PROCEEDINGS OF THE 5th INTERNATIONAL CONFERENCE ON RESEARCH, IMPLEMENTATION AND EDUCATION OF MATHEMATICS AND SCIENCES (5th ICRIEMS)

Revitalizing Research And Education
On Mathematics And Science For
Innovations And Social Development

Yogyakarta, 7 – 8 May 2018

FMIPA UNIVERSITAS NEGERI YOGYAKARTA

Proceedings of The 5th International Conference On Research, Implementation And Education Of Mathematics And Sciences (5th ICRIEMS): Revitalizing Research And Education On Mathematics And Science For Innovations And Social Development

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Preface

This proceedings is the regular edition (non-Scopus-indexed) of the conference proceedings of the 5th International Conference on Research, Implementation, and Education of Mathematics and Sciences (ICRIEMS) held by the Faculty of Mathematics and Science, Yogyakarta State University, Indonesia on 7 – 8 May 2017 at Eastparc Hotel Yogyakarta. All papers in this proceeding were obtained from a selection process by a team of reviewers and had already been presented in the conference. Some selected papers from the conference were compiled under separate proceedings and published by Institute of Physics (IoP) which is Scopus-indexed. This proceedings comprises 9 fields, they are mathematics, mathematics education, physics, physics education, chemistry, chemistry education, biology, biology education, and science education.

The theme of this 5th ICRIEMS is '*revitalizing research and education on mathematics and science for innovations and social development*'. This conference presented five keynote speakers, which were Prof. Dr. Fang-Ying Yang (Graduate Institute of Sciences Education, National Taiwan Normal University), Prof. Muammer Calik, Ph.D (Karadeniz Technical University, Turkey), Prof. Ferry Butar Butar, Ph.D. (Department of Mathematics and Statistics, Sam Houston State University, USA), and Prof. Dr. Eng Khairurrijal (Department of Physics, Bandung Institute Technology, Indonesia), and two invited speakers, which were Prof. (Assoc.) Dr. Azmi Mohamed (Department of Chemistry, Universiti Pendidikan Sultan Idris, Malaysia) and Dr. Lilla Adulyasas (Yala Rajabat University, Thailand). Besides the keynote and invited speakers, there were also parallel articles that present the latest research results in the field of mathematics, sciences, and education. These parallel session speakers came from researchers from Indonesia and abroad.

Hopefully, this proceeding may contribute in disseminating research results and studies in the field of mathematics, sciences and education such that they are accessible by many people and useful for the development of our civilization.

Yogyakarta, October 2018

Editorial Team

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Forewords From The Head of Committee 2018

Assalamu'alaikum warahmatullahi wabarakatuh.

On behalf of the organising committee of the 5th ICRIEMS, please let me welcome you to Yogyakarta, Indonesia. Nothing is more precious for us, besides enable to fete you all here, in the 5th of the International Conference on Research, Implementation, and Education of Mathematics and Science, that is organized by the Faculty of Mathematics and Science, Yogyakarta State University.

It is not only about the research as well as the papers that will be presented. But it is also about the academic networks, mutual cooperation, and meaningful communications amongst us – the researchers, academics, and educators – those which we are expecting to be built and established, in this conference. We believe that this occasion may lead our commitment to strength our roles together, particularly to achieve the innovation and social development through research and education on mathematics and science, as it is accentuated by the theme of this conference.

We are strongly considered that this conference would not be meaningful without other parties. Therefore, I would like to express my highest appreciation and gratitude to our keynote speakers and invited speakers. They are:

1. Prof. Ferry Butar Butar, Ph.D.,
2. Prof. Muammer Calik, Ph.D.,
3. Prof. Dr. Eng Khairurrijal, M.Si.
4. Prof. Dr. Fang-Ying Yang
5. Prof. Assoc. Dr. Azmi Mohamed
6. Dr. Lilla Adulyasas.

I also would like to address our big thank to our motivated and valuable participants. There are 570 papers will be presented and 2 posters displayed, out of 575 registered participants. A few selected papers would be published in the Scopus-indexed proceeding whilst others will be in either regular proceeding or journals.

We believe that there would be any shortcomings and inconveniences in this conference. Thus, we really apologize. We hope that this conference will be very succesful. Have a nice talk, discussion, and surely enjoy Yogyakarta. Thank you.

Wassalamu'alaikum warahmatullahi wabarakatuh.

