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***Trends and Challenges  
toward Asian Economic Community***

**PROCEEDING**

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## **Preface**

Dear all ICERD participants, welcome to Surabaya, Indonesia. Welcome also to Universitas Negeri Surabaya. We are very glad to have you all, to participate in this conference.

In celebrating its 51st anniversary, The State University of Surabaya/Universitas Negeri Surabaya, proudly presents "The 2015 Internasional Conference on Educational Research and Development". The conference is conduction to bring together diversed ideas of researchers, educators, lecturers, teachers, students, and those who have interests in research on education and its development as well as on science and technology.

We are very honored to have Prof. Dr. Muhammad Nuh, DEA (former Republic of Indonesia Minister of Education and Culture, 2009 – 2014), Prof. Dr. Muchlas Samani (Universitas Negeri Surabaya, Indonesia), Prof. Dr. Fou-Lai Lin (National Taiwan Normal University), Prof. Dr. Bill Atweh (Adjunct Professor of Curtin University, Australia, and visiting Professor at Philippines Normal Univesity), and Prof. Dato' Abdul Rahman B. Abdul Aziz, Ph.D (Universiti Utara Malaysia), and Dr. Zeny Reyes (Philippines Normal University) as keynote and plenary speakers.

To all our sponsors for this conference, Bank Tabungan Negara (Universitas Negeri Surabaya branch) and Telkom Divre 5 Surabaya, our thanks are also for you.

On behalf of the Organizing Committee and Steering Committee, I wish you all a blessed and productive time in our ICERD conference. God bless you all.

December 1, 2015  
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## Table of Contents

Dormitory Teachers Education System: Improving the Education Quality of Students Teacher in Indonesia to Answer the Challenges of Asian Economics Community (AEC) .....	1
<i>Immanuel Adhitya Wulanata</i>	
The Analysis of English Language Education Students' Basic Teaching Skills during Listening and Speaking Microteaching in Groups .....	14
<i>Atalya Agustin and Asihlya Sandu</i>	
Literature Research in Indonesia, Ecopsychology Perspective .....	23
<i>Anas Ahmadi</i>	
Modiste: A Novel Method for Enhancing Video Streaming in E-learning .....	28
<i>Yeni Anistyasari</i>	
The Effect of Problem Based Learning Model for High School Student Geography Learning Outcomes .....	35
<i>Bejo Apriyanto</i>	
SIBI and BISINDO Which One is Better For Deaf and Mute People Education? .....	47
<i>Diyah Fatwati Arifah, Dian Eko Wicaksono, Quwwatun Azimah Mustajab and Miftah Wahyudia</i>	
CLIL and Its Feasibility to be implemented in Indonesia towards ASEAN Economic Community .....	56
<i>Silfia Asningtias</i>	
'Reform' Magazine: A Medium in Reforming Student-Author's Motivation In Writing English .....	57
<i>Prima Beauty Kartikasari</i>	
Surabaya Hinterland Area Development In Asean Economic Community .....	63
<i>Hendry Cahyono, Suci Rohayati, Achmad Yasin and Luqman Hakim</i>	
Industrial Area Development in East Java .....	70
<i>Norida Canda Sakti</i>	
Utilizing Business Model Canvas (BMC) to Develop Innovative Analysis in Culinary Business .....	71
<i>Clarashinta Canggih, Sista Paramita and Tias Andarini Indarwati</i>	
The English Presentation on Business Plan Delivered by Economics Student of Unesa (A Case Study) .....	72
<i>Nur Chakim</i>	
The Role of "Ma'had Aly" in Building Students' Characters .....	87
<i>Haris Dibdyaningsih and Hendra Sudarso</i>	
Metacognitive Activity in Conjecturing Process in Problem Solving of pattern Generalization .....	91
<i>Intan Dwi Hastuti, Sutarto, Subanji, Toto Nusantara and Hery Susanto</i>	
The Analysis of Multimedia Elements in PowerPoint Presentation (A Study towards Student Teachers of Economics Education) .....	103
<i>Yanuard Dwikristanto</i>	
Develop Learning Equipment Using CTL (Contextual Teaching And Learning) Model Assisted By PhET Software .....	112
<i>Friske Fazet and Nahindi Putra Gitama</i>	
Synthesis Al-UiO-66-NH <sub>2</sub> with Acetic Acid Modulator by Solvothermal Method .....	119
<i>Embun Rachma Haqiqi and Ratna Ediati</i>	
Improving Soft Skills by Applying Model Centered Learning the Students For Students to SMK Kartika 1 Surabaya Program Accounting Expertise .....	126
<i>Han Tantri Hardini, Susanti Susanti and Mohammad Taufiq</i>	

