



ISBN : 978 - 602 - 397 - 058 - 2
Number 1 / 2017, June, 27th 2017

PROCEEDING ICMETA

International Conference on Mathematics:
Education, Theory, and Application
December, 6-7th 2016

Department of Mathematics
Faculty of Mathematics and Natural Sciences
Universitas Sebelas Maret

PROCEEDING

ICMETA

International Conference
on Mathematics : Education, Theory, and Application

Mathematics in the Science and Art

Number : 1|27th June 2017
ISBN : 978-602-397-058-2

Reviewers :

Prof. Dr. Budiyo, M.Sc.
Prof. Drs. Tri Atmojo Kusmayadi, M.Sc., Ph.D.
Dr. Sutanto, DEA
Drs. Isnandar Slamet, M.Sc., Ph.D.
Dr. Diari Indriati, M.Si.
Dr. Hasih Pratiwi, M.Si.
Dr. Dewi Retno Sari Saputro, M.Kom
Wakhid, MT.

Editors :

Dra. Purnami Widyaningsih, M.App.Sc.
Ririn Setyowati, M.Sc.
Riris Listya Dahita Putri, S.Si.
Kornelius Ronald Demu
Rifqi Choiril Affan

Layout :

Nughthoh Arfawi Kurdhi, M.Sc.
Vika Yugi Kurniawan, M.Sc.
Putranto Hadi, M.Si.

December, 6th-7th 2016
Department of Mathematics
Faculty of Mathematics and Natural Sciences
Universitas Sebelas Maret

PREFACE

This proceeding contains papers collected from event of The International Conference on Mathematics: Education, Theory, and Application (ICMETA). Some papers presented in ICMETA were published in Journal of Physics: Proceeding Series and others were published in this proceeding.

The ICMETA is conference that was first accomplished by Department of Mathematics, Universitas Sebelas Maret and is planned to be held biennially. This conference is an organization of scientific meetings among mathematicians, students, teachers, researchers, and practitioners from various colleges and related institutions. The goals of the conference are

- (a) to increase the role of mathematics, statistics, mathematics education, and computer science in an effort to overcome various problems;
- (b) to disseminate, discuss, and communicate the results of research in the fields of mathematics, statistics, mathematics education and computer sciences;
- (c) to facilitate communication and discussion related to the problems and current issues of education, sciences, and technology.

As a scientific meeting event we invited experts from 6 different countries including Indonesia, Australia, the Netherlands, Malaysia, Japan, and France as keynote speakers. They were

1. Prof. Dr. Edy Tri Baskoro, M.Sc. (Department of Mathematics, Faculty of Mathematics and Natural Sciences, Bandung Institute of Technology, Indonesia),
2. Dr. Darfiana Nur, M.Sc. (Statistical Science in the School of Computer Science, Engineering and Mathematics, Flinders University, Australia),
3. Dr. G.R. (Ruud) Pellikaan (Department of Mathematics and Computer Science, Technische Universiteit Eindhoven, Netherlands),
4. Prof. Dr. Mohd Bin Omar (Institute of Mathematical Sciences, Faculty of Science, University of Malaya, Malaysia),
5. Prof. Dr. Kenjiro T. Miura (Realistic Modeling Laboratory, Department of Mechanical Engineering, Shizuoka University, Japan),
6. Dr. Sutanto, DEA (Department of Mathematics, Faculty of Mathematics and Natural Sciences, March Eleven University, Indonesia),
7. Dr. Hanna Arini Parhusip (Department of Mathematics, Faculty of Science and Mathematics, SWCU, Salatiga Indonesia), and
8. Dr. Benoît Liquet (Laboratory of Mathematics and Their Applications, Université de Pau et des Pays de l'Adou, France).

Call for Papers for this conference has been notified to several academic and professional associations (IndoMS) since April until October 2016 to be able to muster 53 colleges and polytechnics as well as related agencies including the National Institute of Aeronautics and Space (LAPAN). Attending

participants and keynote speakers were from Australia, Europe and Asia. Additionally, Indonesian participants were from various provinces such as: DKI Jakarta, West Java, Yogyakarta, Central Java, East Java, Bali, Southeast Sulawesi, West Sumatra, Riau Islands, and South Sulawesi. During the two days conference, the researchers presented the most lectured discoveries in Mathematics and Statistics as well as established network for possible joint researches and collaborations among the participants. The conference is consisting parallel sessions and plenary sessions from invited speakers with various interesting topics which held in two days.

