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Students' Mathematical Connection Ability in Solving Circle Problems Based on Gender and Learning Motivation Perspectives

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Abstract: This study aims to determine the relationship between gender and student learning motivation on students' mathematical connection abilities in solving problems on circle material. Mixed method research design applied in this study. The subjects of this study were 34 class VIII students of SMPN 1 Bengkulu City. The sampling technique was carried out by purposive random sampling. Data collection techniques used mathematical connection ability test questions, learning motivation questionnaires, and interviews. The chi-square test does hypothesis testing. The results showed: (1) there was no significant relationship between gender and students' mathematical connection abilities, (2) a significant relationship between learning motivation and students' mathematical connection abilities with a correlation index in the medium category. The results of this study also show that male students with high learning motivation have high mathematical connection abilities on all indicators. In contrast, female students with high learning motivation have higher mathematical connection abilities when connecting mathematical concepts.

Keywords: mathematical connection ability, learning motivation, mixed method research.

Abstrak: *Penelitian ini bertujuan untuk mengetahui hubungan antara jenis kelamin dan motivasi belajar siswa terhadap kemampuan koneksi matematis siswa dalam menyelesaikan soal pada materi lingkaran. Jenis penelitian ini adalah penelitian campuran. Subjek penelitian ini yaitu 34 orang siswa kelas VIII SMPN 1 Kota Bengkulu. Teknik pengambilan sampel dilakukan secara purposive random sampling. Teknik pengumpulan data menggunakan soal tes kemampuan koneksi matematis, angket motivasi belajar, dan wawancara. Pengujian hipotesis dilakukan dengan uji chi-square. Hasil penelitian menunjukkan bahwa (1) tidak terdapat hubungan yang signifikan antara jenis kelamin terhadap kemampuan koneksi matematis, (2) terdapat hubungan yang signifikan antara motivasi belajar terhadap kemampuan koneksi matematis siswa dengan indeks korelasi pada kategori sedang. Hasil Penelitian ini juga menunjukkan siswa laki-laki dengan motivasi belajar tinggi memiliki kemampuan koneksi matematis yang tergolong tinggi pada semua indikator sedangkan pada siswa perempuan dengan motivasi belajar tinggi memiliki kemampuan koneksi matematis lebih tinggi pada indikator menghubungkan antarkonsep matematika*

Kata kunci: *kemampuan koneksi matematis, motivasi belajar, penelitian metode campuran.*

▪ INTRODUCTION

Mathematics is a basic science every human must possess because all aspects of life cannot be separated from mathematics. However, many students prefer to avoid mathematics and think it is difficult and scary (Ulya & Irawati, 2016). Even though mathematics is one of the important lessons that must be applied in schools, starting from elementary school to the tertiary level. As a basic science, mathematics plays an important role in the development of science and technology in the modern era, even many other sciences whose discoveries and developments depend on mathematics. (Munahefi et al., 2021). Based on this statement shows how important mathematics is.

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The results of an international survey in mathematics at the Program for International Student Assessment (PISA) 2018 show that Indonesia is ranked seventh lowest out of 79 countries, with an average score of 379 from the average score of the Organization for Economic Cooperation and Development (OECD), which is 487 (OECD, 2019). Meanwhile, in the results of the 2015 Trends in International Mathematics and Science Study (TIMSS) assessment, Indonesia obtained a score of 397 in mathematics with an international average score of 500 so that Indonesia was ranked 44th out of 49 countries (Mullis, Martin, Foy, & Hooper, 2016). Based on these data, it can be seen that the math skills of Indonesian students are still relatively low.

In essence, mathematics is a science that is structured and interrelated between one topic and another (Romli, 2016). As interrelated sciences, students must have sufficient basic mathematical abilities. National Council of Teachers of Mathematics (NCTM) states that one of the mathematical abilities that students must have in order to be able to relate between mathematical concepts is the ability to make mathematical connections (NCTM, 2000; Kleden et al., 2021). Mathematical connection is a person's ability to connect between concepts in mathematics itself and with other fields and its application in everyday life (Kenedy, et all, 2019; Sarkam et al., 2019; Puwanti et al., 2021). As for Indicators, the mathematical connection is connecting between mathematical concepts, connecting mathematical concepts with everyday life, and connecting mathematical concepts with other fields of science.

A student can be said to have good mathematical connection skills if the indicators of mathematical connection abilities can be achieved well. Therefore, every student must build and learn mathematical connections because good mathematical connection skills will help students know the relationships of various mathematical concepts and apply mathematics in everyday life. With a mathematical connection, students will also understand that mathematics is a unified whole and integrated with real life so that learning mathematics becomes more meaningful than before.

