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THE EFFECT OF DISCURSIVE AND GENDER APPROACHES ON THE CRITICAL THINKING SKILLS MATHEMATIC AND SELF-CONCEPT STUDENTS

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ABSTRACT

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The purpose of this study is to determine the effect of discursive and gender approaches to the critical thinking skills of mathematics and self-concept students. This research is a quasi-experiment research with factorial design 2x2. The sample of research is 126 students of class IX SMP from two different schools. The results of this study are the critical mathematical thinking skills that are treated with discursive approaches are better than those treated with conventional approaches. Male students are better suited to using conventional approach learning whereas female students are better suited to using discursive approach to improve the critical thinking ability of mathematics and student self-concept. This is because the discursive approach emphasizes mathematical activity, reflection on mathematical activity, and debate/discussion on mathematical activity. It is in accordance with the characteristics of women who are able to muffle their emotions through discussion and have better verbal skills than male students.

Keywords: discursive approach, mathematical critical thinking skills, self-concept, gender

Introduction

The teaching method of the teacher greatly determines the success of students and learning objectives. Learning objectives will be achieved if students easily understand the material presented by the teacher. Among the objectives of education are academic development, vocational development, personal development and social development (Lin, 2018). In accordance with the (Bellová et al., 2018) capability standards the process standards include problem solving, mathematical reasoning and proof, mathematical connections, mathematical communication, and mathematical representations.

The ability of Indonesian students is still at the stage of remembering and understanding. Meanwhile, the ability to solve mathematical problems that are non-routine in nature which requires strategies, analyzes, and generalizes the relationship between mathematical concepts of Indonesian students is still not sufficient enough and has not shown satisfactory achievement. The survey results of The Third International Mathematics and Science Study (TIMSS) (Yurdakul et al., 2020) where Indonesian students were only able to rank 38 out of 42 countries, with an achievement of a score of 386 and still below the international average score of 500. The Program for International Student Assessment (PISA), for the mathematics literacy of 15 year old students, ranks 64th out of 65 participating countries with a score of 375 far below the PISA international average of 500 (Wang et al., 2019).

The ability of students to determine the strategy to be used and to analyze a problem aimed at making the right decisions is called critical thinking. Critical thinking skills are students' abilities to identify and justify a mathematical concept that will be used in problem solving, generalize, analyze algorithms, and be able to solve mathematical problems (Bliss, 2019; Colthorpe & Bugarcic, 2015; Seah & Beencke, 2019). (Tajudin & Chinnappan, 2016; TIMSS, 2015) critical thinking is in the domain of reasoning which includes the ability to measure students' ability to solve non-routine problems with context and use complex steps to solve them.

In addition to mathematical critical thinking skills, there are affective abilities that must also be considered in the teaching and learning process, namely: self-concept as an aspect of psychology. Self-concept is a person's perspective on himself, seeing his strengths and weaknesses, included in behavior (Brown et al., 2019; Tas et al., 2019). Views about oneself include physical, social, emotional, a person's achievements, and in relation to other people and their environment. Interaction with the environment will get both positive and negative experiences. So that the interactions that take place during classroom learning can change students' self-concept.

Teachers are required to provide a conducive and interesting learning atmosphere. One alternative is to apply a discursive learning approach. An approach that includes mathematical activities, reflection and discussion (Erjavec & Poler Kovačič, 2009; Kieran, C., Forman, E., & Sfard & Publishers, 2001). The discursive approach provides an environment for developing mathematical abilities and provides opportunities for students to carry out mathematical activities, such as asking questions, listening to other people's ideas, writing, and interact in various directions to gain understanding of mathematics. These activities are carried out by students in solving problem solving (Krizsan & Lombardo, 2013).

Gender differences can affect students' mathematical critical thinking skills and self-concept. Men and women have unique and different thinking abilities, which really depends on the experience of each individual. Where male students tend to use language skills on the left brain or use the right brain in spatial skills, spatial, mathematics (Cheema, 2019; Usman et al., 2020).

Finally, from these problems in a study that aims to determine the effect of discursive and gender approaches on the mathematical and self-concept critical thinking skills of junior high school students.

Materials and Methods

This research is a quantitative study using a quasi experiment with treatment design by level 2×2 . The sample in this study were junior high school students, namely: 61 male students consisting of 29 experimental class students and 32 control class students and 65 female students consisting of 33 experimental class students and 32 control class students. The data collection technique uses a mathematical critical thinking skills test instrument that has been validated by experts and empirically has a reliability of 0.418. The student's self-concept instrument with a Likert scale has a reliability of 0.879.