Yogyakarta, May 2018

Agung W. Subiantoro

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Forewords From the Dean of Faculty of Mathematics and Sciences, Universitas Negeri Yogyakarta

Assalamu'alaikum warahmatullahi wabarakatuh. May peace and God's blessings be upon you all.

On behalf of the Committee, first of all allow me to extend my warmest greeting and welcome to the 5th International Conference on Research, Implementation, and Education of Mathematics and Sciences 2018, organized by Faculty of Mathematics and Natural Sciences (FMNS) Yogyakarta State University.

To celebrate the 54th Anniversary of Yogyakarta State University, our faculty has an opportunity to conduct the 5th ICRIEMS 2018 with the theme of Revitalizing Research and Education on Mathematics and Science for Innovations and Social Development. This conference proudly presents five keynote speeches by five fabulous speakers: Prof. Ferry Butar Butar, Ph.D., Prof. Muammer Calik, Ph.D., Prof. Dr. Eng Khairurrijal, M.Si., and Prof. Dr. Fang-Ying Yang and two invited speakers: Prof. Assoc. Dr. Azmi Mohamed and Dr. Lilla Adulyasas.

The independence of a country is impossible to gain if the education does not become the priority and it is not supported with the development of technology. We all know that the technology development could be achieved if it is supported by the improvement of firm fundamental knowledge. The empowerment of fundamental knowledge could not be separated from research which is related to the development of technology and the learning process in school and universities.

This conference is aimed to pull together researchers, educators, policy makers, and practitioners to share their critical thinking and research outcomes. Therefore, we are able to understand and examine the development of fundamental principle, knowledge, and technology. By perceiving the matters and condition in research and education field of mathematics and sciences, we could take a part in conducting qualified education to reach out the real independence of our nation.

This conference will be far from success and we could not accomplish what we do without the support from various parties. So let me extend my deepest gratitude and highest appreciation to all committee members. I would also like to thank each of participants for attending our conference and bringing your expertise to our gathering. Should you find any inconveniences and shortcomings, please accept my sincere apologies.

Wa'alaikumsalam warahmatullahi wabarakatuh.

Yogyakarta, May 2018

Dr. Hartono

Conference Program

THE 5th INTERNATIONAL CONFERENCE ON RESEARCH, IMPLEMENTATION & EDUCATION OF MATHEMATICS AND SCIENCES (ICRIEMS) 2018
7-8 MAY 2018, HOTEL EASTPARC, YOGYAKARTA, INDONESIA

#DAY 1: MONDAY, 7 MAY 2018

TIME	PROGRAM
07.00 – 08.00 AM	Registration
08.00 – 09.00 AM	Opening Ceremony 1. Opening 2. National Anthem: 3. Traditional Dance: 4. Welcome Speech: Chairman of ICRIEMS 2018 5. Opening Conference by Rector of YSU 6. Photo Session
09.00 – 09.30 AM	Tea/Coffee Break
09.30 – 12.00 PM	**Keynote Speech #1 :** **Prof. Ferry Butar Butar, Ph.D.** **Keynote Speech #2 :** **Prof. Dr. Eng Khairurrijal, M.Si**
12.00 – 01.00 PM	Lunch Break
01.00 – 05.00 PM	Parallel Sessions & Coffee Break

#DAY 2: TUESDAY, 8 MAY 2018

TIME	PROGRAM
07.00 – 08.00 AM	Registration
08.00 – 09.30 AM	**Keynote Speech #3:** **Prof. Muammer Calik, Ph.D**
09.30 – 10.00 AM	Tea/Coffee Break
10.00 – 11.30 AM	**Keynote Speech #4:** **Prof. Dr. Fang-Ying Yang**
11.30 AM – 00.30 PM	Lunch Break
00.30 – 04.00 PM	Parallel Sessions & Coffee Break
04.00 – 04.30 PM	Certificate Collection

#DAY 3: WEDNESDAY, 9 MAY 2018

TIME	PROGRAM
07.00 AM – 05.00 PM	City tour

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Analysis of Students' Higher Order Thinking Skills in Solving The Contextual Problem

Tea Tasia Wiwin[1, a)], Marcellinus Andy Rudhito[2,b)] and Herman Joseph Sriyanto[3, c)]

[1]*Master Program in Mathematics Education, Faculty of Teacher Training and Education, Sanata Dharma University, Yogyakarta, Indonesia.*
[2]*Departement of Mathematics Education, Faculty of Teacher Training and Education, Sanata Dharma University, Yogyakarta, Indonesia.*
[3]*De Britto Senior High School, Yogyakarta, Indonesia.*