Short Movie as tools for Learning Sociology .....	135
<i>Grendi Hendrastomo, Poerwanti Hadi Pratiwi and Garry Cantona</i>	
Trends and Challenges of Integrated Mentoring Support for Novice Teachers' Professionalism: A Case Study of a "Lesson Study" Program in an Indonesian Secondary School .....	149
<i>Siti Nurul Hidayah, Noelene Weatherby-Fell and Meeta Chatterjee Padmanabhan</i>	
Optimizing the Existence of Micro, Small, Medium Business Entrepreneurs as the Central of Industry in Facing ASEAN Economic Community Based on Local Wisdom (Optimizing Micro, Small, Medium Business of Madura's Snacks Business) .....	160
<i>Yeti Hidayatillah</i>	
Synthesis and Characterization UiO-66 and Sn-UiO-66 by Solvothermal Method .....	173
<i>Dwi Ima Hikmawati and Ratna Ediati</i>	
Some Contributing Factors to the Students' English Achievemenent .....	181
<i>Tanzil Huda</i>	
The Influence of Problem Based Learning Model to Geography Learning Output of Senior High School Students .....	191
<i>Fahrudi Ikhsan</i>	
Nutritional and Quality Analysis of Kelor ( <i>Moringa oliefera</i> ) Beverage .....	206
<i>Rita Ismawati</i>	
21st Century English Education: High Order Thinking Skills and Technology Support .....	215
<i>Uswatun Khasanah</i>	
Multicultural Learning Model .....	225
<i>Masri Kudrat, Mohamad Jahja and Tirtawaty Abdjul</i>	
The Intercultural Sensitivity of Vocational High School English Teachers .....	228
<i>Dian Maya Kurnia and Nine Febrie Novitasari</i>	
The Influence of Group Investigation Learning Model towards the Learning Motivation of Geography Students in Senior High School .....	229
<i>Fahmi Arif Kurnianto</i>	
The Effect students' perceptions of teachers teaching style and student learning styles of student learning outcomes on economic subjects .....	243
<i>Riza Yonisa Kurniawan, Sukma Nur Andita, Luqman Hakim and Retno Mustika Dewi</i>	
The Study of Ruthenium Dyes Endowed with Alkyl Chain for DSSC Sensitizer .....	251
<i>Yuly Kusumawati, Thierry Pauportè, Muhamad Abdulkadir Martoprawiro, Bambang Prijamboedi and Cynthia Linaya Radiman</i>	
Teacher Performance Based on Stress and Organizational Commitment .....	259
<i>Nur Laily and Dewi Urip Wahyuni</i>	
Influence Perceived of Usefulness of Self-Efficacy With Attitude to Mediation Aplicom .....	271
<i>Agung Listiadi</i>	
Analysis on the Abality of Elementary School Student Who Had High Mathematics Ability in Making The Equation of Fractions .....	287
<i>Syarifatul Maf'ulah, Dwi Juniati and Tatag Yuli Eko Siswono</i>	
The Quality of the Production of Methyl Ester from <i>Jatropha Curcas lin</i> Using Catalyst of H <sub>2</sub> SO <sub>4</sub> ....	296
<i>Muhaji Mangil</i>	
Development Material Teaching Subject of Introduction of Administration and Management in University .....	304
<i>Novi Marlana and Renny Dwijayanti</i>	

