
ANALYSIS OF JUNIOR HIGH SCHOOL STUDENTS' MATHEMATICAL CREATIVE THINKING ABILITY REVIEWED BY GENDER

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ABSTRACT

This research is motivated by the importance of creative mathematical thinking skills for students studying mathematics. This study aims to analyze students' mathematical creative thinking skills in terms of gender. This study used a qualitative descriptive method. The population in this study was 20 grade IX students of SMP Negeri 2 Cimahi who were used as a sample, consisting of 10 male students and 10 female students who were randomly selected. The instrument used in this study is to provide four mathematical creative thinking questions consisting of indicators of fluency, flexibility, originality, and elaboration. The data in this study were analyzed using the value of the percentage of students who had done mathematical creative thinking problems that had been given and then compared based on gender. The results of the research that has been conducted revealed that overall, the ability of female students to think creatively mathematically is valued higher than the ability of male students to think creatively mathematically. This can be seen in terms of the proportion of overall value or certain aspects. Regarding fluency, male students score higher than female students, while female students score higher on flexibility, originality, and elaboration. It can be concluded that gender can affect students' ability to creative mathematical thinking skills.

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INTRODUCTION

Creative thinking is an important mathematical ability that students must possess and develop. Mathematical creative thinking is contained in the curriculum and learning objectives of mathematics (KTSP, 2006; Mathematics Curriculum, 2013), by the vision of mathematics,

namely, to train logical, systematic, critical, creative, careful, and objective thinking, openness to solve everyday problems, and face a rapidly changing future. Thinking creatively in mathematics is one of the important skills for students to deal with increasingly advanced scientific and technological developments as well as increasingly real challenges, demands, and global competition (Hendriana et al., 2017).

The ability to think creatively belongs to the ability to think at a high level or High Order Thinking Skills (HOTS). HOTS is the goal of the 2013 curriculum that students must achieve (Gais & Afriansyah, 2017). This is because creative thinking in different areas, such as mathematics, plays an important role. According to Rusman (2011), "Creative thinking is a way of learning that requires teachers to be able to encourage and demonstrate student creativity when learning using different methods and strategies, such as in groups, role-playing and problem-solving". When studying mathematics, students must understand the interrelationships between mathematical ideas and other fields of study (Rahayu & Afriansyah, 2015).

Students' mathematical creative thinking ability, which is still lacking, is affected by several existing factors, including the teaching and learning process, which is still lacking, as well as the readiness factor of students. Student psychology is included in the readiness factors of students for learning. Gender differences among students can also cause differences in student-learning psychology. Therefore, there is no doubt that there are differences in mathematics learning between male and female students. Gender is a set of interrelated characteristics in which individuals of different sexes acquire different identities and social roles. This gender difference makes people always ask whether their way of thinking will differ according to gender (Astra et al., 2022).

According to Fardah (2012), girls tend to take more complete and extended dictation notes while studying than boys do, but these notes are less critical. There are differences between women and men in their attitudes to learning; for instance, females use a higher number of educational strategies than males. Even though there is no fundamental difference in the abilities of men and women, the difference is in behavior. These behavioral differences manifest in the application of learning strategies (MZ, 2013). Based on the results of research that has been conducted (Dilla et al., 2018) there is a difference in gender and resilience of 86.6% which affects the ability to think creatively mathematically, and 13.4% by other factors.

In their research (Abidin et al., 2018) used four indicators to categorize creative thinking abilities: fluency, flexibility, originality, and elaboration. Creative thinking, according to these views, is a mental activity associated with sensitivity and difficulties, open reflection of new things and novel ideas through an open mind, and involvement in solving the problem. By the results of this presentation, the ability to think creatively and mathematically is an important ability that needs to be developed and possessed by students. Gender differences can also affect students' ability to think creatively and mathematically. Therefore, it is necessary to examine more deeply related to how students' mathematical creative thinking abilities are viewed from a gender perspective, and the purpose of this research is to analyze students' mathematical creative thinking abilities viewed based on gender.

METHOD

The method used in this research is descriptive qualitative. Descriptive research is a study that aims to gather information on the current state of affairs, particularly at the point in time when it was carried out (Nugraha & Pujiastuti, 2019). This research was conducted to analyze and show the ability to think creatively mathematically in terms of gender. The ability to think creatively mathematically to be examined to apply four indicators to categorize creative thinking skills, namely: fluency, flexibility, originality, and elaboration. The subjects in this study were 20 students consisting of 10 male students in class IX and 10 female students in

class IX at SMPN 2 Cimahi. This study uses a mathematical creative thinking ability test instrument. The story problem test used in this study was designed to assess students' mathematical creative thinking skills based on gender.

