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REPRESENTATION MATHEMATICS OF JUNIOR HIGH SCHOOL STUDENTS IN SOLVING TIMSS PROBLEMS IN TERMS OF GENDER

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Abstract

The purpose of this study was to find out and describe the process of student representation in solving TIMSS cognitive domain questions in terms of gender. This study used descriptive qualitative method. This research was conducted at the Karangploso Islamic Middle School in Malang in class VIII in the odd semester of the 2021/2022 academic year. Data collection techniques in this study used tests and interviews. The data analysis technique used consisted of three stages, namely data reduction, data presentation and conclusion. The results of this study indicate that students with male and female gender in carrying out the process of representing questions in the cognitive aware domain do not experience problems, even though there are slight problems with male students in solving questions, students can still improve them. The process of representing material in the cognitive domain by female students is better than that of male students. Male students experience confusion in determining the initial steps when working on questions. While the process of representing questions in the cognitive reasoning domain, female students are also better than male students, female students are able to answer questions in the form of inequalities models well, while male students make mistakes in making inequalities models.

Keywords: Gender; representation; TIMSS.

Abstrak

Tujuan penelitian ini untuk mengetahui dan mendeskripsikan proses representasi siswa dalam menyelesaikan soal domain kognitif TIMSS ditinjau dari jenis kelamin. Penelitian ini menggunakan metode deskriptif kualitatif. Penelitian ini dilaksanakan di SMP Islam Karangploso Malang pada kelas VIII semester ganjil tahun pelajaran 2021/2022. Teknik pengumpulan data dalam penelitian ini menggunakan tes dan wawancara. Teknik analisis data yang digunakan terdiri dari tiga tahap yaitu reduksi data, penyajian data dan penarikan kesimpulan. Hasil penelitian ini menunjukkan bahwa siswa dengan jenis kelamin laki-laki maupun perempuan dalam melakukan proses representasi soal domain kognitif knowing tidak mengalami masalah, walaupun ada sedikit masalah dengan siswa laki-laki dalam menyelesaikan soal, tetapi masih bisa diperbaiki oleh siswa. Proses representasi soal domain kognitif applying yang dilakukan siswa perempuan lebih baik dibandingkan dengan siswa laki-laki. Siswa laki-laki mengalami kebingungan dalam menentukan langkah awal saat mengerjakan soal. Sedangkan proses representasi soal domain kognitif reasoning, siswa perempuan juga lebih baik dibandingkan dengan siswa laki-laki, siswa perempuan mampu menjawab soal dalam bentuk model pertidaksamaan dengan baik, sedangkan siswa laki-laki melakukan kesalahan dalam membuat model pertidaksamaan.

***Kata kunci**: Jenis kelamin; representasi; TIMSS.*

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INTRODUCTION

Education has a very strategic role in the development of a country because the progress of a nation can be measured through progress in the field of education in that country (Nadia et al., 2017). The level of education of a country can reflect the progress of the country concerned (Widayanti & Kolbi, 2018). Education in Indonesia is still relatively low. This can be seen from the results of TIMSS in 2011, it was reported that Indonesia was ranked 38th out of 45 countries with an average score of 386, then in 2015 students' mathematics learning achievement in Indonesia was ranked 44th out of 49 countries (Sidauruk & Ratu, 2018; Widayanti & Kolbi, 2018).

TIMSS is organized by The International Association for the Evaluation of Educational Achievement (IEA), which is an independent international organization that collaborates with national research institutions and government agencies that have completed inter-country achievement studies since 1959 which is held every 4 years (Cahyatia & Kriswandani, 2017) TIMSS is a comprehensive international study to determine the achievement of fourth grade elementary school and eighth grade junior high school students in the fields of mathematics and science (Rizta et al., 2013; Witri et al., 2014).

TIMSS for mathematics has an assessment framework that is grouped into two sections (Sidauruk & Ratu, 2018; Witri et al., 2014) the first is related to mathematics which is divided into: 1) number, 2) geometry shapes and measurement, equations and functions (algebra) and 3) data display, while the second framework is related to cognitive dimensions or students' thinking processes, namely: 1) knowing, 2) applying, and 3) reasoning.

Representation is an attempt to describe an event, thought, and the situation in the form of symbols, words, pictures, or gestures so that information can be received properly or understood (Hutagaol, 2013; Syahid & Noviartati, 2019). Teachers can use representations to clarify students' mathematical ideas, to see students' mathematical thinking, and to help students translate mathematical ideas into other forms (Fennell & Rowan, 2015). Representation is very useful for students as a means of communicating ideas to other students and to the teacher (Sabirin, 2014). According to Zhe (2012) representation is not just a process of learning and teaching mathematics, but also as an instrument for students to understand mathematical knowledge and skills.