Developing Instructional Program of Public Economic Subject Using Exelsa Moodle .....	319
<i>Kurnia Martikasari</i>	
Peer Response in an Indonesian EFL Writing Class: A Case Study.....	320
<i>M. Zaini Miftah</i>	
Use of Project Based Learning Model to Improve Creativity Class XI Subject to the Installation of Electricity 5 SMKN in Surabaya .....	332
<i>Akhmad Mujibur, Mohammad Taufiq, Ainur Rois and Nisa Rahmanyah</i>	
Biology Teachers' Self Perception on Pedagogical Competence .....	339
<i>Kukuh Munandar and Tanzil Huda</i>	
A Critical Review of Empirical Research in Enviromental Education .....	345
<i>Uning Musthofiyah and Malikhatul Lailiyah</i>	
Toward a Bright Future of Socio-Political Trends in Literary and Cultural Studies in Asia: Its Development and Impacts In Asian Educational Backgrounds .....	352
<i>Ali Mustofa</i>	
Facilitating Authentic Language Learning Through Theatrical Activities .....	357
<i>Lailatul Musyarofah and Muhammad Fadeli</i>	
"Let's Speak!": Utilizing Voxopop to Enhance Speaking Skill .....	365
<i>Arif Nugroho</i>	
Exploring Students' Use of Communication Strategies .....	373
<i>Him'Mawan Adi Nugroho and Nur Chakim</i>	
Prosocial and Risk-Taking Level on Teaching Intentions in Remote Areas (A Study on Students of Elemantary School Teacher in East Java) .....	385
<i>Sakinah Nur Rokhmah, Suciatma Umiasih and Ummu Imaroh</i>	
The Implementation of Metacognition-Based Information and Communication Technology (ICT) In Vocational Education .....	391
<i>Luthfiyah Nurlaela and Igp Asto Buditjahjanto</i>	
Zone of Promoted Action (ZPA) of Elementary School Teacher in Mathematics Learning.....	398
<i>Jauhara Dian Nurul Iffah, Akbar Sutawidjaja, Cholis Sa'Dijah and Subanji</i>	
The Urgency of Gen Z Economic Education .....	407
<i>Finisica Patrikha</i>	
Board Game as a Media to Increase Students' Speaking Skill .....	412
<i>Fitra Pinandhita and Rahardian Kusumawardhani</i>	
Developing Taxation Learning Model by Using Animated Media to Enhance Students' Comprehension.....	424
<i>Dewi Pratiwi, Made Dudy Satyawan and Eko Wahjudi</i>	
"Let's Write a Caption!": Utilizing Instagram to Teach Generation Y .....	448
<i>Dian Pratiwi and Miftachul Rohmah</i>	
Social Studies Teacher Role in the Development of Pattern Learning System Facing AEC 2015.....	456
<i>Jossapat Prijanto</i>	
Developing Language Games for Teaching English to the Eighth Grade Students of SMP Negeri 1 Tulungagung.....	467
<i>Anik Purwani</i>	
A Proposed Syllabus for Computer and Networking Technology Students of Vocational High School at Jember .....	475
<i>Areta Puspa and Pebrina Pirmani</i>	