Table 1. Creative Thinking Ability Assessment Rubric

Measured aspects	Student response to the problem	Score
Fluency	Does not present answers or provide related ideas.	0
	Present unrelated ideas to solve problems.	1
	Present a related idea but the answer given is wrong.	2
	Present more than one related idea, but the answer is still incorrect.	3
	Present more than one related idea and the solution provided is true and clear.	4
Flexibility	Not answering or presenting answers in one or more ways, all that is presented incorrectly.	0
	Answer one way but answer wrong.	1
	Answering in one way, the calculation process as well as the results are correct.	2
	Answering more than one way (different) but in the given results there is an error because there is an error in the calculation process.	3
	Answering in one way (different), the calculation process and the results are correct.	4
Originality	Not answering or giving the wrong answer	0
	Answered in his way but could not be understood.	1
	Answering in its own way, the calculation process is directed but not complete.	2

	They answer on their own terms, but the calculation process makes errors and hence the results presented are incorrect.	3
	Answering in your way, the calculation process and the results are correct.	4
	Does not answer and gives the wrong answer	0
	There is an error in the answer and no information is given	1
Elaboration	There is an error in the answer but a lack of detail in the information provided	2
	There is an error in the answer, but the information provided is detail	3
	Present answers correctly and in detail	4

Source: Bosch (Ismaimuza, 2013)

Table 2. Criteria for Mathematical Creative Thinking Ability

Percentage (%)	Criteria
68-100	Creative
33-67	Quite Creative
0-33	Less Creative

Source: (Putra et al., 2018)

RESULTS AND DISCUSSION

Results

Based on the results of the tests that have been given, it can be seen in Table 3 summarizes the data obtained based on the results of the mathematical creativity tests that have been carried out on 10 men and 10 women as measured by indicators related to mathematical creative thinking abilities and gender differences.

Table 3. Percentage of Mathematical Creative Thinking Ability Scores of Male and Female Students

No	Aspects	Percentage of male value	Percentage of Women's Value
1	Fluency	87,5%	77,5%
2	Flexibility	62,5%	67,5%
3	Originality	57,5%	62,5%
4	Elaboration	47,5%	52,5%
	Total	63,7%	65%

Results obtained from $Persentase = \frac{\text{jumlah tiap butir soal}}{\text{jumlah keseluruhan}} \times 100\%$

The following are students' answers according to the indicators of creative thinking ability:

1). a. # Persamaannya
 - sama-sama berpangkat 2 (kuadrat)
 - semua persamaan berbentuk $= 0$
 * Perbedaannya
 - Tanda negatif dan positifnya berbeda
 - ada yg memiliki nilai x atau yang tidak
 b. Disebut persamaan kuadrat karena pangkat semua persamaan tersebut bernilai 2

Figure 1. Male students' answers on the fluency

Figure 1 shows that one of the male students answered the fluency indicator question in a slightly different manner or gave more than one correct and precise answer when answering it. It can be seen that the male student in answering the question is able to develop his ideas so that he can provide several alternative answers and give the right answer, in accordance with the indicators measured in fluency is expected to be able to provide answers with several.

<input checked="" type="checkbox"/>	1. a. Sama-sama memiliki memiliki nilai x^2 , # no 1 dan 2 sama-sama tidak memiliki nilai bx .
<input type="checkbox"/>	
<input type="checkbox"/>	b. Karena pangkat tertinggi x -nya adalah 2.

Figure 2. Female students' answers on the fluency

Figure 2 shows one of the answers of female students to the fluency indicator question, seen in answering the question female students tend to answer only with a single answer. In answering the question, the female student did not give an answer with several alternatives, which means that the female student did not develop her ideas, but the answers given were correct but less clear.

a). a. $x = y = 9$
 $x \times y = 60$
 $x \times x - y - 60 = 0$
 b. Umur Aeng = 10 tahun bulan akan persamaan kuadrat

Figure 3. Male students' answers on the flexibility

Figure 3 shows one of the answers of male students on the flexibility indicator question, it can be seen that answering the question only produces answers in one way or does not vary, and in the calculation process is unclear and the answers given are wrong. In answering these questions, male students tend not to develop their ideas in answering the questions given so that the students have not been able to answer these problems with various answers.