[a)]teatasia@gmail.com
[b)]arudhito@gmail.com
[c)]hermanjoyo@gmail.com

Abstract. This study aimed was to analyze students' higher order thinking skills in solving the contextual problem. The study was conducted at one private high school in Yogyakarta from October to November 2017. The type of research used in this research was descriptive qualitative. The research subjects in this study were 6 students selected based on the resemblance of student answers. However, in this paper will be discussed 2 subjects. The methods of the data collection in this research were written test and interview. Data analysis technique used in this research were data reduction, data display, and verification or conclusion. The contextual problem used in this study related to the counting rules material consisting of 1 problem.The results of research indicated that subject 2 (S_2) already has a higher order thinking skills namely analyzing and evaluating. While the subject 1 (S_1) does not yet has a higher order thinking skills.

Keywords: Analysis, Higher Order Thinking Skills, Contextual Problem.

INTRODUCTION

Facing the era of globalization and technological development as it is today, it takes a reliable human resources who have critical, systematic, logical, creative thinking and willingness to cooperate effectively [1]. Different types of thinking skills as mentioned above are the basis for higher order thinking skills. Higher order thinking skills will occur when a person associates new information with information already stored in his memory and connects it, rearrange and develop the information to achieve a goal or find a solution of a situation that is difficult to solve, such as determining policies, problem solving skills, decision making abilities, and entrepreneurial skills [2]. Thus, higher order thinking skills need to be trained and developed early on.

Higher order thinking skills can be trained and developed in the learning process, especially math learning in schools. According to Susanto, the purpose of learning mathematics in schools is intended so that students are not only skilled at using mathematics, but can provide supplies to students with the emphasis of reasoning in the application of mathematics in everyday life in the midst of society where students live. Furthermore, Susanto explained that by studying mathematics, students will reason critically, creatively, and actively [3]. All of the above will be realized if the students are more active role in the learning process.

In addition, Shadiq reveals that learning mathematics should be started with the introduction of problems in accordance with the situation (contextual problem) [2]. Contextual problems emphasize the use of higher order thinking, meaning that by working on contextual problems, problems that require reasoning, argumentation and creativity in solving them, it is hoped that higher order thinking skills will be more trained and evolving.

However, one tendency that often happens was to forget that the essence of learning was the learning of students and not the teacher's learning [4]. The learning process in schools also still refers to lower order thinking skills. Teaching methods used were lectures so students become passive. In addition, examples, exercises and repetition problems tend to test the less memory aspects of students' higher order thinking skills. Thus, students' higher order thinking skills were difficult to develop and were not trained. This also causes students to feel difficult if given a problem that demands reasoning and was slightly different from that learned. Of course this makes the achievement of students, especially in the learning of mathematics was still relatively low. It was also evidenced from the results of a survey on student achievement that was carried out internationally namely Trends in International Mathematics and Science Study (TIMSS) and Program for International Student Assessment (PISA). The survey results show that the value of Indonesian students was still far below the average.

Therefore, teaching and learning process conducted in schools should demand and direct students to use higher order thinking skills. The process of developing higher order thinking skills can be done in various ways. For example, the process of learning more demanding student activeness, giving questions that require reasoning, argumentation and creativity in solving it and of course the learning process that refers to higher order thinking skills. Based on the problems that have been described above, researchers interested in conducting research related to the analysis of students' higher order thinking in solving the contextual problem.

CONTEXTUAL PROBLEMS AND HIGHER ORDER THINKING SKILLS

Contextual Problems

The word of "contextual" comes from the "context" in the Big Indonesian Dictionary Created two meanings: 1) the part of a description or sentence that can replace or add to the clarity of meaning; 2) call related to the situation [5]. Contextual meaning in learning is able to bring students to achieve learning objectives (mastery of learning materials) that are relevant to them, and meaningful in life. A problem is said to be contextual if the problem is related to situations that children can understand in terms of their prior knowledge.

According to De Lange, the purpose of the use of context is to sustain the implementation of the guided reinvention process (modeling, concept, application, and practicing certain skills). In addition, the use of context can make it easier for students to recognize problems before solving them. Context can be raised not necessarily at the beginning of learning but also in the middle of the learning process, and at the time of assessment [6]. Furthermore, De Lange reveals that the contextual math problem is a mathematical problem that uses a variety of contexts so as to present situations that have been experienced for students. In that case, the context must be in accordance with the mathematical concepts being studied.Context itself can be interpreted by the situation or phenomena / natural events associated with the concept of mathematics that is being studied [6].