Learning Model Talking Stick As An Effort to Improve Collaboration Students Office Administration Education of Secretary Subjects.....	481
<i>Durinda Puspasari and Durinta Puspasari</i>	
Thinking Process Statistics on Primary School Students in Resolving Issues Statistics.....	486
<i>Oemi Noer Qomariyah</i>	
Theories of Moral Education And Implementation In Indonesia: Re-Energizing Cultural Identity and Addressing Future Challenges.....	494
<i>Uswatun Qoyyimah</i>	
Enhance The Student's Result Through The Implementation of Problem Based Learning In Making Man's Shirts Pattern Subject in Fashion Science Student at Surabaya State University.....	505
<i>Imami Rahayu, Anneke Karyaningrum and Biyan Wilujeng</i>	
Developing Virtual Test as Alternative Assessment for Measure Student' Science Literacy.....	513
<i>Abdul Aziz Rahman, Jaka Afriana and Ismail</i>	
Actualization of Parenting Education Program to Encourage the Optimization of Non Formal Education.....	518
<i>Misran Rahman</i>	
What Have the Teachers Learnt from CLIL?.....	525
<i>Elfi Rahmi and Utik Kuntariati</i>	
Socio-Economic Impact of Traditional Crude oil Mining to Traditional Mining Community in rural Districts Wonocolo Kedewan – Bojonegoro.....	532
<i>Wiwik Retnoningsih</i>	
Effectiveness Course Introduction to Accounting in the financial records in Accounting Education among Students in 2013.....	543
<i>Rochmawati and Irin Widayati</i>	
Student's Creative Reasoning in Solving Pattern Generalization Problem: A Case Study.....	548
<i>Imam Rofiki, Subanji, Toto Nusantara and Tjang D. Chandra</i>	
Implementing Inquiry-Based Instruction In a Indonesian Snack and Beverage Management.....	556
<i>Ita Fatkhur Romadhoni Romadhoni, Dwi Kristiastuti and Siti Yuliana</i>	
Analyzing Student's Understanding the Relationship Between Quadrilateral at the Early Formal Stage.....	557
<i>Agustan S</i>	
Teaching Speaking through rong-chang Website.....	564
<i>Yuliyanto Sabat</i>	
Developing IELTS Curriculum for University Students: A Current Trend on Standardized Foreign Language Testing.....	569
<i>Kartika Sari</i>	
Environmental Approach with Science Kit Seqip to Enhancing Students' Scientific Process Skills, Learning Motivation, and Cognitive Learning Outcomes.....	580
<i>Erwinsyah Satria</i>	
Curriculum Based Blended Learning Model to Improve Student Softskill in Higher Education.....	592
<i>Nisaul Barokati Selirwangi and Nurdian Susilowati</i>	
"Enemies" at Our Home: The Threat to Indigenous Languages Seen from Language Use.....	593
<i>Slamet Setiawan</i>	
Developing Instructional Design of Literary Appreciation Based on Reader Response Theory.....	610
<i>Heny Subandiyah</i>	

Increase Ability Creative Economic Thinking Through.....	621
<i>Waspodo Tjipto Subroto</i>	
Students' Attitude towards Critical Thinking Practices in Classroom Discussion .....	632
<i>Sueb</i>	
Small Medium Enterprise (SME) Partnership Model Using the Triple Helix to Improve Competitiveness Towards Asean Economic Community.....	639
<i>Wiwik Sulistiyowati, Atikha Sidhi Cahyana, Rifda Abadiyah, Udi Subakti Ciptomulyono and Bambang Syairuddin</i>	
Learning to Write Short Story Using Mind Map Technique.....	647
<i>Sulistyaningsih</i>	
Developing Update Portfolio as Authentic Assessment in Teaching Speaking for University Students: A Challenge to be Trending Lecturers.....	655
<i>Sumardiono</i>	
Material Conception, Development Strategy and Constraint in Implementing Civic Education Curriculum.....	664
<i>Hassan Suryono</i>	
The Students Teacher Readiness in Implementing Economic Curriculum 2013 (Study of Self-Efficacy Theory).....	673
<i>Nurdian Susilowati and Lyna Latifah</i>	
Indicators of Conjecturing Process in Problem Solving of patterns Generalization .....	674
<i>Sutarto, Toto Nusantara, Subanji and Sisworo</i>	
Inquiry-Based Integrated Science Education: The Application of Local Content Soil Washing Project to Improve Junior High School Students' Environmental Literacy .....	688
<i>Syifahayu</i>	
Students' Perception on the Benefits and Problems of Blended Learning.....	700
<i>Ellis Tamela, Murniasih and Yuliana Fatima Dayana</i>	
Neuroplasticity Concept in Teaching Elementary School Students: Preparing the 21st Century Generation .....	712
<i>Tatik</i>	
Assistance Compilation Module and Lesson Plan of Craft and Entrepreneurship Subject to Produce Face Cream for Science Teachers High School and Vocational School in Kediri .....	730
<i>Titik Taufikurohmah, Bertha Yonata and Siti Tjahjani</i>	
Brand and Repurchase Intention .....	740
<i>Tegowati</i>	
Fan Fiction in the Class .....	759
<i>Mamik Tri Wedawati</i>	
Modelling Student Mathematical Argumentation With Structural-Intuitive and Deductive Warrant to Solve Mathematics Problem .....	763
<i>Lia Budi Trisanti, Akbar Sutawidjaja, Abdur Rahman As'ari and Makbul Muksar</i>	
Using Animation Clips to Improve the Listening Ability of the Tenth Grade Students Majoring in Animation.....	773
<i>Atik Ulinuha</i>	
The Use of Digital Stories to Improve Students' Recount Writing Ability.....	780
<i>Roisatul Wahdiyah</i>	