Gender is one identity that distinguishes humans. So far, gender differences have been touted as one that distinguishes human development, including cognitive development (Kurniasi, 2016). According to Slavin (Sandie et al., 2013) the gender of a student is a clear and lasting characteristic. Zhu (Rasyid et al., 2017) concluded that men and women have different preferences in using problem solving strategies. Male students excel, especially in receiving math material and do not easily forget the material being taught (Anggoro, 2016). Kartono (Kurniasi, 2016) states that women are generally more accurate and more detailed in paying attention to things than men.

In the 2011 TIMSS evaluation results for the category of content domains and cognitive domains for class VIII in Indonesia it is still in a position below the average, the

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percentage of Indonesian students who answered correctly based on the number content domain was 24%, algebra was 22%, geometry was 24%, data and a chance of 29%. The percentage of Indonesian students who answered correctly based on the cognitive domain at knowing 31%, applying 23%, and reasoning 17%

(Sidauruk & Ratu, 2018). Based on the results of the percentage of content domains, it can be concluded that for algebraic content domains it has a very low percentage, so the subjects of this study were class VIII students of Karangploso Islamic Middle School Malang. The selection was made with the consideration that class VIII is a student who has received algebra material and is the lowest domain content in TIMSS 2011.

Several studies have been conducted on TIMSS questions. Research on the analysis of the ability to solve mathematical problems in TIMSS questions has been carried out (Sidauruk & Ratu, 2018; Widayanti & Kolbi, 2018; Witri et al., 2014). Mathematical representation of students in cognitive visualizer-verbalizer style in solving TIMSS math problems has also been carried out (Syahid & Noviartati, 2019). However, studies on the analysis of the mathematical representation of junior high school students in solving TIMSS questions in terms of gender differences have not been carried out, so that in this study what distinguishes it from previous research is the representation of TIMSS questions in algebraic content based on the New cognitive domain, Behavior, and Reasoning and in terms of gender differences.

Based on the description above, the mathematical representation of male and female students in solving TIMSS questions is very interesting for researchers, so that it can provide opportunities for students to express or express in solving problems such as TIMSS. Based on the background above, the purpose of this study was to find out and describe the process of student representation in solving TIMSS cognitive domain questions in terms of gender.

METHOD

This study uses a qualitative approach. The data obtained from this study were in the form of TIMSS test results and interviews of the students studied. Therefore, the type of research used in this research is descriptive qualitative research.

This research was conducted at the Karangploso Islamic Middle School in Malang in the odd semester of the 2021/2022 academic year. The subjects in this study were of class VIII students, totaling 26 people. The subject selection technique applied was random sampling.

The stages in this research are preparation, implementation and data analysis. In the preparatory stage the researcher made observations at school, made TIMSS test instruments, and asked permission to conduct research. At the implementation stage, the researcher, distributed the TIMSS questions that had been prepared and conducted interviews with several students to find out the students' problem solving. At the data analysis stage, the researcher collects the data that has been obtained and selects important data to describe.

Data collection techniques in this study used tests and interviews. 1) Test. The test used in this study is a question adapted from TIMSS 2011 on the algebraic content of equations and

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functions which have the cognitive domains of Knowing, Applying, and Reasoning. This question is used to see the students' mathematical representation of Knowing, Applying, and Reasoning. 2) Interview. Interviews were conducted to obtain information from students as a clarification of the results of student work about the mathematical representation process in solving TIMSS questions.

Data analysis in this study used descriptive qualitative analysis, namely analyzing data in the form of written or oral data from the observed subject. The qualitative data analysis technique consists of three stages, namely data reduction, data presentation and conclusion drawing. Data reduction is carried out by researchers which leads to the process of selecting, summarizing and focusing on important data. Presentation of data is done by presenting the results of test and interview answers in the form of narrative text. The final step is drawing conclusions by comparing the results of students' answers and interviews, so that conclusions can be drawn about the students' mathematical representation process in solving TIMSS questions with the cognitive domains of Knowing, Applying, and Reasoning.

RESULTS AND DISCUSSION

1) Male Student

a) Cognitive domain Representation Process Knowing

Male students in the knowing cognitive domain representation process. The following is an explanation of the representation process carried out by student L in Figure 1. Based on the results of data analysis in Figure 1, it shows that male students are able to represent the knowing cognitive domain well and are able to answer the questions given correctly. In Figure 1, students carry out the elimination process well by eliminating the x variable, which has a smaller constant compared to the y variable. However, students experience a little confusion when equating the constants in variable x to be eliminated.