In general, in Indonesia's Realistic Mathematics Education, the context is useful for the formation of concepts, namely access and motivation to mathematics, modeling, providing tools for thinking, using procedures, notations, drawings and rules, reality as the source and application domain, and specific skills training at certain situations [7].

According to De Lange there are four kinds of context or situation problems [6], namely:

1. Personal Students, situations relating to the daily life of students both at home with family, with friends, classmates and fun.
2. School or academic, situations related to academic life in schools, in classrooms, and activities related to the learning process.
3. Community or Public, situations related to the life and activities of the surrounding community where the student lives.
4. Scientific or mathematical, situations relating to phenomena and substances scientifically or related to mathematics itself.

In Indonesia's Realistic Mathematics Education, De Lange grouped contextual questions into three parts [6], namely:

1. No context at all.
   In this group, the question of not using the context at all, directly in the formal form of mathematics.

2. Context Dress-up (camouflage)
   In this group, the usual problem is changed using the language of the story so it feels that the matter has a context.
3. Context that is relevant to the concept
   Here, the question really has a context relevant to the mathematical concept being studied.

In addition, De Lange shares the difficulties of contextual math for students into three levels [6], namely:

1. Level I: Easy - Reproduction, definitions, standard procedures, and facts. At this level, it takes only one mathematical concept. In addition, at this level there is no context or if there is only camouflage, meaning mathematical operations are added context.
2. Level II: Medium - Combination, integration, connection. The question at this level requires at least two mathematical concepts. This type of problem tends to be a problem-solving. At this level, context serves as a tool for organizing, structuring and solving a reality problem.
3. Level III: Difficult - Mathematization, reasoning, generalization, modeling. The mathematical concept needed to answer the question at this level is the same as at level 2. Only, at this level the questions are directed towards generalization and modeling. At this level, the context serves as a characteristic of the process of mathematization.

Higher Order Thinking Skills

Higher order thinking skills basically means thinking that occurs in higher cognitive processing. Higher order thinking skills patterns involve the transformation of information and ideas. This transformation occurs when students combine facts and ideas and synthesize, generalize, explain, hypothesize or arrive at conclusions or interpretations.

Higher order thinking skills occurs when a person gets new information and the information is stored in memory and then the information is linked to each other, developed to achieve a goal or to obtain possible answers in confusing situations [8].

According to Krathwohl, HOTS *(Higher Order Thinking Skills)* goes at the level of Analize, Evaluate and Create. Here is the HOTS (Higher Order Thinking Skills) dimension [9]:

1. Analize, divided into:
   a. Differentiating: the ability to differentiate and discover which parts are important and not important.
   b. Organizing: the ability to determine how one element matches the other and is able to determine the function of that element in a full section.
   c. Atributing: the ability to see from different angles and values held.
2. Evaluate, divided into:
   a. Checking: the ability to see consistency between processes and outcomes.
   b. Critiquing: the ability to see inconsistencies between outcomes and external criteria.
3. Create, divided into:
   a. Generating: the ability to generate an alternative hypothesis based on criteria.
   b. Planning: the ability to design a procedure to achieve a particular goal.
   c. Producing: the ability to produce a product or something new.

In addition, the test questions are prepared based on the HOTS (Higher Order Thinking Skills) indicator and Basic Competencies [10]. The HOTS (Higher Order Thinking Skills) indicator is synthesized from critical and creative thinking indicators. The indicator in question is as follows:

1. Identify and link relevant information from a situation / problem.
2. Make the right conclusion based on information from a situation / problem.
3. Find consistency / inconsistency in an operation / product.
4. Assess a relevant operation / product based on criteria / standards.
5. Integrating ideas / strategies to solve a problem.
6. Using the right idea / strategy to solve a problem.
7. Develop or create new alternatives to solve a problem.