**ANALYSIS ON THE ABILITY OF ELEMENTARY SCHOOL STUDENT  
WHO HAD HIGH MATHEMATICS ABILITY  
IN MAKING THE EQUATION OF FRACTIONS**

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**ABSTRACT**

The purpose of this study was to analyze the ability of fifth grade elementary school student who had high mathematic ability in making the equation of fractions. This kind of research was qualitative by a student subject. Data collection was conducted by giving a test to the subject, continued by interviews. The next stage was data analysis, include reduce the data, presentate the data, conclusion and verificate the data. Subject was given a test containing an equation  $\frac{4}{5} - a = \frac{1}{4}$  as initial equation. Then, subject was asked to make an another equation as equivalent as initial one as much as possible. The result test indicated that subject able to make the eleven equations correctly. The following steps were (1) subject changed the initial equation element position; (2) subject refered on  $\frac{4}{5} - \frac{1}{4} = a$ , then changed both elements known to the another equivalent fraction; (3) subject changed the operan known at initial equation to the another equivalent fraction without changed the position of elements at initial equation ; (4) subject refered on  $a + \frac{1}{4} = \frac{4}{5}$ , then changed both elements known to the another equivalent fraction; (5) subject changed the element position from initial equation, then added both elements with an element or an  $a$ .

**Keywords:** analysis, ability to make equation, fraction

**I. INTRODUCTION**

The research is inspired by Piaget's theory of reversibility. Reversibility means the person mental ability to change the mind purpose to the original point (Piaget via Slavin, 2008: 48). While (Krutetskii, 1976: 287) explains that reversibility is the person thinking to build up the reversible sides. Furthermore, Krutetskii identifies one of the categorized mathematics ability related to success in solving the problem, it is reversibility. On the other hand, student mathematics ability has the role in solving mathematical problem. It means that reversibility affects the student ability to solve the problem. Whereas problem solving is the learning mathematics focused. This is constructed by NCTM (2000: 52) that expands problem solving is the integral part of learning matematics. It is relevant with Soedjadi (1992: 33) states mathematics should be directed to develop the student future live transferable ability.

Reversibility is the person thinking ability to build up the reversible sides. It means that reversibility has two reversible ways, they are beginning side to the final one as the reached goal, and the final side returns to the beginning one. However, research focussed is how the student thinking ability from the beginning side to the final. The beginning side is the first equation test given. Then, subject asked to make many equations as equivalent as the beginning one. So the equation student made means the reached goal.

The defined equation related to fractions and arithmetic operations. Fractions is one of the pre-requisites for understanding the subsequent and the intertwined materials of fractions concept. If student do not understand the basic, student will difficulty in studying further. Research subject is the fifth grade of elementary school student by considering the fractions is the first time material given at elementary school. In addition, Piaget states the ability of building the two-way relation develop in concrete operational stage, it is about 7 to 11 years old. It means reversibility begins on elementary school student. But focus of research subject is student who had high mathematics by considering the result of research is used as basic by the teacher to teach fractions and arithmetic operations. In expectation is the ability the other student can be same or equal with ability of student who had high mathematics especially fraction and arithmetic operation materials. Based on the descriptions, researcher interested analyzing the elementary student ability in making fractions.

## **II. RESEARCH METHOD**

### **Research Design**

This study purposed analyzing the elementary school student ability in making fractions. Therefore, this is a descriptive qualitative research. Researcher gave a test to the subject, then researcher conducted interview to the subject for comprehending about the things of uncovered test yet. Furthermore, the result data analyzed based on the framework established in theoretical study.

### **Research Subject**

Research subject was the fifth grade of elementary school student who is capable in high mathematic. High mathematic information was obtained by mathematic test and consultation with the teacher

### **Research Instrument**

The main instrument is the researcher herself. While supporting instrument are as follows:

1. Test used to obtain the data about subject's ability delineation in making equation. A test contains an equation then subject was asked to make as many as another equivalent equation.
2. Interview guideline in this study is semi-structured or opened. Subject was interviewed based on the work result

### Research Procedure

Research procedure consists of three stages described by following:

1. Preparation Stage

The research preparation stage examines theory in making equation's ability refers to part of reversibility characteristic.