We are grateful to all the members of the program committee who contributed for the success in framing the program. We also thank all the delegates who contributed to the success of this conference by accepting our invitation and submitting articles for presentation in the scientific program. We wish for all of us a grand success in our scientific life and we do hope that the coming conferences will pick up similar success, and even better.

Finally, we wish that proceeding will be useful for readers and researchers who want to look for materials in order to support their study.

Chair of ICMETA 2016

Dr. Dewi Retno Sari Saputro, M.Kom

E-mail : dewiretnoss@staff.uns.ac.id

Department of Mathematics, Faculty of Mathematics and Natural Sciences
Universitas Sebelas Maret

TABLE OF CONTENTS

Title	i
Preface	ii
Table of Contents	iv
The Development of Social Arithmetical Teaching Equipment with Problem Based Learning Model (Tri Andari and Restu Lusiana)	1
Development of Teaching Materials Based Digital Storytelling on Strategy Learning Mathematics Course (Dwijayanti and Rasiman)	13
The Use of Core Model in Enhancing The Mathematical Reasoning Ability of Junior High School (Dahlia Fisher and Poppy Yaniawati).....	22
Fuzzy Logic for Grasping Type Classification of Human Hand Based on Myoelectric Signal Parameter (Hartono, Priadythama, and Rochman)	33
Gas Measurement System (Haryono and Dian Yudha R).....	42
Technical Implementation of Gas Measurement System (Haryono)	51
The Context of Students Following The Introduction Probability Theory Course in The Reflective Pedagogy Perspective (Hongki Julie)	60
Student Misconceptions in Solving Real Analysis Problem Based on Reasoning Framework (Rita Pramujiyanti Khotimah).....	70

Preliminary Study: Mathematics' Teacher Conception in Supporting the Integration of Mathematics' Literacy and Mathematics Teaching and Learning (N D S Lestari, D Juniati, and St Suwarsono)	76
The Development of Introduction for Basic Mathematics Based Structured Tasks Textbook to Improve the Ability of Logical Thinking (Restu Lusiana and Tri Andari)	84
On Gamma Labeling of Double Cones Graph (Titin Sri Martini and Mania Roswitha)	95
Upgrading Statistical Reasoning Ability Junior High School Students Through Contextual Teaching and Learning (Iyam Maryati)	101
Beliefs in Problem Solving: Case Study in Circles Tangents Line Materials (Muhtarom, Dwi Juniati, and Tatag Yuli Eko Siswono)	108
Test of Difference Between Paired Sample by Using Mcnemar Test (Tantri Nawangsari)	117
Diagnosis of The Diabetes Mellitus Disease with Fuzzy Inference System Mamdani (Za'imaitun Niswati, Aulia Paramita, and Fanisya Alva Mustika)	126
Learning Mathematics with Traditional Game "Jirak": Impact on Mathematics Disposition and Students' Achievement (Nizaruddin, Muhtarom, and Sugiyanti)	134
Mathematics learning activities of the acceleration class program of SMA Negeri 2 Purwokerto (Paskalia Pradanti and St Suwarsono)	141
On The Strong Metric Dimension of Lollipop Graph and Generalized Web Graph (Tiffani Arzaqi Putri and Tri Atmojo Kusmayadi)	146
The Use of Modules and Game "Code" On The Padlock as a Media to Improve Motivation of XI Accounting Class in the Material of Combinatorial Analysis in SMK Putra Tama Bantul (Anindiati Praminto Putri)	151
Effect of Students Creativity in Wolfram Mathematica Assisted on Learning Achievement in Linear Algebra Course (Noviana D R, Aryo A N, Lukman H, Tri Atmojo K, and Budi U)	157
Seventh Grade Students' Performance in Dealing with Multiplication of Fractions	

(Veronika Fitri Rianasari and Hongki Julie)	165
Multivariate Adaptive Regression Spline (MARS) Model on Dengue Hemorrhagic Fever (DHF) Sufferers in Semarang (Dewi Retno Sari S, D H Puspitaningrum, N A Kurdhi, and Respatiwulan)	170
Students Learning Activities in Mathematics Learning Using Scientific Approach SMA Negeri 10 in Class XI MIA 4 Of Yogyakarta (Maria Rettian A S and St Suwarsono)	179
Breast Cancer Detection Using Data Mining Classification Methods (Ni Wayan P S, Rayung Wulan, and Mei Lestari)	185
An Empirical Analysis of Portfolio Performance Using Maximin and Fuzzy Linear Programming (Retno Subekti and Rosita Kusumawati)	192
Geometry High School Students Thinking Ability Based on Level Van Hiele (Abi Suwito, Ipung Yuwono, I Nengah Patra, and Santi Irawan)	200
The Evaluation of E-Learning Maturity at Senior High Schools in Yogyakarta (Nur Hadi Waryanto, Nur Insani, and Retno Subekti)	208
Learning Analysis Based on Humanism Theory and Mathematics Creative Thinking Ability of Student (Hevy Risqi Maharani and Sukestiyarno).....	218