According to Lewis and Smith, to achieve higher order thinking skills in a learning can be influenced by various factors [8], among others:

1. Differences in the level of knowledge and teaching skills among teachers. The more highly educated and experienced a teacher will have an effect in teaching higher order thinking skills to the learner. Teachers who have understood more pedagogic issues as well as become experts in the field will provide the learning process by making higher order thinking skills as teaching objectives and will be taught with more frequencies than those with less knowledgeable and skilled teachers.
2. The influence of the environment. For example, the bureaucratic rules that teachers teach by today's human resources give meaning to the development of a country. As a result, the growing times, the increasing demand

for young people to have such impressive skills as high-level thinking. The definition of higher order thinking skills has some implications in life. This impilkasi one of them found in the teacher, among others:

a. Learning to be effective in mastering higher order thinking skills is paramount for everyone, higher order thinking is not a skill that only a gifted child possesses and overwhelms. So, everyone needs to develop it.
b. Whether an activity requires high-level thinking skills, it depends on the intellectual history of a learner.
c. Evaluating the higher order thinking skills of learners becomes an important thing. Therefore, teachers need to present situations or questions that learners can not easily answer simply by remembering information.
d. Teaching the basics of higher order thinking skills may be intertwined in classroom learning.
e. Helping learners to understand the difficulty level in developing higher order thinking skills is important.

METHOD

The type of research used in this research was descriptive qualitative. The study was conducted at one private high school in Yogyakarta from October to November 2017. The research subjects in this study were 6 students selected based on the resemblance of student answers. However, in this paper will be discussed 2 subjects. While the object of research was the analysis of higher order thinking skills in solving the contextual problem. The contextual problem used in this study related to the counting rules material consisting of 1 problem.

The methods of the data collection in this research were written test and interview. The data obtained were then analyzed to see students' higher order thinking skills in solving the contextual problem. In addition, interview results were used to determine the thinking process of students in solving the contextual problem. Data analysis technique used in this research were data reduction, data display, and verification or conclusion.

RESULTS AND DISCUSSION

The contextual problem developed in this study related to the counting rules material consisting of 1 problem. This contextual problem was included in the level of analyzing and evaluating. The problem was as follows:

Pedro playing with blocks of the same size. The blocks consists of 3 green blocks, 3 red blocks, and 2 blue blocks. Find how many ways to set the blocks on a tower if:

a. all red blocks are adjacent
b. no adjacent green blocks
c. the top and bottom blocks are the same color
d. three adjacent red blocks and two blue blocks should not be adjacent

The Analysis of Subject 1 (S1)

The analysis of subject 1 (S1) was as follows:

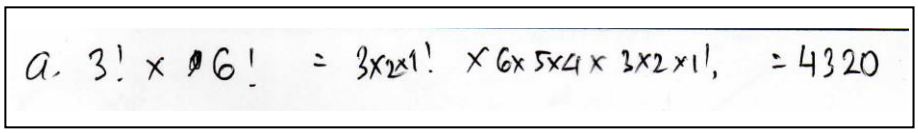

FIGURE 1. Answer for problem 1.a

From the results of work a, it appears that S1 made a mistake in answering the question. S1 less accurate in reading the problem. S1 considered the problem can be solved using the concept of permutation with different elements. In fact, if the question was scrutinized there was a sentence that says that "the blocks are the same size". Thus, the problem should be done using the concept of permutation with the same element.

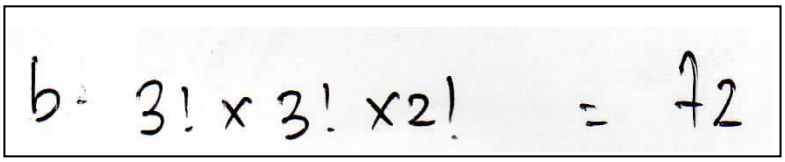

FIGURE 2. Answer for problem 1.b

From answer b, seen S1 made a mistake. From the answer S1 assume that the problem b can be solved with the concept of permutation with different elements. In fact, the problem must be done using the concept of permutation with the same element. In addition, there was a condition that says there were no adjacent green blocks. So to solve the problem requires several steps. The first step was to find the total way of arranging the blocks if there was no requirement of using the permutation concept with the same element, the second step looks for how to set the blocks if all the green blocks are adjacent, and the last step is to reduce the total way of arranging the blocks if there was no provision how to set the blocks if all green blocks were adjacent.