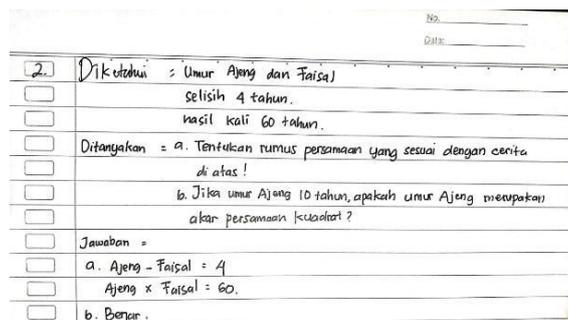


Figure 4. Female students' answers on the flexibility

Figure 4 shows one of the female students answers to the flexibility indicator question can be seen that she actually solved it in a single way but did not seem clear during the calculation procedure, and this is consistent with the results obtained. It appeared that the female student in her answer did not develop an ideas for solving problems and had been unable to present any answers which differed with a clear calculation method.

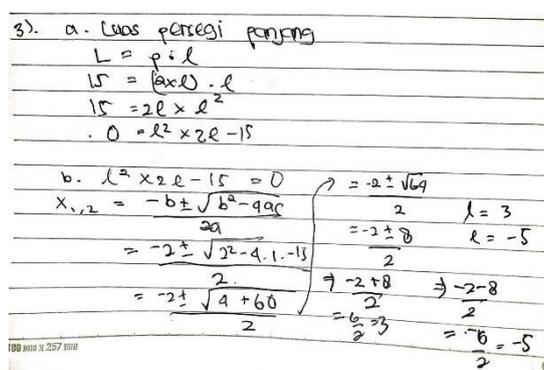


Figure 5. Male students' answers on the originality

Figure 5 shows that, in the calculation process, the answer given by one of the male students to the problem of the originality indicator, which the student solved in his own way, can be understood, but the answer given is still unclear. In answering the question, the male student has been good at developing his ideas by giving answers in his own way, but in the calculation process it looks still unclear.

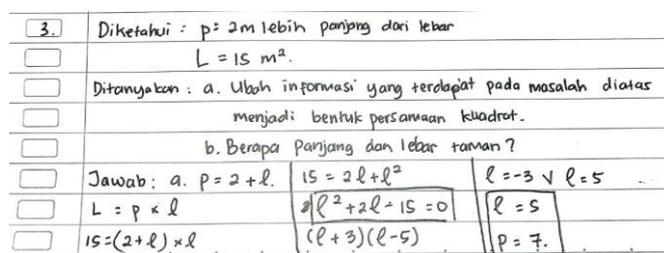


Figure 6. Female students' answers on the originality

Figure 6 shows one of the female students' answers to the originality problem seen in solving the student's problem using their own method or way, it can be seen in the answer that students are able to change information in the form of stories can be converted into mathematical form, and the calculation process is understandable and the information provided is clear. This is because a female student can come up with her own ideas on how to deal with the problem when she answers it.

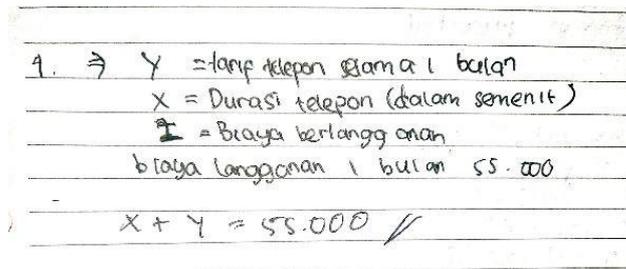


Figure 7. Male students' answers on the elaboration

Figure 7 shows one of the male students' answers to the elaboration indicator problem, seen in solving the problem the student gave an answer that was unclear and of inaccurate value. That means the student is not able to solve the problem clearly and in detail. In this case, the student does not develop his idea to solve the problem so that the student is only able to answer the question with unclear and undetailed answers.