Research Procedure

The discursive approach can develop mathematical critical thinking skills by implementing steps in the classroom as follows:

1. The teacher monitors the activeness of students during the discussion, as a facilitator the teacher often asks several questions, provides criticism and information that aims to direct students to the expected answers.
2. At this stage the teacher expects students to be able to solve the problems presented to explore the critical thinking skills of each student.
3. Students are given problems related to the congruence and congruence of flat shapes to be able to analyze problems.
4. Students write down anything related to the problems given. At this stage students use their logical thinking skills to find something that is in the problem.
5. Students make questions to make it easier to determine the strategies used to solve these math problems with the group. Students discuss solving the problems given.
6. After all groups solve the problems given by the teacher. The teacher randomly appoints several groups to present the results of the discussion in front of the class.
7. Before the teacher checks the correctness of the results, other students provide responses or questions to students who make presentations. This stage occurs interactions between students not only in groups but between students in the class.
8. Furthermore, the teacher together with the students draw conclusions from these math problems.

Results and Discussion

The average mathematical critical thinking skills of students who were given discursive approach learning was 7.026 and students who were given conventional approach learning were 6.22. Whereas the average self-concept of students who were given discursive approach learning was 98.24 and students who were given conventional approach learning were 93.62. This shows that the mathematical critical thinking skills of students who receive discursive approach learning are higher than students learning conventional approaches. The self-concept of students who received discursive approach learning was higher than students learning conventional approaches.

Table 1. Average students' mathematical critical thinking skills and self-concept

	Critical Thinking Skills		Self-concept	
	Discursive	Conventional	Discursive	Conventional
M	6,34	6,28	94,28	93,72
F	7,71	6,16	101,73	93,53

The results showed that the average mathematical critical thinking skills of male students who received conventional approach learning (6.28) was lower than the discursive approach learning (6.34). Meanwhile, the group of female students who

received discursive approach learning (7.71) was higher than the conventional approach learning (6.22). Likewise, the average self-concept result of male students who received conventional approach learning (93.72) was lower than learning discursive approaches (94.28). Meanwhile, the group of female students who received discursive approach learning (101.7) was higher than conventional learning approaches (93.53).

Table 2 Mathematical Critical Thinking Skills

Main effect	Sig.
Approach	
Discursive \geq Conventional	0,016
Gender	
Male and Female	0,023
Interaction	
Approach * Gender	0,027

The result of the analysis of the influence of the main factors of the learning approach shows sig. = 0.016, which means that there is a difference in the critical thinking skills in mathematics between the discursive approach and the conventional approach. Furthermore, the influence of the interaction approach *Gender sig. = 0.027, then there is an interaction effect between the learning approach and gender on the mathematical critical thinking skills. The male student group is more suitable to use the conventional approach, while the female group is more suitable to use the discursive approach.

The results of the simple effect test with the t-test are to test (1) the mathematical critical thinking skills of male students with a lower discursive approach than the conventional approach, and (2) the mathematical critical thinking skills of female students with a higher discursive approach than conventional approaches.

Table 3. Mathematical critical thinking skills

Simple effect	Sig.
Male	
Discursive \leq Conventional	0,730 > 0,025
Female	
Discursive \geq Conventional	0,001 < 0,025

The results of the analysis showed that the difference in the mathematical critical thinking skills of the male group was obtained Sig. (2-tailed) = $0.730 / 2 = 0.365 < 0.025$. Because the sig. $> \alpha$, then H0 is accepted, which means that there is no difference in the mathematical critical thinking skills of male students through a discursive approach with the group of students who received a conventional approach. The value of Sig. (2-tailed) 0.0005 shows that there are differences in the mathematical critical thinking skills of female students through a discursive approach with the group of students who received a conventional approach. This can be seen in Table 1 showing that on average there is a significant difference. So it can be concluded that there are differences in the mathematical critical thinking skills of

female students between those who received discursive mathematics learning and those who received conventional learning approaches.

Table 4. Student self-concept

Main effect	Sig.
Approach	
Discursive \geq Conventional	0,012
Interaction	
Approach *Gender	0,028

The results of the analysis of the influence of the main factors of the learning approach on the self-concept that sig = 0.012 and the mean score of the group of students who received the discursive approach was 97.90, while the average score of the group of students who received the conventional approach was 93.73. So it can be concluded that the students' self-concept among the groups of students who received the discursive approach was higher than the group of students who received the conventional approach.

The results of the analysis of the influence of the interaction of the learning approach and gender on self-concept obtained a sig. = 0.028. This shows that there is a significant influence of the learning approach on mathematical self-concept depending on gender. This means that the male student group is more suitable for learning mathematics using a conventional approach, while for the female group it is more suitable to use a discursive approach to learning.