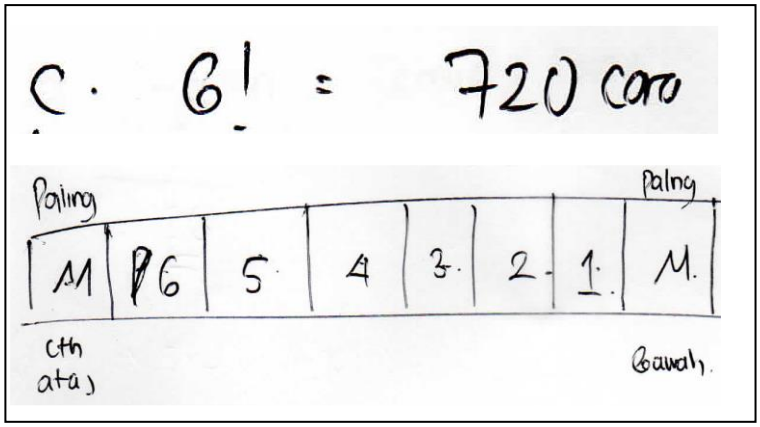

FIGURE 3. Answer for problem 1.c

From the work c, S1 made a mistake in solving the problem. S1 still uses the concept of permutation with different elements in solving the problem. From the answer, S1 only answer if the top and bottom of the blocks was red. Whereas the question c wants that the top and bottom blocks were the same color. Because there were 3 colors of red, green and blue then it should be searched how many ways to set the blocks for each color by using the concept of permutation with the same element. Then the result of each color should be added.

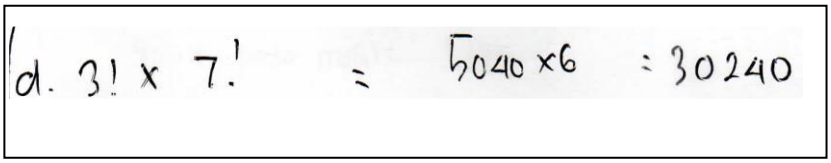

FIGURE 4. Answer for problem 1.d

From the results of work d, it appears that S1 made a mistake. The concept that S1 uses in solving the problem d erroneously. Like the previous problem solving, S1 uses the concept of permutation with different elements to solve the problem. In addition, S1 does not pay attention to the question command well.

Based on the results of the interview, it was known that S1 experienced confusion in interpreting the problem. S1 does not understand the phrase that says "the blocks were the same size". so, S1 uses the concept of permutation with different elements in solving the problem.

From the results of the analysis, it was known that S1 has not been able to identify and link relevant information from the problem. S1 has not been able to make the right conclusion based on the information of the problem. S1 has not been able to integrate ideas / strategies to solve problems. S1 also has not been able to develop or create new alternatives in solving problems. Therefore, it can be deduced that S1 has not been able to reach the stage of analyzing, and evaluating perfectly which means the higher order thinking skills of S1 was still relatively low.

The Analysis of Subjek 2 (S2)

The analysis of subject 2 (S2) was as follows:

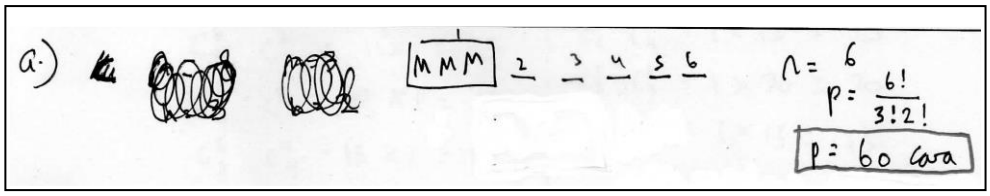

FIGURE 5. Answer for problem 1.a

From the results of the work, the first step made by S2 was to group the red blocks in one place and make 5 lines used to put the blocks other than red. S2 writes n = 6 indicating the number of places the blocks will fill. Based on the results of interview S2 know n = 6 because red blocks have the same size. So, the 3 beams are counted to 1. Therefore, the number of places to be filled is no longer 8 but 6 places.

