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5 Junior high school student's strategy in partial formal correspondence relationship generalization

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Abstract. Partial formal correspondence relationship generalization is general rule that described the correspondence relationship of the pattern. Symbolic statements were obtained through relating, searching and extending process by paying attention to the parts of the image on the problem partially. The purpose of this research was to describe junior high school student's strategy in partial formal correspondence relationship generalization. This research was a qualitative research with data collection method by using think aloud and interview. Subjects in this research there were two students selected from five students who were included in the category of partial formal correspondence relationship generalization. The results showed that the strategies undertaken by students in partial formal correspondence relationship generalization was a contextual strategy. In relating process, the subject observed and they were given the image partially and they connected the parts that existed in the picture. In searching process, the subject found the same pattern or procedure based on the information obtained from the image contextually. Then in extending process, the subject applied the pattern or procedure obtained while searching for a more general case.

1. Introduction

Generalization is one of the important activities in learning [1,2,3]. Statements about some nature or technique applied to a wider set of mathematical objects, this statement was a mathematical generalization [4]. In this study, the generalization process was used in Ellis's generalization taxonomy theory. Based on the generalization's taxonomy, generalization was divided into two kinds namely generalizing actions and generalizing reflection. The generalization action was divided into three, namely relating, searching and extending [5]. Relating was the process of connecting two objects contained in the problem. Searching was the process of finding the same procedure or pattern from the image contained in the problem. Extending was the process of applying the procedure or pattern obtained in searching for an unknown number.

Generalizing reflection were the student's statements in generalizing the form of verbal statements or written statements [5]. Generalizing Reflection on the research included the subject's verbal statement during the interview as well as the written statement of the subject on the results of their work. In this research, generalizing action added pre-relating action. Pre relating was done before relating



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action. So generalization was a general rule obtained by students through the process of pre relating, relating, searching and extending.

Generalization in this research was a generalization about functional relationship. There were two types of functional relationships namely covariation relationship and correspondence relationship [6]. The functional relationship in this research was the correspondence relationship of two patterns. The correspondence relationship of the two patterns described the relationship between two patterns through a formula (general rule) [6]. The covariation and correspondence relationships could be shown using tables, words, variables, and compare representations [7].

Doing strategy of generalization was required because some strategies that students could use to generalize include counting, recursion, whole object, contextual, guess and check, and rate-adjusting [8]. In the counting strategy, there was an activity of constructing a model that represented a particular situation and calculated by the nature of the requested. The recursion strategy was to determine the next rule based on the previous rule. A whole-object strategy used parts of a unit to construct larger units by using unit multiplication. In a contextual strategy, they constructed the formula (general rule) on the basic relationship that was determined from the situation contained in the question. A guess and check strategy, students suspected a rule regardless of the reason. The rate-adjust strategy, using the average change fixed as a multiplier factor.

Several studies about functional relationships generalization include research Carraher [4] and Canadas [9]. Carraher's research showed that the third grade of primary school students through learning could produce recursive generalizations and showed three ways of generalizing. Canadas's research showed that second grade of primary school students through learning could understand the functional relationships in terms of multiplying or adding to the same number to themselves. The students re contextualized the problems from real situations into mathematical contexts and vice versa [3].

This research developed both research, the research conducted on the eighth grade of junior high school students. In this research, the strategy of the students in partial formal correspondence relationship generalization would be described. In this generalization students make general rule partially.

3 Experimental method

This research is a qualitative research, with data collection method by using think aloud and interview. Think aloud is the process of students working on the problem by vocalizing what they thought. The process of selecting the subject was done until the data was saturated, so that the same or fixed characteristics of some subjects would appear. The researcher gave question to 50 eighth grade students of junior high school, from the 50 students there were 26 students who did the problem correctly by using think aloud.

After the students did the problem by think aloud then they conducted interview. The researcher made groups from 26 students into several categories, namely 4 students in formal correspondence relationship generalization, 17 students in inductive formal correspondence relationship generalization and 5 students [3] partial formal correspondence relationship generalization. This study described the strategies used by students in partial formal correspondence relationship generalization category. In this category, there were 5 students, from the 5 students were taken 2 subjects to be analyzed.

3. Result and discussion

The result of the research described in this research was the result of the analysis of two subjects in partial formal correspondence relationship generalization category. In this generalization students make general rule partially. The subject looked at the parts of figure 1 partially through pre-relating, relating, searching and extending actions. Here was a question given to the subject: a florist made some model places to put the flower pot (model as in figure 1), flowerpot was marked in a small black sphere. The place was made by leaving a space in the middle of a square. If there was one square as an empty space then the place could be drawn as in model 1. If there were two squares as empty space then the place could be drawn as in model 2. If there were three squares as empty space then the place could be drawn

like model 3, and so on and they were made consistently to meet the flower shop. If there was a square n , how many pots could be put into?

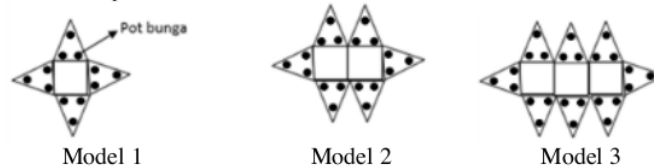


Figure 1. Place model to put flowers.