Seventh Grade Students' Performance in Dealing with Multiplication of Fractions

¹Veronika Fitri Rianasari, ²Hongki Julie

^{1,2}Sanata Dharma University, Yogyakarta, Indonesia

¹veronikafitri@usd.ac.id, ²hongki_julie@usd.ac.id

Abstract. The aim of this study was to investigate the seventh graders' performance when they solve fractions problems formulated in the contexts of the multiplication calculations, area model, and words problems. This descriptive study was conducted with 44 seventh grade students in Pangudi Luhur Junior High School in Yogyakarta, Indonesia. Data were collected during teaching and learning fractions in the first semester in 2016. Findings showed that the students' performance was high on the computation in multiplying fractions and low on solving words problems and drawing area model to illustrate fraction multiplication.

1. Introduction

Fraction concepts are among the most complex and important ideas for children, the importance can be seen from a practical perspective, fraction understanding improves one's ability to understand and handle situations and problems in the real world [2]. However, many students get difficulty in dealing with fractions and the difficulty might be caused by different interpretations for fraction. The concept of fractions can be interpreted as 1) a part-whole comparison, 2) a measure, 3) an operator, 4) a quotient, and 5) a ratio [1].

There are two different approaches to understanding: instrumental and relational understanding [4]. By having instrumental understanding, students know a mathematical rule and they are able to use and manipulate it. By having relational understanding, students know how to use a mathematical rule and know why it works.

In multiplying fractions, many students are able to use procedural rules for carrying out operations, such as $\frac{3}{4} \times \frac{1}{2}$, but they cannot explain the meaning of multiplying two fractions. Many conventional teaching fractions tend to focus on computation and lack of experiences to promote students' understanding of the meanings of fractions and operations. Focusing the learning attention on procedural algorithm of fractions has some disadvantages. Memorizing rules do not help students to think about the meaning of operations, students' skill in carrying out those operations is quickly lost, and therefore they get difficulty in solving word problems [2].

Although there are various studies on fractions teaching and learning, studies on fractions multiplication in Indonesia are very rare. Therefore, this study aims to investigate the seventh graders' performance when they solve multiplication of fractions problems.

2. Literature Review

Meanings for multiplication of fractions

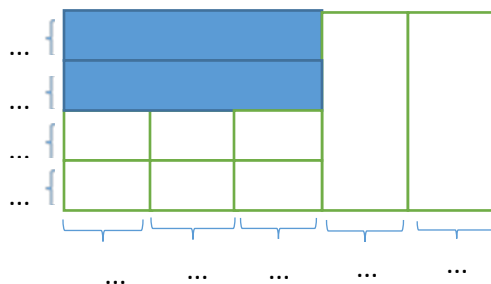
The common meaning for multiplication is repeated addition, such as $2 \times 3 = 3 + 3$. In this interpretation, one factor play the role as the operator, because it represent the number of times a quantity must be added, so that it is must be a whole number. Therefore this interpretation cannot be extended to the rational numbers [5]. For example, if 2×3 means $3 + 3$, then it is difficult to interpret what $2\frac{1}{2} \times 3$ means. Webel & DeLeeuw explain that fraction multiplication can be interpreted as "part of a part", a conception where one fraction play the role as an operator, specifying a fractional part of the other

fraction, the operand [6]. For example, $\frac{2}{3} \times \frac{1}{4}$ means to partition $\frac{1}{4}$ into 3 parts and iterate the result 2 times. Moreover, fraction multiplication can be interpreted the measure of a rectangular area, that is so many units long and so many units wide [6].

3. Methods

This study was a descriptive study investigating the seventh graders' performance when they solve fractions problems formulated in the contexts of the multiplication calculations and words problems. This study was conducted with 44 seventh in Pangudi Luhur Junior High School in Yogyakarta, Indonesia. Data were collected after completion of the fractions lesson and the students were administered a written test. The test consisted of 4 questions and the following are the questions:

- 1) Find the product of $\frac{2}{3} \times \frac{4}{6}$!
- 2) Find the value of the shaded area below!



