

Comparative Study On High Order Thinking Skills

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Abstract: This study aimed to describe student's high order thinking skill (HOTS) about fraction. The research subject was three students consist of one male and one female from medium standard school and one female from high standard School with similar high mathematics ability. There are 3 indicators of HOTS in this study, analysis, create, and evaluate. The research began by determining subjects using mathematics tests, then followed by HOTS test. The last stage was interviewing the subject to reveal how the subject think in solving HOTS test and examine the match between the answers and the reasons given. The research found that The difference between subjects in indicators Analyze, Female and male from medium standard school have similar ability with mentioning what is known and asked in the problem. On the other side, female from high standard School also have that ability but she can also give illustration from the problem by drawing a rectangle. In indicators Create, The difference between female and male from medium standard school just lay on the ability of male to convert centimeters to meter, and female cannot. Both subjects are not able to divide decimal fraction. While female from high standard school succeed to divide decimal fraction by dividing the area of rectangle with the area of squares and finally got the final result of that problem. She is very well on solving the problem with giving the conclusion in her answer sheet. In indicators Evaluate, Female and male from medium standard school did not complete the final answer so the subject was unable to evaluate their own answer since that both cannot divide decimal fraction. On the other side, From interview with female from high standard school, the researchers asked how to evaluate the result and she said that she double check there might be an error or typo. The answer is corrected, seen and tested again, tested again its area, tested the results of multiplication and division again. Thus, it could be concluded that gender with similar mathematics ability can show bit different result with similar school in medium school and having big different with female from high school.

Index Terms : High Order Thinking Skill, Gender, Fraction .

1 INTRODUCTION

High order thinking skill (HOTS) has been new issue of Indonesia in the last decade. This is the impact of the 2015 PISA (The Program for International Student Assessment) results, where Indonesia ranked 62 out of 70 countries. PISA is an examination system organized by the Organization for Economic Cooperation and Development (OECD), to evaluate the education system of 72 countries around the world. Every three years, 15-year-old students are randomly selected to take a test of three basic competencies, reading, mathematics and science. Other international assessments is TIMSS (Trends In Mathematics and Science Study) 2015, Indonesia is ranked 46 out of 51 countries. TIMSS is an international study that measures students' abilities in the fields of mathematics and science. TIMSS aims to investigate the curriculum of each country in accordance with countries' planning. TIMSS is held every 4 years and is coordinated by the International Association for the Evaluation of Educational Achievement (IEA). There are the fact that he weaknesses of Indonesian students are (1) understanding complex information, (2) theory, analysis and problem solving, (3) the use of tools, procedures and problem solving and (4) investigation [1]. From these results it can be concluded that HOTS Indonesian students are still low compared to other countries in the world. According to Murtiyasa the renewal of mathematics learning in the 2013 curriculum has referred to TIMSS and PISA, the government has begun to make improvements in the field of education [2].

Improving education by changing the curriculum from KTSP to 2013 Curriculum to answer the challenges of TIMSS and PISA although there are still pros and cons from several parties. Synergizing with this, Minister of Education og Indonesia Muhajir Effendy has designed National examintaion 2018 questions, especially mathematics problems with the HOTS concept which requires students to be able to apply knowledge in everyday life. However, it is known that many students who complain cannot even work on the problem at all and are confused about how to solve it. This of course must be returned to learning in class which is most likely not yet referring to the HOTS concept. Gap between the expectations of the government that students are able to apply their knowledge in answering HOTS questions on the National Examination 2018 with classroom learning which is not yet HOTS oriented is one of the backgrounds of this research. As is well known, HOTS questions are certainly made more difficult and require high reasoning thinking. Therefore, treatment needs to be given as early as possible to both students and the instructors themselves. The introduction of HOTS to students should be made in stages. Teachers must first understand HOTS. As a matter of fact, there are still many teachers who are still confused HOTS is actually the method, the learning process, the ability or what it looks like. Some teachers assume that HOTS is a learning phase, other teachers also assume a learning method. Considering the fact that only some teachers understand HOTS, socialization and training are still needed to introduce HOTS to mathematics teachers [3]. According to Brookhart suggested that HOTS as a process of critical thinking that is a problem reasoning, investigate, then observe and explain it, compare and connect the problem [4]. Raiyn & Tilchin also believes that High Order Thinking is student-centered and in the learning process students are encouraged to think critically and solve problems [5]. Meanwhile, according to Ennis HOTS is students' skills in logical and reflective thinking in solving a problem [6]. states that thinking a high level occurs when someone takes information and new information that is stored in memory and is interconnected and / or rearranges and extends this information to achieve a goal or find an answer in a confusing situation[7]. One of the dominant mathematics material in elementary school is