Based on the results of think aloud, interview and the answer of first subject shown on figure 2, in the pre-relating action the subject found the information on the problem through reading the problem. Subjects found the information of the number of squares and triangles of each model. In relating action, the subject connected and observed figure 1 partially by counting the number of squares and triangles of the known model (models 1, 2 and 3). In searching action, the subject found that every square increased then there would be two triangles and six pots. The subject found that the two triangles that were on the right and left of the square were always fixed (unchanged from each model), which changed the center of the model that was always increased by one square. In the extending action, the subject found a way to determine the number of pots if there was a n square that was n multiplied by 2 then multiplied 3 and plus 6 as in figure 2. n was the number of squares, then it was multiplied by two because there were two triangles (1 above triangle and 1 in down triangle) on each model. It was multiplied by three because in one triangle there were three flower pots. It was plus 6 because there were six pots located on the right and left of the square.

General rule obtained by subject could be seen in figure 2 ($n \times 2 \times 3 + 6$) and the subject simplifies this general rule to be $6n + 6$, general rule was also partially paid attention to each part in figure 1. Generalizing Reflection in the form of written and oral student statements [5]. The written statement of subject 1 could be seen at the result of his work as in figure 2.

Jika ada 1 persegi, maka ada 2 segitiga yg terletak di depan & belakang persegi ..
 ada 2 segitiga di sisi kanan & kiri ..
 rumus : $n \text{ persegi} \times 2 \times 3 + 6$..
 banyak pot
 $n \text{ persegi} : n \times 2 \times 3 + 6$
 $= 2n \times 3 + 6$
 $= 6n + 6$

Figure 2. The answer of first subject.

The first subject in relating action in using strategy was by looking at the parts contained in figure 1 was the number of square and triangle, the subject used a strategy by creating relationships based on figure. In searching action, subjects found similar patterns of each model. Likewise in the extending action, the subject uses a strategy by deducing the relationships obtained at the time of relating action and similarity patterns at the time of searching action. Subjects acquired general rule by making relationships based on figure 1. The strategy used by the first subject in doing generalization was the subject constructed the basic relationship in accordance with the situation contained in the problem and this strategy was called contextual strategy [8].

Based on the results of think aloud, interview and the answer of second subject shown on figure 3, in the pre-relating action the subject found the information of the problem through reading the problem. In relating action, the subject connected and observed figure 1 partially by counting the number of

squares and pots of the known model (models 1, 2 and 3). In the searching action, the subject found that from model 1, 2 and 3 (in figure 1) increased 1 square and 2 triangle that made the number of the pot also increased. The pot increased 6 from each model because of each model was increased by two triangles. One triangle was three flower pots. In the extending action, the subject found a way to determine the number of pots if there was a square n that was n multiplied by 2 then multiplied 3 and added 2 times 3 as in figure 3. The number of squares (n) was multiplied by 2 because there were two triangles above and below square. Then they were multiplied by 3 because each triangle had three pots. Then plus 2×3 , two was the number of triangles that were on the right and left of the square while the three was the number of pots on each triangle.

General rule obtained by subject could be seen in figure 3 $[(n \times 2 \times 3) + (2 \times 3)]$, general rule was also partially paid attention to each part in figure 1 for generalizing reflection in the form of written and oral student statements [5]. The written statement of second subject looked at the result of his work as in figure 3.

Handwritten work showing the derivation of a general formula for the number of pots based on the number of squares (n):

$$n_1 = 12 \text{ pot}$$

$$n_2 = 18 \text{ pot}$$

$$n_3 = 24 \text{ pot}$$

$$n \square = ?$$

$$n \square = (n \times 2 \times 3) + (2 \times 3)$$

Annotations for the formula:

- $n \times 2 \times 3$: bertambahnya potegi (increase in pots)
- $n \times 2$: sisi atas dan sisi bawah (top and bottom sides)
- 2×3 : sisi kanan dan sisi kiri (right and left sides)
- Each side is further annotated with "3 pot" (3 pots).

Figure 3. The answer of second subject.

The second subject related the action by using a strategy in connecting the number of pots with the number of squares and triangles, the subject used a strategy by creating relationships based on figure 1. In searching action, subjects found similar patterns of each model, each model increased by one square and six pots. Likewise in the extending action, the subject uses a strategy by deducing the relationships obtained at the time of relating action and similarity patterns at the time of searching action. Subjects acquired general rule by making relationships based on figure 1. The strategy used by the first subject in doing generalization was the subject who constructed the basic relationship in accordance with the situation contained in the problem. This strategy was also called contextual strategy [8].

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4. Conclusion

Based on the result of research and discussion could be concluded that the strategy used by the first subject and the second subject was a contextual strategy. The strategy used by both subjects was contextual strategy because the subject gets a general rule with regard to the relationship and pattern similarity of each model partially, the subjects made the relationship based on the situation contained in the problem. The subject looked at figure 1 partially, took into account on the square and triangle contained in the model to determine the number of pots.

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