rayner & Cools, 2011a, p. 1), the book may be seen as another step in taking the field forward. The collection of research reported in this edition, looking at learning styles and experiential learning, and more specifically issues around learning styles flexibility and adaptation, provides a rich bed of data and new evidence further supporting previous research (Backhaus, 2011; Sharma & Kolb, 2011). Indeed, a commendable approach to research design includes the framing of longitudinal data, to further support the take-up of styles-based pedagogic and curricular design in business and management education in the United States (Boyatzis & Mainemelis, 2011). When applied to assessing the learning patterns of students following programs of study in different disciplines at university (Vanthournout, Donche, Gijbels, & Van Petegem, 2011) and in the professional learning of teachers in Holland (Vermunt, 2011), longitudinal design is again used for securing a more robust evidence base in eliciting evidence of individual styles.

To summarize, we argue these recently published books contain visible thematic markers in what can be argued as an "evolution" of the styles paradigm as described by Cools and Rayner (2011, pp. 296–299). For example, it might be

useful to consider extending the concept of a styles paradigm, in a way similar to that identified by Jablokow and Kirton (2009) and Rayner and Peterson (2009). This notion of knowledge domain and field identity linked to an emerging paradigm is further explored by Rayner and Cools (2011b). The perspective presented in this chapter, and reflected in the content of this handbook, provides a further and perhaps immediate conceptual seedbed in which to grow new knowledge in the styles field as a product of scholarly insight, perspective, and intellectual discourse. In the final section of this chapter, we turn once again to the question of building not only upon the past, but also upon the present to determine a future direction for the paradigm.

MORE PARADIGM RENEWAL: WORKING TOGETHER

A continuing need for academic leadership located within the existing styles paradigm is in large part an endeavor that requires the promotion and support of new communities of research practice and collaborative activity (see Rayner, 2011). Moreover, a need for interresearcher collaboration and cross-disciplinary research is arguably implicit in most if not all of the research reported in this handbook. We think that the field is now ready for this development and for this handbook, marking another important point in knowledge domain development. However, we do not mean to suggest that the collection of work in this handbook is a product marking full maturity of a knowledge domain. We propose the need for much more of what is suggested here as a research agenda. There are four key themes implicit in this proposed agenda. The first is to realize a deliberate attempt at involving the wider research community in better managing the root and branch work of knowledge production. This work must reflect a shared aspiration for the advancement of the styles field. The second is a concerted effort at further theory-building, utilizing basic and applied research together with new and improved research methodology linked to style assessment. The third is "political" in nature involving a clearly and carefully stated "field manifesto" aimed at mapping key directions, principles, and priorities for practitioners working at different times and points along the spectrum of pure or basic to applied research and related practice. The fourth is the resourcing and managing of production and mobilization of further research and development, shaped by the preceding three stages of collaborating and contributing to paradigm renewal.

To attempt all of this is in large measure to follow some of the suggestions outlined by Rayner and Peterson (2009) and by Rayner (2011). One example is the pursuit of a shared research agenda to facilitate a global aim for international and interdisciplinary cooperation in the study of theory and application in the styles research community. This endeavor would require a readiness to consider multiple and sometimes conflicting or at the least challenging aspects in models of styles and related research methodology. A first step might be to emulate this kind of approach following the example of the Self-Regulated Learning symposium held at an American Education Research Association (AERA) annual meeting. A transforming approach to a specific area of applied psychology was achieved by researchers at

this meeting, in establishing an agenda for renewal of theory-building and the production of a common research rubric.

Zimmerman (1986, 2008) provides a succinct and clearly reported account of this event as a defining moment in research on self-regulation in which the immediate and pressing challenge facing participants in the field at that point in time was to organize leading researchers in a problem-solving symposium. The group agreed to integrate under a single research rubric and agree theoretical definitions of processes such as learning strategies, metacognitive monitoring, self-concept perceptions, volitional strategies, and self-control. As Zimmerman explains,

> An outcome of the 1986 symposium was an inclusive definition of SRL as the degree to which students are metacognitively, motivationally, and behaviourally active participants in their own learning process (Zimmerman, 1986). This definition focused on students' proactive use of specific processes or responses to improve their academic achievement.
>
> *Zimmerman, 2008, p. 167*

It is exactly this kind of managed event that enables a discourse that can help refocus the researching community and might be used to reestablish shared movement toward a global paradigm in the field of styles research. We should therefore perhaps call for expert leaders in the field of styles to mobilize a similar "symposium," and perhaps the AERA annual conference might be the ideal forum for such a venture. Alternatively, some other global community in either education or psychology might provide an equal or better arena within which the same kind of event(s) could be facilitated.