- 3) Draw a model to show $\frac{2}{3}$ of $\frac{3}{4}$ and determine the product!
- 4) A tub can accommodate 27 liters of water. However, the tub is only filled two third of the maximum capacity. Dad want to pour some water from bucket with the volume is $\frac{1}{9}$ of the tub's volume.
 - a. How many liters of water that is already filled in the container?
 - b. How many buckets need to be poured into the container so that the tub filled up with water?

(The problem 4b is not discussed in this article.)

From the written test, students' understanding of fraction multiplication were examined. Descriptive statistics were used to determine students' understanding of fraction multiplication. Students who wrote inappropriate solutions were probed.

4. Findings

4.1. Findings of Students' Performance in Computation of Fraction Multiplication

From students' answer, it can be seen that 80% of 44 students could give the correct answer, 16% could not give the correct answer, and 5% could not able to give any answer. There are two types of strategy used by the students who could not give the correct answer. The first strategy is shown in Figure 1, the students found the common denominator for the fractions, $\frac{2}{3}$ and $\frac{4}{6}$, and then the students multiplied the numerators. From this incorrect strategy, it is clear to see that the students used the strategy in fraction addition, creating a common denominator for the fractions, to find the product of fraction multiplication.

$$\frac{2}{3} \times \frac{4}{6} = \frac{12}{18} \times \frac{12}{18} = \frac{144}{18}$$

Figure 1

The second strategy is shown in Figure 2, the students multiplied the numerator of the first fraction with the denominator of the second fraction and the result became the numerator of the product. Then, the students multiplied the denominator of the second fraction with the numerator of the second fraction and the result became the denominator of the product. From this incorrect strategy, it shows that the students used cross-multiplication, a common strategy to work with fraction division, in order to solve fraction multiplication.

$$\frac{2}{3} \times \frac{4}{6} = \frac{12}{12} = 1$$

Figure 2

4.2. Findings of Students' Performance in Determining Fraction Multiplication from A Rectangular Area Model

From students' answer, it can be seen that 43% of the students could give the correct answer, 50% could not give the correct answer, and 7% could not able to give any answer. Many students actually were able to determine the fraction from the shaded area model, however they got difficulty in determining the fraction multiplication (see Figure 3).

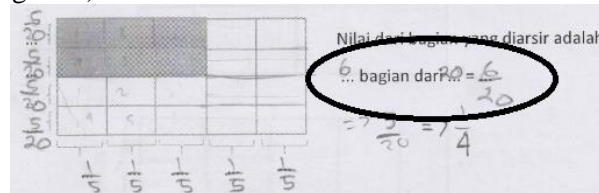


Figure 3

The student's answer shown in Figure 3 shows that the student understood the meaning of fraction as a part-whole relationship.

4.3. Findings of Students' Performance in Modelling Fraction Multiplication

From students' answer, it can be seen that 60% of the students could give the correct answer, 27% could not give the correct answer, and 13% could not able to give any answer. The correct answers given by the students is shown in Figure 4 and Figure 5.

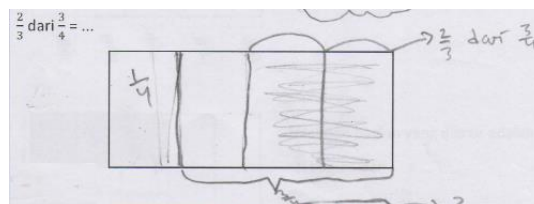


Figure 4

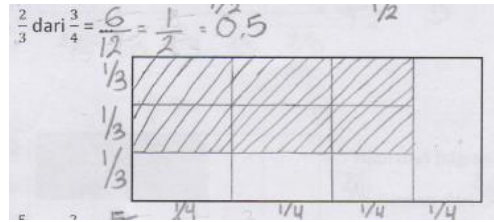


Figure 5

Figure 4 and 5 indicate that the students were able to determine $\frac{3}{4}$ of a rectangle area, that is a rectangle with the length is $\frac{3}{4}$ of the first rectangle's length and the width is the same as the first rectangle's width. Moreover as it is shown in Figure 4, the students drew $\frac{2}{3}$ of $\frac{3}{4}$ as a rectangle with the length is $\frac{2}{3}$ of $\frac{3}{4}$. The other strategy shown in Figure 5, the students drew $\frac{2}{3}$ of $\frac{3}{4}$ as a rectangle with the width is $\frac{2}{3}$ of the first rectangle's width and the length is $\frac{3}{4}$ of the first rectangle's length.