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fractions. Even fractions are officially studied from elementary school grade 3 through junior high school. This urgency is the reason researchers choose fraction material to assess students' HOTS. In the teaching and learning process, teachers will be confronted by various kinds of children's characteristics, both in terms of ethnicity, race, and gender differences. Gender refers to physiological and biological differences between women and men. Another difference that can be seen between male and female students is their ability to think. Mathematical thinking ability of men and women will be clearer with male students more superior to deal with tasks that require the ability to reason while women excel from calculation factors [8]. This is caused by differences in hormonal influence and structure of the human brain with these differences related to the way and style in terms of doing things, both in behavior, language processes, spatial abilities, emotions and so on [9]. Therefore linking between HOTS, gender and fractions is an idea that can be developed more deeply in the future

2 METHOD

The type of research is qualitative. The instrument are mathematics ability test, HOTS test and interview question list. To choose the subject, mathematics ability used to select students from similar ability. The participant of this study is three students from two schools, those are SDN 38 (High Standard School) and SDN 44 Ternate (Medium standard School). The reason why two schools are selected is that the researchers aim to see what the HOTS's differences between school from medium standard and high standard. Choosing one female and one male in SDN 44 Ternate. And also comparing with one female also in SDN 38 Ternate with no male because there is no students with similar math ability. After determining the subject, HOTS tests used to see the student's high order thinking skills. And the last steps are interviews to obtain more information about how student solve the HOTS problem. In this study, to find out the high order thinking skills of students, students must have the aspects of analyzing, creating, and evaluating. indicators of HOTS are first analyze is defined as an activity in separating material into its constituent parts and being able to establish a part related to other parts. Second, create is an activity where individuals create or obtain new perspectives, ideas or products from seeing a particular event. Create meant here is to put an element together to form a new structure or pattern, or the results are not imitated by others but the results of oneself. Third, evaluate is an activity in making decisions on certain criteria and standards, which includes checking and critiquing [10]. From these indicators, research formulated test that will be given to subjects to see their HOTS. The test can be seen in table 1

TABLE 1.
HOTS PROBLEM

No	Problem
1	Pak Rio has a rectangular-shaped house with a length of $6\frac{3}{5}$ m and a width of $4\frac{1}{2}$ m. The floor will be fitted with square tiles with a side length of 20 cm. how many tiles are needed for Pak Rio's house floor?

From this problem, students' answer sheet will be analysed by the three indicators of HOTS which is analyze, create, and evaluate that also supported with the interview.

3. RESULT AND DISCUSSION

3.1 ANALYZING ASPECTS OF FEMALE FROM MEDIUM STANDARD SCHOOL

From interview, female subjects can find out and explain what information is known from the problem, the subject can also explain the core of the problem. Even she did not write down in her answer sheet. In addition, the subject also said that any information that is known to have a relationship. The subject understand the steps to solve that problem. Subject answer illustrated below on figure 1.

Jawab: $4\frac{1}{2} \times 6\frac{3}{5} = \frac{9}{2} \times \frac{33}{5}$
 $= \frac{297}{10}$
 $= 29,7 \text{ m}^2$

Luas ubin = $20 \times 20 = 400$
 banyak ubin $29,7 : 400$

29.7
 10 297
 20
 97
 90
 70
 70
 0

20
 20
 400
 400

Figure 1. Female Answers

3.2 Analyzing Aspects of Male Subject from Medium standard School

Male subjects can find out and explain what information is known from the problem, the subject can also explain the core of the problem. Even subject did not write down in answer sheet but from interview he can explain it well. In addition, the subject also said that any information that is known to have a relationship. The subject understand how to solve the problem and start to plan the steps. Subject answer illustrated below on figure 2

Penyelesaian: $6\frac{3}{5} \text{ m} = \frac{33}{5} \text{ m}$
 $4\frac{1}{2} \text{ m} = \frac{9}{2} \text{ m}$
 $= \frac{33 \times 9}{5 \times 2}$
 $= \frac{33 \times 9}{5 \times 2} = \frac{297}{2 \times 10} = 29,7$
 $= 29,7 \text{ m}^2$

ubin = 20 cm persegi
 $= 5 \times 5$
 $= 20 \times 20 \text{ cm}$
 $= 400 \text{ cm}^2$
 $= 0,04 \text{ m}^2$
 $= 29,7 \text{ m}^2 : 0,04 \text{ m}^2$
 $= 742,5$

Figure 2. Female Answers

3.3 Analyzing Aspects of Female Subject from High Standard School

The subject can write down what is known and what is asked from the problem clearly in the answer sheet. Subject also illustrate the problem by drawing a rectangle. Subject answer illustrated below on figure 3.