A third possibility is the joint creation of an international university-based center(s) dedicated to this work that serves the wider international and interdisciplinary field. As always, albeit perhaps less restrictively in the contemporary world of rapidly advancing information technology, resources would need to be found to set up and sustain this kind collaborative venture. Nonetheless, the way forward must involve reaffirming as well as further clarifying style differences phenomena, by orientating research in a strategic manner across an international research community of practice. The primary aim is to relocate intellectual styles as situated theory in the wider domain of personal and differential psychology. We believe this handbook represents a substantial movement in this direction.

Moreover, and regardless of the ways in which the styles research community eventually moves, we suggest that the following agenda, characterized as a paradigm shift, is crucial for the further development of the field. We also suggest, as previously argued, taking up this agenda should in large part focus upon a set of shared research priorities as a kind of "field-led project." These might therefore include:

- Establishing a shared conceptual framework for the concept of style, differences, and individuality within which to locate both theoretical and applied problem-posing/-solving actions as key drivers in the research community and knowledge domain.
- Realizing a consensual research rubric and agenda for new knowledge production and the identification of most critical research questions for the field.

- Adopting a solutions-focused strategy for producing an orchestrated but shared approach to developing both pure and applied research epistemology.
- Creating the means for sustaining a "common language" and a "frame(s) of reference" for asserting knowledge boundaries in the field.
- Producing a reference repository as a means for collating and informing applied research in a range of learning contexts and areas of human performance so that it can, in turn, guide development efforts and improve practice in a wide range of settings in the workplace.

The game plan is not instant transformation, but rather one of step-wise paradigm shift to enable better resolution of style differences theory in respect to research, knowledge production, and applied practice. The endgame is one in which achieving a better understanding and representation of how *intellectual styles do make a difference* in human performance. Equally importantly, it is also about knowing more about and understanding how style differences *do matter* in explaining the psychology of the self as an individual in a social world.

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Epilogue

Robert J. Sternberg, Li-fang Zhang, and Stephen Rayner

Researchers study intellectual styles because they care about differences in how people think and learn that go beyond abilities and, to a large extent, personality as traditionally defined. These researchers recognize that children and adults differ from each other in how they approach material. For example, some prefer to distribute attention across several tasks that are prioritized; others prefer to work toward multiple objectives during the same period of time, but without setting clear priorities; and still others have a propensity for being engaged in tasks that allow complete focus on one thing at a time. And there is no one "right" way to learn or think. Teachers and employers who accommodate preferences in styles achieve better productivity among their charges.

This volume has made clear why styles research is so important to education, psychology, and business. We close by summarizing the reasons why research on intellectual styles is so important to the fields of psychology, education, and business.

First, styles research recognizes that much of success in school and life depends not merely upon the main effects of cognitive abilities or of personality, but of their interaction how people utilize their intellectual abilities as mediated by their personality. There is no area of research that better characterizes the interface between cognition and personality than does styles research.

Second, as implied by the first point, measures of styles show discriminant validity with respect to both cognitive ability and personality measures. Many of the assessments that have been introduced into psychological and educational research have been shown to be minor variants of either cognitive or personality (usually, Big Five) assessments.

Third, styles research acknowledges something that much research on cognitive abilities seems not to that, in the course of a century, research on the predictive validity of cognitive abilities for predicting school and life achievement has not gone very far. The work of the pioneers Alfred Binet, Charles Spearman, David Wechsler, Carl Brigham, and others was tremendously promising. They created assessments that provided moderate and meaningful prediction of academic success and modest to moderate prediction of other life outcomes. But after this initial great success came a lot of "normal science" research that moved their direction forward without any great leaps or bounds or interesting changes of direction. The cognitive-ability tests used today are cosmetic variants of the early tests, and thus their predictive power

is only cosmetically better than that of the early tests. Styles research looks at a different dimension of human performance and, as the studies in this volume show, meaningfully improves prediction of academic and other life outcomes. These measures converge with important life outcomes.

Fourth, styles have been conceptualized in ways that are both measurable and disconfirmable. A major problem in education has been a series of interventions and assessments that are introduced and then stick around because there is no clear way of disconfirming their validity. For example, what psychometric validation is there of Bloom's Taxonomy? This extremely widely used taxonomy has been around for many years, but it is stipulative. There is no serious evidence that it corresponds to the way people think. Styles, in contrast, have been empirically studied and, in some cases, have been shown to be less successful as measures than one might have hoped for. The fact that theories of styles are testable provides a great incentive for continuing to pose and study them in the future.