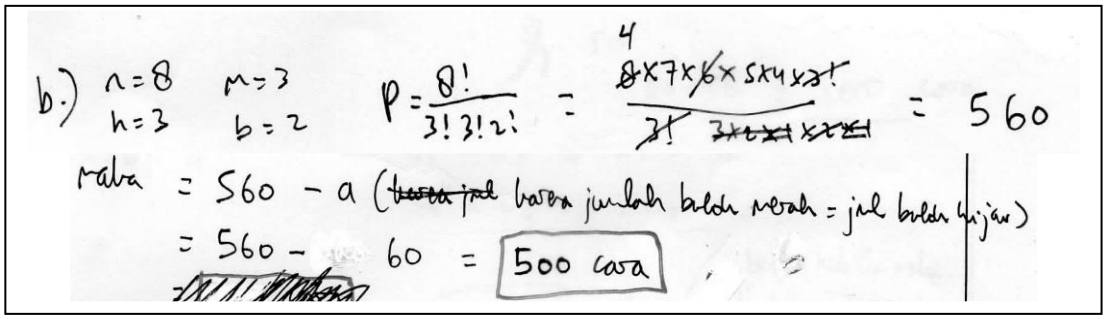

FIGURE 5. Answer for problem 1.b

In solving the problem b, the first step made by S2 was to find the total way of arranging the blocks if there was no condition whatsoever. Then S2 looks for how to set the blocks if all the green blocks were next to each other. Furthermore, the total way of arranging the blocks if there was no condition was reduced by the number of ways to set the blocks if all green beams were contiguous. During the interview process, S2 explained that to get an answer b there were several steps that must be done as written on the answer sheet. S2 does not need to recalculate the number of ways to set the blocks if all the green blocks were adjacent because the S2 has got information from a problem where the red blocks and green blocks have the same amount.

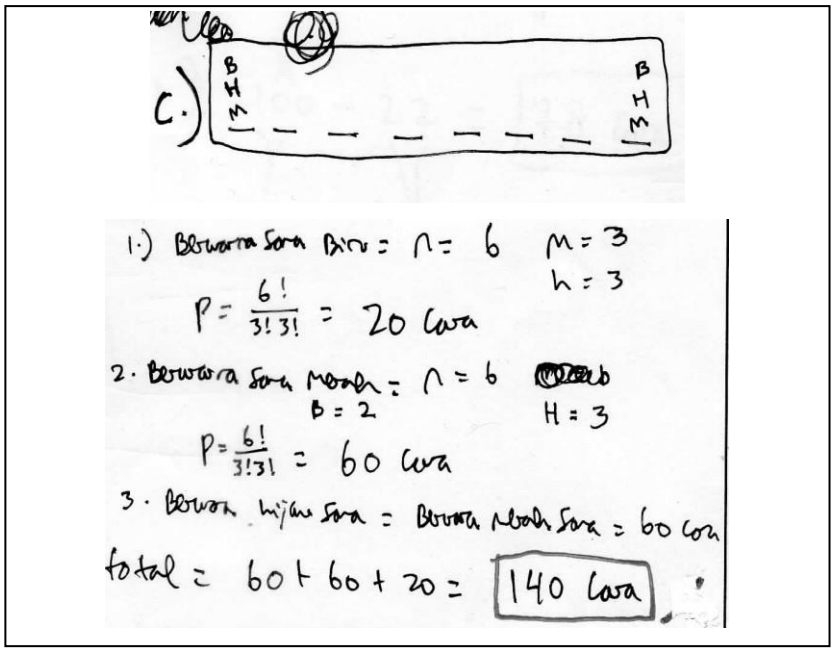

Figure 7. Answer for problem 1.c

From the work c, the first step of S2 was to make an illustration like the picture above. The illustrations help the S2 know that there were 3 steps that must be done to solve the problem. S2 calculates the number of ways to set the blocks if the topmost blocks and the lowest blocks were blue. Then S2 calculates the number of ways to set the block if the topmost blocks and the lowest blocks were red. Furthermore, S2 calculates the number of ways to set the blocks if the topmost block and the lowest blocks were green. Then, S2 sums up the results. During the interview process, S2 explained that S2 does not need to recalculate the number of ways to set the blocks if the topmost block and the lowest blocks were green because the S2 has been informed on the previous calculation. It was known S2 because the green block and red blocks have the same amount. S2 says that there was a mistake

that S2 do the writing on the calculate the number of ways to set the blocks if the topmost blocks and the lowest blocks were red. Should be 2! but written 3!.