Dik: Pak Rio memiliki rumah yang lantaiinya berbentuk persegi panjang dengan lebar $6\frac{3}{5}$ dan $4\frac{1}{2}$ m. Lantai tersebut akan dipasang ubin yang berbentuk persegi dengan panjang sisi 20 cm.

Dit: Banyak ubin yang diperlukan untuk lantai rumah Pak Rio?

Jawab:

$L = P \times l$
 $L = 6\frac{3}{5} \times 4\frac{1}{2}$
 $L = \frac{33}{5} \times \frac{9}{2} = \frac{297}{10} = 29,7 \text{ m}$
 $L = 20 \text{ cm} = \text{--- m}$
 $L = \frac{20}{100} = 0,2 \text{ m}$
 $L = 0,2 \times 0,2 = 0,04$
 $L = 29,7 : 0,04$
 $L = 0,04 \times 100 = 4$
 $29,7 \times 100 = 2970$
 $L = \frac{2970}{4} = 742,5$

Banyak Ubin yang diperlukan untuk lantai rumah Pak Rio yaitu 742,5

Figure 3. Female subject answer

3.4 Analyzing Aspects of Female Subject from High Standard School

In the factual knowledge the demention of the female answered were be well than male, this can be seen from female students who can write the facts of the completion of the problem. Elements that are known to students, for example, write the mixed shape form correctly. This can be the basis for students' understanding in solving subsequent mathematical problems for example in the addition of decimal numbers. Furthermore, in conceptual knowledge, between female and male it is seen that female can connect between unit elements and fractional elements compared with male students. Can be explained that female students have the ability to connect better than female students. On the procedural knowledge dimension, it is seen that female students are better off using criteria and completion steps than male students, for example changing mixed fractions to ordinary fractions and then finding the answers. On the metacognition dimension, it can be seen that self-confidence that grows from the answers that are presented correctly for those who answer correctly, can be input and additional knowledge to students from the test questions given by the teacher and the test questions that have just been received. This has not happened to students who have not been able to answer correctly. It also fosters awareness of the knowledge it has so that it can become a comparison for learning. Further it can be explained the dimensions of factual knowledge of the results of the completion of female students in the medium

elementary school category in writing the elements of fractions (figure 1) is good, for example writing mixed fractions can distinguish mixed and ordinary fractions and be able to organize (arrange) these fractions to be solved. In terms of distinguishing between mixed fractions and ordinary fractions, the two levels of school between those who smell and those who are high seem to be able to distinguish the two things, and what dominates is still on female students. Likewise, the dimension of the conceptual knowledge of female students at both elementary and high school levels can be explained from the results of their completion being able to connect between mixed fractions to ordinary cracks. Furthermore, on the dimension of procedural knowledge from work results it can be explained that it has been able to use the criteria of workmanship by both levels of the school even though schools with high categories have more students who answer well than the medium category schools, and are generally dominated by female students. As a result, students who can complete the answers at both levels of the school can have implications for the process of forming metacognition by giving confidence to solving fraction problems and problems related to fractions.

3.5 Creating Aspect of Female subject from Medium standard School

From figure 1 and from the results of interviews, The subject stated that to solve this problem, subject must find the area of the room first. Then look for the area of the tile. And the results are then divided. But the subject is constrained to change the centimeter to meter, she said forget the way to changes it and the last she cannot solve the division of decimal fractions. Therefore the subject cannot solve the problem until it is finished

3.6 Creating Aspect of Male Subject from Medium standard School

The subject stated that to solve this problem, subject must find the area of the rectangle first. Then find the area of a square. And the results are then divided. He can also change from centimeter and meter. It means that he has idea that with different units, it is possible to be finished. But the subject was constrained by the division of decimal fractions. Therefore the subject cannot solve the problem until it is finished

3.7 Creating Aspect of Female subject from High standard School

From interview, subject explain that every solve a problem, she always draw a illustration of the case to be more focus. Subject also solve the problem step by step clearly. First, she find out the area of rectang aspek dimensi factual le. And find the area of square. Then changing the unit from centimeter to meter. She explain that it ,ust be changed because it is impossible to solve the result before changes the units. The last she succeed to divide the area of rectangle with the area of squares and finally got the final result of that problem. she is very well on solving the problem with giving the conclusion in her anwer sheet.