For the students who could not give the correct answer, they got difficulty in understanding the meaning of $\frac{2}{3}$ of $\frac{3}{4}$. Most of them drew a model that represents the fractions $\frac{2}{3}$ of $\frac{1}{4}$ (see Figure 6).

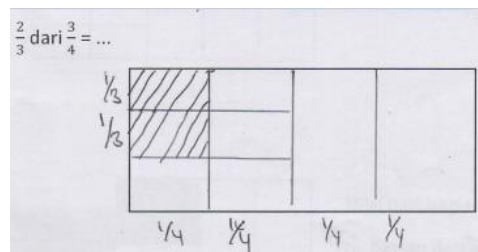


Figure 6

4.4. Findings of Students' Performance in Solving Word Problems

From students' answer, it can be seen that only 45% of 44 students could give correct answer, 48% could not give the correct answer, and 7% could not able to give any answer. There were two common incorrect answers given by the students. First, the students found two third of 27 liters and one ninth of 27 liters and added up the results (see Figure 7). This kind of answer (Figure 7) shows that the students might get difficulties in reading and understanding the language used within a word problem. Moreover, there is a possibility that the students did not able to recognize and image the context in which the word problem is set, although the context chosen in this problem is familiar to the students [3].

Figure 7

Another strategy is shown in Figure 8, the students did some calculations using the numbers mentioned in the problems. This strategy indicates that the students might get difficulties in understanding the

language, imaging the context, and also forming a mathematical sentence from the word problem. As it is shown in Figure 8, the mathematical sentence posed in the students' answer is meaningfulness [3].

$$\frac{27}{1} - \frac{2}{2} = \frac{81-2}{3} = \frac{79}{3}$$

$$a) 24 - \left(\frac{2}{3} \times \frac{1}{12}\right) = 24 - \frac{2}{6}$$

$$= 24 \frac{1}{6}$$

$$\frac{108}{60} - \frac{2}{60}$$

$$= \frac{4}{50} \text{ liter.}$$

Figure 8

5. Discussion and Conclusion

This findings is consistent with previous studies ([3] and [6]) that have revealed students' low performance in problem solving of fractions.

The result of this study have implications for mathematics teachers and mathematics education researchers. Mathematics teachers and mathematics education researchers should work collaboratively to facilitate students' development of mathematics conceptual knowledge. By having conceptual knowledge, students have integrated mathematical ideas and concepts and this knowledge help them in solving problem. Furthermore, the result also implies that mathematics teaching should emphasis in problem solving skills because it can reinforce mathematical knowledge, enhance logical reasoning, and it encompasses skills which are important in everyday life.

References

- [1] Anderson, J., & Wong, M. (2006). Teaching common fractions in primary school: Teachers' Reactions to a New Curriculum. *Proceedings of Australian Association for Research in Education*, 1-13.
- [2] Behr, M., Lesh, R., Post, T., & Silver E. (1983). Rational Number Concepts. In R. Lesh & M. Landau (Eds.), *Acquisition of Mathematics Concepts and Processes*, (pp. 91-125). New York: Academic Press
- [3] Gooding, S. (2009). Children's Difficulties with Mathematical Word Problems. *Proceedings of the British Society for Research into Learning Mathematics*, 29(3), 31-36.
- [4] Skemp, R. (1978) . Relational understanding and in instrumental understanding. *Arithmetic Teacher*, 26(3), 9-15.
- [5] Thompson, P. W., & Saldanha, L. A. (2003). Fractions and multiplicative reasoning. *Research companion to the principles and standards for school mathematics*, 95-113.
- [6] Webel, C., & DeLeeuw, W. W. (2016). Meaning for fraction multiplication: Thematic analysis of mathematical talk in three fifth grade classes. *The Journal of Mathematical Behavior*, 41, 123-140.



CERTIFICATE

This is to certify that

Veronika Fitri Rianasari

has presented a paper with entitled

Seventh Grade Students' Performance in Dealing With Multiplication of Fractions

International Conference on Mathematics : Education, Theory & Application
(ICMETA) 6-7 December 2016

Prof. Ir. Ari Handono Ramelan, M.Sc.(Hons), Ph.D.

Dean



Surakarta, 7 December 2016



Dr. Dewi Retno Sari Saputro, S.Si., M.Kom.
Chair of ICMETA 2016