However, some previous research results show that the mathematical connection ability of junior high school students is still relatively low, especially on the indicator of connecting mathematics with everyday life and connecting mathematics with other fields of study (Nugraha, 2018; Zuyyina et al., 2018). The math connection ability is still low is also supported by facts in the field that the researchers found based on observations and interviews with one of the mathematics teachers during the Apprenticeship at school (PLP) activities at SMPN 1 Bengkulu City that most students were able to solve problems that had links between mathematical concepts. Nevertheless, on questions related to everyday life, many students still need help to solve them. The proven that when the teacher asks students to work on questions related to everyday life during learning, they still need clarification about where to start because they need to understand the problem properly if the teacher still needs to direct it. It shows that students' mathematical connection ability still needs to improve.

The low ability of mathematical connections will affect student learning outcomes because, in essence, mathematical connections play a role in improving student learning outcomes (Utami & Effendi, 2019). If student learning outcomes are low, students' mathematical connection abilities are also low. Thus, factors that influence learning outcomes also affect students' mathematical connection abilities. These factors can come from outside and from within students, including interest in learning, learning

methods, learning motivation (Nabillah & Prasetyo, 2019), and a factor that is no less important, namely gender (MZ, 2013). In this study, the factors to be analyzed were based on gender and learning motivation. Learning motivation is a driving factor that arises from oneself to carry out learning activities. Without learning motivation, students will be lazy to take lessons mathematics, giving rise to a passive learning attitude and lack of confidence and ultimately leading to low learning outcomes. Students who are motivated select tasks at the edge of their competencies, initiate action when given the chance, and exert intense effort and concentration in the implementation of learning tasks; they show generally positive emotions during ongoing action, including enthusiasm, optimism, curiosity, and interest. (Skinner & Belmont, 1991; Suraya, et al., 2009)

Learning motivation is the power or encouragement that can come from within or outside the student self that encourages students to learn (Gopalan et al., 2017; Yunos et al., 2022) Learning motivation was measured using a questionnaire compiled based on indicators of the desire and desire to succeed, the urge and need to learn, the hopes and aspirations for the future, the appreciation of learning, the existence of interesting activities in learning, and the existence of a conducive learning environment. Motivation plays an important role in student success in achieving learning goals, especially in improving mathematical connection abilities (Tran, L.T., & Nguyen, T.S. , 2021). Ulya & Irawati (2016) reinforced the research results that students with high learning motivation have high mathematical connection abilities. The observations of researchers also supported it during apprenticeship at school (PLP II), that in general, students who were active or students who showed good motivation to learn in learning mathematics obtained high learning outcomes and were able to solve questions that had many interrelated mathematical concepts. Therefore, researchers are interested in conducting in-depth research whether learning motivation strongly correlates with mathematical connection abilities.

Gender is also an important factor influencing students' mathematics abilities. It is marked by the 2018 PISA results in the field of mathematics, which show that Indonesian female students are 10 points superior to male students, while male students in all countries participating in PISA are 5 points superior compared to female students (OECD, 2019). The data shows differences in mathematical abilities between male and female students. The difference between boys and girls in learning mathematics shows that there are also differences in mathematical connection abilities between boys and girls.

In learning mathematics, for example, a similar mathematical problem is given to several individuals. They will get different responses in solving them. The difference in how to solve it is because each individual has a uniqueness in himself. In his journal (Hoang, 2008) revealed that men, with all their innate characteristics, are different from women. These differences are thought to influence the aspects of student learning motivation experienced. Karim & Sumartono's research (2015) showed no difference in the mathematical connection abilities of male and female students. Other study discovered cognitive skill variations, with females outperforming male in some tasks and vice versa. Hedges and Nowell (2005), for instance, discovered that men generally had less proficiency in reading and writing. They discovered that on measures of reading comprehension, perceptual quickness, and associative memory, females

marginally outperformed males. On the other hand, on the arithmetic and social studies assessments, men somewhat outscored women. (Ghasemi, & Burley, 2019). In comparison, the results of Yuniawatika's research (2018) show significant differences in mathematical connections between men and women, where the mathematical connection abilities of female students are better than those of male students. From the results of these different previous studies, the researcher is interested in analyzing in terms of gender to find out whether the existence of gender differences will affect students' mathematical connection abilities.