3.8 Comparison Cognitif Demention of Creating Aspect of Female and Male subject from Medium and High standard School

The cognitive process creates between female and male in the medium and high standard school categories in the factual cognitive dimensions of students in the two schools based on

the results presented in the picture above, it can be explained that they can determine the basic elements in fractions that can equate denominators and numerators from fractions and can then solve the combined fractions into ordinary fractions and get the answer. The answers in the two types of schools between medium and high standard schools based on female and male in the factual category, then they do not show significant differences, meaning that there are similarities in aspects of factual knowledge. Furthermore, in the aspect of conceptual knowledge between medium and high standard schools based on female and male, the results of the settlement can be explained that they can make connections between mixed fractions to ordinary fractions (figures 1, 2, 3). Understanding the relationship of mixed fractions that are changed to ordinary fractions is important in solving the problem. It can be stated that in this dimension there is no significant difference between female and male in the two categories of medium and high school. Then in the dimension of procedural knowledge, it can be seen in the results of their settlement using the criteria and the steps for solving fractions from mixed fractions are changed in ordinary fractions and the next step is to find the answers as expected. On this procedural dimension, the difference appears that female students from high schools are more systematic in their completion than students from medium schools. In the aspect of creating from the results of students' completion, they have not been seen yet, they have not been able to combine parts to form something new. For example, mixed fractions can be converted into ordinary fractions in other ways. As a result, the meta-cognition dimension does not show any new knowledge in students' self.

3.9 Evaluate Aspect of Female subject from Medium standard School

In the last indicator, the subject cannot do it because the work is not finished. Therefore. The HOTS ability of the students only reaches analysis and create, and even then the create indicator is not perfect because the final results have not been obtained.

3.10 Evaluate Aspect of Male Subject from Medium standard School

In the last indicator, the subject cannot do it because the work is not finished. Therefore. The HOTS ability of the students only reaches analysis and create, and even then the create indicator is not perfect because the final results have not been obtained.

3.11 Evaluate Aspect of Female subject from High standard School

From interview, the researchers asked how to evaluate the result and she said that she double check there might be an error or typo. The answer are corrected, seen and tested again, tested again its area, tested the results of multiplication and division again.

3.12 Comparison Cognitif Demention of Evaluate Aspect of Female and Male subject from Medium and High standard School

The dimensions of the factual knowledge dimension in the evaluation have not seen criticism from students in the form of basic elements that are known, for example in mixed fractions there are basic numbers, denominators and fractions of

pictures (1,2 and 3), this is due to the unfamiliarity of students building the habit of making criticisms productive of what is given. This happened to medium and high category students. Likewise with the conceptual knowledge dimension, there is no criticism related to the relationships between mixed fractions and ordinary fractions. Furthermore, on the dimension of procedural knowledge there is no critique of the criteria and steps for problem solving. As a result of the metacognitive dimension, there is no self-sensitivity in solving problems. All of these cognitive dimensions occur in both female and male students in both the medium and high school categories.

4 CONCLUSION

From the result of this research, it can be concluded some points that can be seen in table 2.

Indicators	The difference between subjects
Analyze	Female and male from medium standard school have similar ability with mentioning what is known and asked in the problem. on the other side, female from high standard School also have that ability but she can also give illustration from the problem by drawing a rectangle.
Create	The difference between female and male from medium standard school just lay on the ability of male to convert centimeters to meter, and female cannot. Both subjects are not able to divide decimal fraction. While female from high standard school succeed to divide decimal fraction by dividing the area of rectangle with the area of squares and finally got the final result of that problem. She is very well on solving the problem with giving the conclusion in her answer sheet.
Evaluate	Female and male from medium standard school did not complete the final answer so the subject was unable to evaluate their own answer since that both cannot divide decimal fraction. On the other side, From interview with female from high standard school, the researchers asked how to evaluate the result and she said that she double check there might be an error or typo. The answer is corrected, seen and tested again, tested again its area, tested the results of multiplication and division again.

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