2. Implementation Stage

The research implementation stage selectes the subject. Furthermore, researcher give a test to the subject, then followed by interviewed based on the work resultt.

3. Analysis Stage

The research analysis stage analyzes the data and report writing.

### Data Analysis Technique

Result data was analyzed with references to (i) the equation subject made number (ii) subject's way in making each the beginning equivalent equation. Analysis conducted after finishing the interview. Then data analysis conducted by following step: (1) data reduction; (2) data exploring; (3) drawing conclusion.

### III. RESULT AND DISCUSSION

Before research was conducted, researcher choose the subject previously, it is fifth grade of elementary student of MIN Kauman Jombang. Furthermore, researcher conduted the research and analyzed the result data

### Data Analysis Finding and Discussion

1. Test result

A test was given by the researcher such as the following:

TEST (30 minutes)  
Given the following form:  
Form: " $\frac{4}{5} - a = \frac{1}{4}$ "  
Rewrite the above from to the  
"another similar form" as much as possible

Fig. 1. Test Instrument

The followings are the the result subject in making the equation

**Table 1 : Subject Equation Made**

Equation Code	Subject Equation Made
P1	$\frac{4}{5} \cdot \frac{1}{4} = a$
P2	$a + \frac{1}{4} = \frac{4}{5}$
P3	$\frac{8}{10} - \frac{2}{8} = a$
P4	$\frac{8}{10} - a = \frac{1}{4}$
P5	$\frac{4}{5} - \frac{2}{8} = a$
P6	$a + \frac{3}{12} = \frac{8}{10}$
P7	$\frac{1}{4} + \frac{1}{4} + a - \frac{4}{5} = \frac{1}{4}$
P8	$\frac{4}{5} - a - \frac{1}{4} + a = a$
P9	$\frac{1}{4} + \frac{4}{5} = \frac{4}{5} - a + \frac{4}{5}$
P10	$\frac{4}{5} + a = a + a + \frac{1}{4}$
P11	$\frac{1}{4} + a = \frac{4}{5}$

Based on the test result, known the subject has made 10 the beginning equivalent equation.

While subject way in making the beginning equivalent equation was obtained from interview. The followings are the subject way in making each equation

**Table 2: Subject Way in Making Each Equation**

Equation Code	Equation Subject Made	Equation Making Way
P1	$\frac{4}{5} - \frac{1}{4} = a$	The beginning equation was $\frac{4}{5} - a = \frac{1}{4}$ subject made P1 by moving $\frac{1}{4}$ elements to the right side and moving a to left side, obtained $\frac{4}{5} - \frac{1}{4} = a$ as P1
P2	$a + \frac{1}{4} = \frac{4}{5}$	The beginning equation was $\frac{4}{5} - a = \frac{1}{4}$ . Subject made P2 by moving a side. It should be obtained $\frac{4}{5} = \frac{1}{4} + a$ , but subject wrote in $a + \frac{1}{4} = \frac{4}{5}$ form by reasoning there were an equal sign "=", so $\frac{4}{5} = \frac{1}{4} + a = a + \frac{1}{4} = \frac{4}{5}$ . Thus, obtained $a + \frac{1}{4} = \frac{4}{5}$ as P2.
P3	$\frac{8}{10} - \frac{2}{8} = a$	The beginning equation was $\frac{4}{5} - a = \frac{1}{4}$ . Subject made P3 in reference to P1, it was $\frac{4}{5} - \frac{1}{4} = a$ because of the beginning equation made. Then subject changed both of known elements on $\frac{4}{5} - \frac{1}{4} = a$ to an another equivalent fraction. It changed $\frac{4}{5}$ into $\frac{8}{10}$ and $\frac{1}{4}$ into $\frac{2}{8}$ obtained $\frac{8}{10} - \frac{2}{8} = a$ as P3