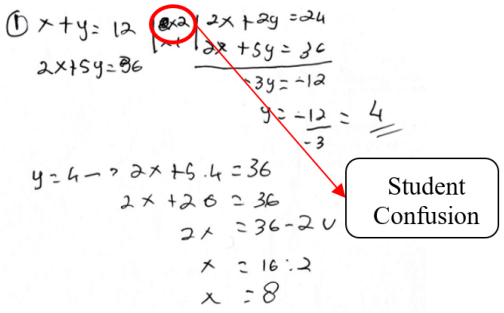

Figure. 1 Cognitive domain representation process knowing male students

Furthermore, to get a value of x students do substitution, the elimination and substitution methods are the fastest way to solve SPLDV, so that male students can understand this problem well, this is shown by students not making mistakes in the substitution method. These results were reinforced by the results of interviews with students who said that students understood the questions given because the teacher often gave examples of old questions. Then students said they were a little confused when determining how many times so that the constant variable x could be the same, but then they could do it.

b) Process of Representing the cognitive domain Applying

Meanwhile, the process of representing the cognitive domain of applying by male students is shown in Figure 2.

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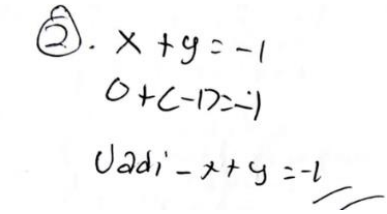

Figure. 2 Process of applying cognitive domain representation for male

Based on Figure. 2 male students did not do well on the cognitive domain questions Applying, students were asked to determine the equations of the points that were already known, but students did not understand in determining the initial steps when working on the questions. Seen in the picture. 2 male students did the cognitive domain questions Applying carelessly, such as just entering the point (0,-1) in the equation x + y = -1, and what is important for students is that there is an answer compared to not doing it at all. The results of the male students' answers were reinforced by interviews with students who said the students had forgotten the formula that had to be used to solve the problem, so they only did what they could.

c) Process of Representation of Cognitive Domain Reasoning

The process of representing the domain of cognitive reasoning by male students is shown in Figure 3.

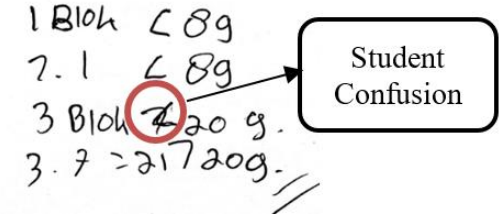

Figure. 3 Process of representation of cognitive domain reasoning for male students

In Figure 3 it can be seen that male students can generate ideas for this comparison question by representing the cognitive reasoning domain questions in an approximate form, but male students experience confusion when determining which 3 blocks are larger or smaller than 20 g, male students are still confused in determining the inequality sign, because they have not been able to distinguish which one is heavier, when determining in the form of a scale, so the answers given are not correct. This was reinforced by the results of interviews with students who said that students did not understand what was being asked from the questions and students had just gotten questions like this so they were a little confused in understanding the questions.

2) Female Student

a) Cognitive domain Representation Process Knowing

The process of representing the knowing cognitive domain carried out by female students in Figure 4.

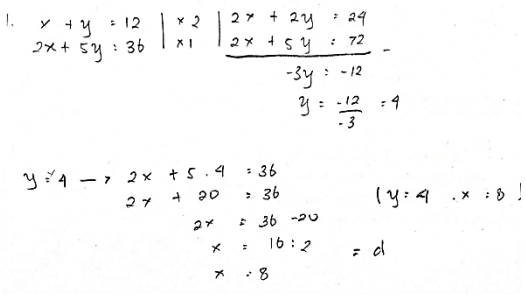

Figure. 4 Cognitive domain representation process knowing female students

Based on Figure. 4 shows that female students are able to represent the cognitive domain of Knowing properly and correctly like male students. In figure 4 the students carried out the elimination process well by eliminating

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the x variable, which has a smaller constant compared to the y variable. In contrast to male students, female students did not experience problems in making the elimination and substitution processes. Similar to male students, female students are also familiar with the SPLDV questions given by the teacher, so students have no difficulty getting questions like this. These results were reinforced by the results of interviews with students who said that students understood the steps that had to be done first for these questions because the teacher often gave questions like this. Teachers also use the substitution elimination method more often so that students also use this method.

b) Process of Representing the cognitive domain Applying

The process of applying cognitive domain representation by female students is shown in Figure 5.