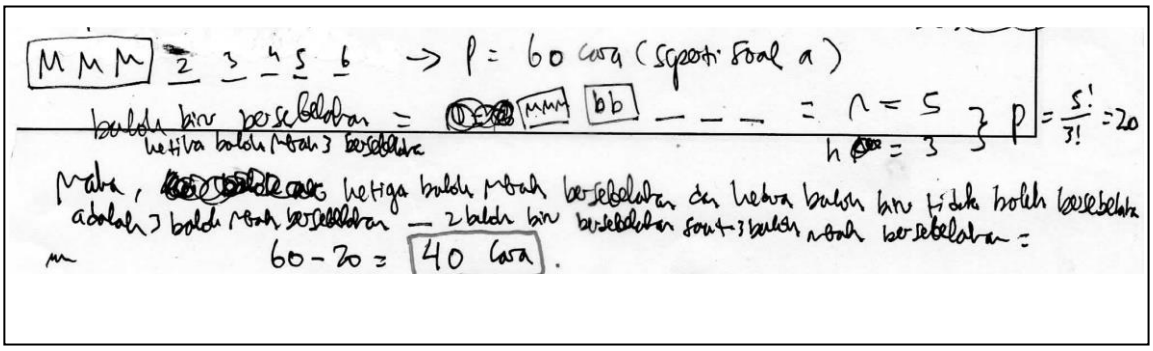

Figure 8. Answer for problem 1.d

To solve the problem d, S2 does 3 steps of completion. The first step of S2 rewrote the answer he got to the answer on a. Based on the results of the interview, the information in question a was required to obtain a solution on the problem d. The second step, S2 calculates the number of ways to set the blocks if all the blue blocks were adjacent when all the red blocks were also contiguous. Next, S2 subtracts the result in the first step with the result in the second step.

S2 managed to answer the questions correctly. From the analysis it can be seen that S2 was able to identify and relate relevant information from the problem. S2 was able to make the right conclusion based on information from the problem. S2 was able to integrate ideas / strategies to solve problems. S2 was able to develop or create new alternatives in solving problems. Therefore, it can be deduced that S2 has reached the stage of analyzing and evaluating which means higher order thinking skills of S2 was high.

Based on the results of interviews, S1 and S2 said that the problem was easy to understand, sentences per sentence contained in the problem easy to understand and does not cause multiple interpretations. It's just that you need to add the word "from" so the problem becomes "Pedro was playing with the same sized blocks. The blocks consists of 3 green blocks, 3 red blocks, and 2 blue blocks. Find the number of ways to set the blocks on a tower if: (a) All adjacent red blocks, (b) No green blocks were overlaid, (c) the top and bottom blocks were the same colours, (d) the third red blocks adjacent and the two blue blocks were not adjacent.

CONCLUSION

The results of the analysis indicated that subject 2 (S_2) already has a higher order thinking skills namely analyzing and evaluating. While the subject 1 (S_1) does not yet has a higher order thinking skills.

ACKNOWLEGMENT

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REFERENCES

1. Anisah, Zulkardi and Darmawijoyo, *Pengembangan Soal Matematika Model PISA pada Konten Quantity untuk Mengukur Kemampuan Penalaran Matematis Siswa Sekolah Menengah Pertama, Jurnal Pendidikan Matematika* Vol.5.No.1, pp 1-15 (2011).
2. Shadiq, Fadjar. *Pembelajaran Matematika Cara Meningkatkan Kemampuan Berpikir Siswa.* Yogyakarta: Graha Ilmu (2014).
3. Susanto, Ahmad. *Teori Belajar & Pembelajaran di Sekolah Dasar*. Jakarta: Prenadamedia Group. (2013).
4. Rusman, *Model-model Pembelajaran Mengembangkan Profesi Guru*. Jakarta: PT Rajagrafindo Persada. (2014).

5. Kadir, Abdul, *Konsep Pembelajaran Kontekstual di Sekolah*, *Dinamika Ilmu,* Vol. 13. No. 3, 17-38, Desember (2013)
6. De Lange, J., *Mathematics, insight and meaning.* Utrecht: OW &OC, (1987)
7. Van den Heuvel-Panhuizen, M., *Assessment and realistic mathematics, education*. Utrecht: CD-B Press / Freudenthal Institute, (1996).
8. Lewis, Arthur and Smith, David. *Defining Higher Order Thinking, Theory into Practice. Collage* of Education: The Ohio State University. 32, 1993 (2013)
9. Kratwohl, D.R, *A revision of Bloom's Taxonomy: an overview – Theory Into Practice, Colloge of education, The Ohio State University* (2002)
10. Budiman, Agus & Jailani. *Pengembangan Instrumen Asesmen Higher Order Thinking Skills (HOTS) Pada Mata Pelajaran Matematika SMP Kelas VIII Semester I. Jurnal Riset Pendidikan Matematika.* Volume 1 (2). p 139-151 (2014).