Fifth, styles can make and have made a meaningful difference to instruction. As the studies in this volume have shown, teachers can reach more students if they teach to a variety of intellectual styles rather than always teaching to the same ones (most likely, their own). Most researchers who study styles care about educational outcomes and recognize that by working with teachers they can improve education in a way that otherwise might not be possible.

Finally, styles have also been shown to play a critical role in business settings. As has been demonstrated in this volume, intellectual styles not only have a significant impact on individuals' career behavior and job performance, but also matter a great deal in the management of an organization as a whole. Business leaders who are aware of the notion of styles and who apply their knowledge about styles to organizational management can expect to achieve more success.

If styles research can continue to make a difference to the world, what are the big issues that are likely to be the focus of future research? It is always risky to speculate on where research will go in a particular field. But we would hazard a guess that seven areas will be particularly important.

First, there needs to be a sorting out of theories. It is impressive that many of the theories have been subjected to testing. The field needs the theories to be sorted out. Those that receive empirical support will continue to generate research. Those that do not prove to be valid need to be merged into other theories or discarded.

Second, the assessments available are not, for the most part, on par with the most sophisticated ability and personality assessments. The field needs better assessments ones that are on par with those in the fields of cognitive and personality psychology.

Third, what we have learned about styles needs to be integrated better into instruction. Then, we need to know more conclusively whether integrating styles into the educational process improves instruction, assessment, and ultimately student learning and developmental outcomes.

Fourth, styles research could better be utilized in organizations, but in a more research-based way. The use of styles in organizations sometimes has been based more on faith than on empirical research.

Fifth, styles need to be used to predict new kinds of outcomes, such as health and longevity outcomes. They probably have predictive power in domains not yet studied.

Sixth, styles research needs to be integrated better with neuropsychological research. What are the areas of the brain that are responsible for individual differences in styles?

Finally, methodologically, there is a crying need for random-assignment studies with control groups. The research that has been conducted has been of variable quality, and styles would get more research if they were more rigorously researched.

No one knows for sure the future of any given research area. But as long as there are differences in learners and people who care about them, styles research should contribute to the understanding of individual differences in learning, thinking, and performance.

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Handbook of Intellectual Styles
Preferences in Cognition, Learning, and Thinking

Li-fang Zhang, PhD • Robert J. Sternberg, PhD • Stephen Rayner, PhD

". . . a masterly attempt to bring order and cohesion to a field that for many years has been riven with claims and counterclaims. The editors and authors are to be congratulated for addressing a very complex task so helpfully."
— **John Biggs**, PhD
Honorary Professor of Psychology, University of Hong Kong

"If you are interested in intellectual styles—people's preferred ways of processing information—then this book belongs on your bookshelf."
— **Richard E. Mayer**, PhD
Professor of Psychology, University of California, Santa Barbara

"For more than half a century, the construct of style—whether designated as cognitive, thinking, or learning—has been in or out of fashion in the history of psychology and education. The editors of the present Handbook *have invigorated the style construct in the form of intellectual styles, and have brought together a distinguished international panel of chapter authors who offer up-to-date surveys of the assessment, development, correlates, and educational and organizational applications of intellectual styles. For those seeking to familiarize themselves with current theory and research in an intellectually exciting field, the present* Handbook *is essential."*
— **Nathan Kogan**, PhD
Professor Emeritus, Department of Psychology, New School for Social Research, New York, NY

The concept of intellectual styles has had a controversial history based on diverse philosophical and theoretical foundations. Most recently, the idea of intellectual styles—an umbrella term that covers such closely related constructs as "cognitive styles," "learning styles," "teaching styles," and "thinking styles"—has gained momentum as an explanation why different people succeed in different professional and organizational settings. Previously, it was thought that high-achievers simply had more innate abilities than their less successful peers, but research has shown that individuals have different intellectual styles that are better suited for varying types of contexts and problems.

Based on the most current and expansive research, this handbook is the first to provide a comprehensive review of research on the construct of intellectual styles from its foundations and development, to its relations to allied constructs, its roles in school and job performance, its applications in various populations, and its future. This understanding of intellectual styles as a valid concept for both individuals and groups has far-reaching implications for researchers in cross-cultural psychology, multicultural education, organizational behavior and work performance, and many other academic disciplines, as well as for practitioners in education and beyond.

KEY FEATURES:

- Provides a comprehensive review of intellectual styles from multiple perspectives
- Written for students and scholars in diverse academic areas, as well as practitioners in education and other fields
- Includes contributions from researchers from diverse disciplines, such as psychology, business, education, and health sciences

ISBN 978-0-8261-0667-4
9 780826 106674 >

SPRINGER PUBLISHING COMPANY
11 W. 42nd Street
New York, NY 10036-8002
www.springerpub.com