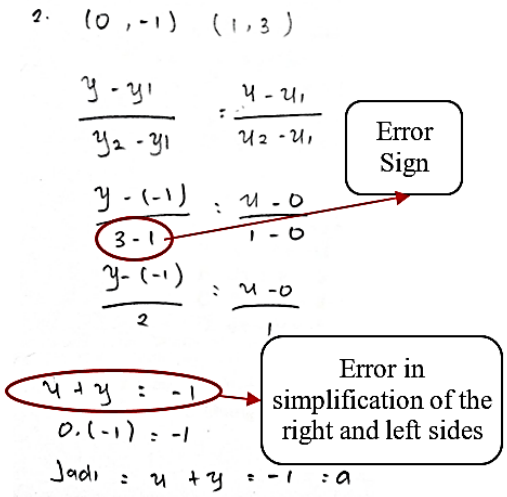

Figure. 5 Cognitive domain representation process applying for female students

Based on Figure 5, unlike male students, female students can generate ideas for this applying cognitive domain equation problem by representing the problem in the correct equation model. Female students can find the desired formula to get the equation in question. Students enter the known values in the problem into the formula correctly, but students make mistakes in operational signs (addition and subtraction), resulting in inaccurate equations. Students also experience difficulties in simplifying between the left side and the right side, to produce an equation. This is because students do not understand the basics of mathematics, such as; a positive sign if it meets a negative sign, and students do not understand the concept of how to simplify between the left and right sides. These results were reinforced by the results of interviews with students who said that students understood how to solve the problem but after doing it they did not get the similarities in the multiple choice answers so that students experienced confusion and did not continue.

c) Representation process of cognitive domain Reasoning

Then the process of representing the cognitive reasoning domain carried out by female students in Figure 6.

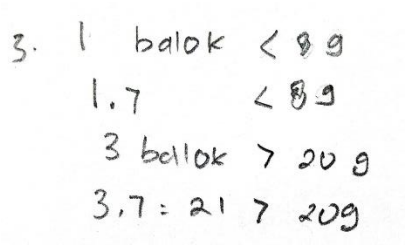

Figure. 6 Process of representing cognitive domain reasoning for female students

On the Figure 6 it can be seen that female students can generate ideas for cognitive reasoning domain questions by representing the problem in the

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correct inequality model. In contrast to male students, female students did well in the third model, namely by determining how many grams of 1 block weighed so they could compare which one was larger. But female students experience a little confusion in solving problems like this, the first steps to be taken, the formulas to be used, when determining in the form of scales, but the answers given are correct. This was reinforced by the results of interviews with students who said that students did not understand what was being asked from the questions because they had just gotten questions like this but students tried to work in the form of inequalities.

The results of the analysis of students' mathematical representation processes in solving TIMSS questions based on gender are as follows. Students with both male and female gender in carrying out the process of representing cognitive knowing domain questions did not experience problems, even though there were a few problems with male students in solving questions, students could still improve them. This is in line with research conducted by Saputri et al., (2018) the algebra performance of male students and female students has not too significant difference.

Then the process of representing cognitive domain questions applied by female students is better than that of male students. Male students experience confusion in determining the initial steps when working on problems, while female students already know the initial steps that must be taken in working on problems, but female students experience errors in the basic operations in mathematics, so male and female students have answers. which is not quite right.

While the process of representing cognitive reasoning domain questions, female students are also better than male students, female students are able to answer questions in the form of inequalities models well, while male students make mistakes in making inequalities models, resulting in inaccurate conclusions. This is in line with Kurniasi (2016) states that women are generally more accurate and more detailed in paying attention to things than men.

Overall, female students are better than male students in applying cognitive domains, cognitive reasoning domains for TIMSS 2011 questions. In line with this study Dagun (Kurniasi, 2016) argues that girls score higher in certain areas than boys. Female students were more likely to excel compared to male students (Sandie et al., 2013; Wang et al., 2013). This research is different from the research conducted by Pinanti (2014) which resulted in the conclusion that men are superior in mathematics than women.

CONCLUSIONS AND SUGGESTION

Based on the research and discussion above, it can be concluded that male and female students in the process of representing the cognitive domain knowing, applying cognitive domain, and cognitive reasoning domain, overall female students are better than male students. The male students experienced confusion in determining the initial steps when working on the questions, while the female students already knew the initial steps to be taken in working on the questions. Then the male students made mistakes in making the inequality model, while the female students were able to answer questions in the form of an inequality model well.

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Based on the results of this study, suggestions for further research are mathematical representations in solving TIMSS questions in terms of students' cognitive styles or abilities.

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