<input type="checkbox"/>	4.	Diketahui : Tarif telpon rumah
<input type="checkbox"/>		dirumuskan dengan durasi telpon (dalam menit)
<input type="checkbox"/>		Tarif telepon senilai dengan 250 lebihnya dari durasi telpon
<input type="checkbox"/>		Y = tarif telepon selama satu bulan.
<input type="checkbox"/>		X = durasi telepon (dalam menit)
<input type="checkbox"/>		Z = biaya berlangganan.
<input type="checkbox"/>		Biaya langganan satu bulan Rp.55.000.
<input type="checkbox"/>		Ditanyakan = Persamaan tarif telpon rumah yang dibayarkan oleh pelanggan
<input type="checkbox"/>		selama satu bulan dalam rupiah.

Figure 8. Female students' answers on the elaboration

Figure 8 shows the answer of one of the female students to the elaboration indicator question, seen in solving the problem the student provides detailed and detailed information, but the answer given is still unclear. This means that the female student has been able to process the problem information in detail but does not understand the calculation process, so the answer given is less clear.

Discussions

Based on data analysis, it was apparent that gender has a role to play in students' mathematical creative thinking ability which is derived from the percentage value according to an indikator or view as a whole. Therefore, it can be seen that the mathematical creative thinking ability of female students is generally higher than that of male students. The results of student answers that will be analyzed using the creative thinking skills indikator will be explained below.

Figure 1 shows that male students provided more than one relevant idea and clear answers. Based on the fluency indikator, the percentage value of male students is 87.5%, which shows that male students have a higher value than female students. Furthermore, Figure 2 shows that female students in solving the problem only provide one relevant idea. In the fluency indikator, female students have a percentage value of 77.5%, it shows that in the fluency indikator female students are lower than male students. In line with creating Potur and Barkul (2009) research states there is no difference in the creativity of male students with female students and male students are more likely to be creative in discussing, building, trying new ideas in the real world, while women also tend to be creative in discussing, designing, and creating.

It can also be seen in Figure 3 that male students solve problems in only one way but the process and results are not correct. In the flexibility indikator, the percentage value of male students is

62.5%, indicating that in the flexibility indicator male students are lower than female students. It can also be seen in Figure 4 that female students solve problems in one way but with the right process and results. In the flexibility indicator, the percentage of female students' scores is 67.5%, which shows that female students are higher than male students in the flexibility indicator. In line with that, research conducted by Dilla et al. (2018) found that female students were relatively better at solving mathematical creative thinking ability problems than male students. In several studies, experts said that they believe that the effect of gender on mathematical creative thinking ability is due to biological differences in the brains of male students and female students.

Figure 5 shows that male students solve the problem in their own way, the calculation process can be understood but the information is not clear. In the originality indicator, the percentage of male students' scores is 57.5%, which shows that in the originality indicator, male students are lower than female students. Figure 6 shows that female students solve the problem using their own method, the calculation process is understandable and the information provided is clear. In the originality indicator, the percentage of female students' scores is 62.5%, which means that in the originality indicator, female students are superior to male students. In line with Purwanti (2016) in her research states that there are differences that are quite visible in mathematics, the creative thinking ability of female students is higher than male students in class VIII, especially in practice problems. Likewise, the results of research Arifin & Bharata (2017) found that male and female students can pass the stages of mathematical creative thinking, but male students generally do not write what they do not understand or write reviews, but can write what they understand, for female students can write what they understand and provide their assessment.

Figure 7 shows that male students in solving problems provide answers that are not clear and do not elaborate. In the elaboration indicator, the percentage of male students is 47.5%, which means that male students in the elaboration indicator are still low compared to female students and male students are still unable to think in detail. And also in Figure 8 shows that female students in solving problems provide detailed answers but the answers given are still unclear. In the elaboration indicator, the percentage of female students is 52.5%, it shows that female students in the elaboration indicator are better than male students. As in line with research conducted by Ülger (2016), reported that female students have higher creative thinking skills than male students in writing and arithmetic.

After going through the process of analyzing the data obtained, that there is an influence of gender factors on the mathematical creative thinking ability of junior high school students. Female students look better than male students. Based on the results of the data analysis obtained, it shows that male students are superior in the fluency aspect, while female students are superior in the aspects of flexibility, originality and elaboration.

CONCLUSION

Based on the results of the research and data analysis, it can be concluded that gender influences the mathematical creative thinking abilities of junior high school students. Female students appear superior in terms of flexibility, originality, and elaboration. Meanwhile, male students appeared to be superior only in the fluency indicator. Therefore, overall, female students are superior in their mathematical creative thinking abilities compared to male students.

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