<p>P4</p>	$\frac{8}{10} - a = \frac{1}{4}$	<p>The beginning equation was <math>\frac{4}{5} - a = \frac{1}{4}</math>. Subject made P4 by changing the side knowed on beginning equation to an another equivalent fraction. It changed <math>\frac{4}{5}</math> as <math>\frac{8}{10}</math> obtained <math>\frac{8}{10} - a = \frac{1}{4}</math> as P4</p>
<p>P5</p>	$\frac{4}{5} - \frac{2}{8} = a$	<p>The beginning equation was <math>\frac{4}{5} - a = \frac{1}{4}</math>. Subject made P5 in reference on P1, it was <math>\frac{4}{5} - \frac{1}{4} = a</math> by reasoning P1 the beginning equation made. Then subject changed one of the element known by <math>\frac{4}{5} - \frac{1}{4} = a</math> into an another equivalent fraction. It changed <math>\frac{1}{4}</math> into <math>\frac{2}{8}</math> obtained <math>\frac{4}{5} - \frac{2}{8} = a</math> as P5.</p>
<p>P6</p>	$a + \frac{3}{12} = \frac{8}{10}$	<p>The beginning equation was <math>\frac{4}{5} - a = \frac{1}{4}</math>. Subject made P6 in reference on P2, it was <math>a + \frac{1}{4} = \frac{4}{5}</math>. Then it changed both of elements known by P2 into anan another equivalent fraction. It changed <math>\frac{4}{5}</math> into <math>\frac{8}{10}</math> and changed <math>\frac{1}{4}</math> into <math>\frac{3}{12}</math> obtained <math>a + \frac{3}{12} = \frac{8}{10}</math> as P6.</p>
<p>P7</p>	$\frac{1}{4} + \frac{1}{4} + a - \frac{4}{5} = \frac{1}{4}$	<p>The beginning equation was <math>\frac{4}{5} - a = \frac{1}{4}</math>. Subject made P7 by moving the a and <math>\frac{4}{5}</math> side, obtained <math>0 = \frac{1}{4} + a - \frac{4}{5}</math>. Then added the</p>

		<p>sides of <math>0 = \frac{1}{4} + a - \frac{4}{5}</math> with <math>\frac{1}{4}</math>.</p> <p>Obtained <math>\frac{1}{4} = \frac{1}{4} + a - \frac{4}{5} + \frac{1}{4}</math>, but subject wrote <math>\frac{1}{4} + a - \frac{4}{5} + \frac{1}{4} = \frac{1}{4}</math> as P7</p>
P8	$\frac{4}{5} - a - \frac{1}{4} + a = a$	<p>The beginning equation was <math>\frac{4}{5} - a = \frac{1}{4}</math>. Subject made by moving the <math>\frac{1}{4}</math> side, obtained <math>\frac{4}{5} - a - \frac{1}{4} = 0</math>.</p> <p>Then added the sides of <math>\frac{4}{5} - a - \frac{1}{4} = 0</math> with a, obtained <math>\frac{4}{5} - a - \frac{1}{4} + a = a</math> as P8.</p>
P9	$\frac{1}{4} + \frac{4}{5} = \frac{4}{5} - a + \frac{4}{5}$	<p>The beginning equation was <math>\frac{4}{5} - a = \frac{1}{4}</math>. Subject made P9 by changing <math>\frac{4}{5} - a = \frac{1}{4}</math> form into <math>\frac{1}{4} = \frac{4}{5} - a</math> by reasoning there was an equal sign "=", so <math>\frac{4}{5} - a = \frac{1}{4}</math> same as <math>\frac{1}{4} = \frac{4}{5} - a</math>. Then added the sides of <math>\frac{1}{4} = \frac{4}{5} - a</math> with <math>\frac{4}{5}</math>, obtained <math>\frac{1}{4} + \frac{4}{5} = \frac{4}{5} - a + \frac{4}{5}</math> as P9</p>
P10	$\frac{4}{5} + a = a + a + \frac{1}{4}$	<p>The beginning equation was <math>\frac{4}{5} - a = \frac{1}{4}</math>. Subject made P10 by moving the a side, obtained <math>\frac{4}{5} = a + \frac{1}{4}</math>. Then operated the sides of <math>\frac{4}{5} = a + \frac{1}{4}</math> with a, obtained <math>\frac{4}{5} + a = a + a + \frac{1}{4}</math> as P10</p>
P11	$\frac{1}{4} + a = \frac{4}{5}$	<p>The beginning equation was <math>\frac{4}{5} - a = \frac{1}{4}</math>. Subject made P10 by moving the a side. It should be</p>