Table 5. Student self-concept

Simple effect	Sig.
Male	
Discursive \geq Conventional	0,907 < 0,025
Female	
Discursive \leq Conventional	0,002 > 0,025

The results of the simple effect test analysis showed that the differences in the self-concept of the male group were Sig. (2-tailed) = $0.907 / 2 = 0.4535 > 0.025$. Because the sig. $> \alpha$ then H_0 is accepted, which means there is no difference in the average self-concept of male students who received a discursive approach with the group of students who received a conventional approach.

The results of the simple effect test analysis showed that the differences in the self-concept of the women's group obtained a Sig. (2-tailed) value of 0.0005. The result of the average self-concept score of the female students who got discursive was 101.7, while the self-concept score of students who received the conventional approach was 93.53. This shows that the self-concept of the female student group who received a higher discursive approach than the conventional approach.

The discursive learning approach can develop mathematical critical thinking skills because the discursive approach provides opportunities for students to carry out mathematical activities, reflect on mathematical activities carried out, discuss mathematical activities carried out. This is in accordance with the opinion of (Shaw,

2014; Vijayaratnam, 2012) states that students become creators in the learning process, students are more independent, more able to express his opinion, more got their own learning experience, can develop the knowledge they have to train their ability to think creatively, critically, systematically, logical in solving a problem, especially in solving mathematical problem¹.

The teacher as a facilitator directs students to be able to solve the problems presented to explore students' critical thinking skills. Students use their thinking skills logically to find something that is in the problem. The application of the discursive approach supports students to develop mathematical critical thinking skills. This can be seen when students make questions before solving the mathematical problems presented, This is one of the characteristics of critical thinking skills, namely identifying and justifying concepts. So, students are more critical of a problem. Students determine the strategies used in problem solving, and provide statements in the discuss⁴⁰, or provide rebuttals in logical language.

The effect of the interaction between the learning approach and gender on mathematical critical thinking skills, shows that groups of female students are more suited to using a discursive approach, whereas for the male group it is more suitable to use the conventional approach. This happens because the discursive approach provides mathematical problems to be analyzed which require accuracy, prowess, activeness in conducting group discussions and class discussions, this can be done well by female students because female students are more active, better able to reduce emotions when in group discussions, and able to communicate well. Meanwhile, male students are more suitable to use the conventional approach because the teacher is dominant¹⁵. This agrees with (Ackermann & Siegfried, 2019; Opolot-Okurut, 2010) showing that there are differences in learning styles between male and female students, if women prefer convergent learning styles where this learning style uses abstract conceptualization, do experimentation actively, and prefer interacting learning. Meanwhile, male students' learning styles prefer assimilator learning styles that dominate abstract conceptualization, listen, observations of reflection and think what is seen.

Female students are more experimental and able to interact well. Whereas the conventional approach provides facilities for male students to always study the material according to what is given by the teacher. Male students feel confident with the practice questions given by the teacher with a conventional approach, because in conventional learning students are not required to directly convey their ideas or opinions regarding the problems given. In addition, conventional learning approaches are not required to make presentations. Unlike the discursive approach which has the characteristics to identify problems, hold a discussion debate presenting the results of the discussion. Female students are more enthusiastic, more motivated to do these activities. Accuracy in using learning approach that is tailored to the advantages of each gender and the abilities of male and female students are needed in the conceptual understanding of mathematics which is used to spur students' mathematical critical thinking skills..¹

The ability of self-accept from the results of observations and interviews with students shows that both male and female students look enthusiastic in learning, looks more active. They are more active in asking questions or answering questions. In learning, students are more enthusiastic and have a positive influence or experience.

Students in group study can be more unselfish and respect their friends' opinions in making decisions. With the application of an innovative approach, students who initially have low abilities and also lack confidence, unsure of her abilities to get better and expecting herself to behave as she did now. (Clausen & Andersson, 2019; Ibrahim & Widodo, 2020) said that the use of a learning approach is more effective in improving students' self-concept in mathematics compared to the application of conventional approaches. (Sever et al., 2019; TURHAN, 2017) state that the learning process that students like is the basis for developing positive self-concepts. If the self-concept is negative, it can affect student achievement.

CONCLUSION

Mathematical critical thinking skills are better at using discursive approach learning than learning using conventional approaches. Male students are more suitable to use conventional learning approaches to develop students' mathematical critical thinking skills and self-concept, while female students are more suitable to use discursive learning approaches to develop students' mathematical critical thinking skills and self-concept.

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