		obtained $\frac{4}{5} = \frac{1}{4} + a$ , but subject wrote $\frac{1}{4} + a = \frac{4}{5}$ form as P11
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Based on the table 2 above, obtained the descriptions of subject way in making the equation of fractions

1. Subject made a new equation by the changing the side on beginning equation without changing these element to an another equivalent equation. At this category divided by two, they were as follows

- a. Moving the  $\frac{1}{4}$  and elements side

The test beginning equation given was  $\frac{4}{5} - a = \frac{1}{4}$ . Subject made a new equation by moving the  $\frac{1}{4}$  of right side and moving the a of left side. The subject equation made included P1 category was  $\frac{4}{5} - \frac{1}{4} = a$ .

- b. Moving the element side

A test beginning equation given was  $\frac{4}{5} - a = \frac{1}{4}$ . Subject made a new equation by moving the a element. The subject equation made included P2 category was  $\frac{1}{4} + a = \frac{4}{5}$ , and P11 category was  $a + \frac{1}{4} = \frac{4}{5}$ . But P11, subject also used the commutative to arithmetic, it was  $\frac{1}{4} + a = a + \frac{1}{4}$ .

2. Subject made a new equation in reference on P1, it was  $\frac{4}{5} - \frac{1}{4} = a$  by reasoning P1 made from the beginning equation. Then, subject changed the known sides of  $\frac{4}{5} - \frac{1}{4} = a$  to an another equivalent equation. The subject equation made included P3 category was  $\frac{8}{10} - \frac{2}{8} = a$  and P5 category was  $\frac{4}{5} - \frac{2}{8} = a$ .
3. Subject made a new equation by changing the known side on beginning equation to an another equivalent equation. The subject equation made included P4 category was  $\frac{8}{10} - a = \frac{1}{4}$ .
4. Subject made a new equation in reference on P2, it was  $a + \frac{1}{4} = \frac{4}{5}$ . Then, changed the known sides on P2 to an another equivalent equation. The subject equation made included P6 category  $a + \frac{3}{12} = \frac{8}{10}$ .



5. Subject made a new equation by moving the side of beginning equation, then added the sides with the fractions. These category divided by two parts, they are as follows
  - a. Moving the one of beginning equation element then added those sides by fractions, the included category of equation was P8  $\frac{4}{5} - a - \frac{1}{4} + a = a$  and P10  $\frac{4}{5} + a = a + a + \frac{1}{4}$ .
  - b. Moving the beginning equation side elements then added those sides by fractions, the included category of equation was P7  $\frac{1}{4} + a - \frac{4}{5} + \frac{1}{4} = \frac{1}{4}$ .
6. Subject made a new equation by moving one of these then added the sides by the fractions. The included category of equation was  $\frac{1}{4} + \frac{4}{5} = \frac{4}{5} - a + \frac{4}{5}$ .

#### IV. CONCLUSION

Based on the result analysis obtained the conclusion about subject ability in making of equation. It was a subject making the eleven equivalent equations  $\frac{4}{5} - a = \frac{1}{4}$ . The subject way in making the beginning equivalent equation as follows

1. Subject only moved the beginning equation of element side.
2. Subject referenced at  $\frac{4}{5} - \frac{1}{4} = a$ , then changed the known elements at  $\frac{4}{5} - \frac{1}{4} = a$  to an another equivalent fractions
3. Subject changed the known position on beginning equation to an another equivalent fractions
4. Subject referenced at  $a + \frac{1}{4} = \frac{4}{5}$ , then changed the known sides on  $a + \frac{1}{4} = \frac{4}{5}$  to an another equivalent fractions
5. Subject moved the sides of beginning equation, then added the sides by fractions
6. Subject moved one of the beginning equation sides then added those equation sides by the fractions

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