Researchers use circle material as research material. After all, the circle concept is close to students because the circle concept is often found and applied in everyday life. However, even though circle material is widely applied in everyday life, many students need help understanding the concept of circle material. It follows the results of previous research; namely, students still experience difficulties in working on questions on circle material related to everyday life problems (Manalu & Zanthy, 2020). Based on the description above, the researcher was motivated to analyze students' mathematical connection abilities in terms of gender and learning motivation.

▪ METHOD

Research Design

The method used in this research is a mixed method. Mixed research is research that combines two types of research, namely quantitative research and qualitative research (Samsu, 2021). This research aims to determine the relationship between gender and mathematical connection ability and the relationship between learning motivation and mathematical connection ability. The research procedures carried out are as follows the mathematical connection ability test and learning motivation questionnaire were compiled based on indicators. The logical analysis (expert validation) and field trials were carried out on the test questions and the learning motivation questionnaire to measure the tests' and questionnaires' empirical validity and reliability. The next step is to provide a learning motivation questionnaire and carry out a mathematical connection ability test on research subjects, namely class VIII.1. Researchers tested the hypothesis using crosstab analysis and chi-square test.

Population and Sample

The population in this study were class VIII students at SMP Negeri 1 Bengkulu City. In this study, the sample was selected using purposive random sampling, namely class VIII.1 SMPN 1 Bengkulu City in the even semester of the 2021/2022 academic year, with 34 students, with 11 male students and 23 female students, who will be given a mathematical connection ability test and a student learning motivation questionnaire.

Test Collection Techniques and Instruments

This study used data collection techniques to test techniques, questionnaires, and interviews. Namely, the test instrument for measuring the ability of mathematical connections is arranged based on indicators of competency in the circle material, which totals 6 questions. The mathematical connection is connecting between mathematical concepts, connecting mathematical concepts with everyday life, and connecting mathematical concepts with other fields of science (Menanti et al., 2018; Putri & Wutsqa, 2019). The grid of instrument is presented in table 1.

Table 1. Grid of mathematical connection ability instruments

Basic competencies	Mathematical Connection Indicator
3.7 Explain the central angle, circumscribed angle, arc length, and area of the sector of a circle, and their relationship	Connecting between Mathematical concepts
3.8 Describe the common external and common internal tangents of the two circles.	Connecting between Mathematical concepts
4.7 Solve problems related to central angles, circumferential angles, arc lengths, and areas of circles and their relationships.	Connecting Mathematical topics with other subjects
	Connecting mathematical topics to daily life
4.8 Solve problems related to common external tangents and common inner two circles.	Connecting mathematical topics to daily life

Instruments for student learning motivation are structured based on six indicators of learning motivation, namely (1) the desire and desire to succeed, (2) the encouragement and need to learn, (3) the hopes and aspirations for the future, (4) the appreciation in learning, (5) there are interesting activities in learning, and (6) there is a conducive learning environment. Of the six indicators of motivation to learn, 33 statements were compiled with positive and negative aspects using a Likert rating scale. The preparation of the questionnaire was carried out based on the grid, as shown in Table 2. The learning motivation questionnaire instrument was a checklist using a Likert scale of 1-4. The selection of answers consists of: (1) strongly agree, (2) agree, (3) disagree, and (4) strongly disagree. The following are the answer choices and assessment guidelines that will be used in the learning motivation questionnaire:

Table 2. Grid of student learning motivation questionnaire

Types of Motivation	Learning Motivation Indicator	Item Number		Number of Items
		Positive	Negative	
Intrinsic Motivation	There is desire and desire to succeed	1. 2. 4. 5. 6	3	6
	There is a drive and a need to learn	8. 9. 10	7. 11	5
	There are hopes and aspirations for the future	12. 13. 14. 15, 16	17	6
Extrinsic Motivation	There is an appreciation for learning	18. 19. 21. 22. 23	20	6
	There are interesting activities for learning	24. 25. 26. 27. 28	29	6
	There is a conducive learning environment.	30. 31. 32. 33	-	4
Total		27	6	33

Table 3. Guidelines for learning motivation questionnaire assessment

Answer Choices	Statement Score	
	Positive	Negative
Strongly Agree (SS)	4	1
Agree (S)	3	2
Disagree (TS)	2	3
Strongly Disagree (STS)	1	4

In preparing the research instrument, logical and empirical testing was first carried out. Logically carried out to analyze the validity of the compiled instruments. The research instrument was tested for content validity. Content validity measures three aspects, namely: (1) material, (2) construct, and (3) language. The results of the validity of the literacy ability test use analysis with the calculation of the Aiken index (1980). The results of the validity analysis show that all test items meet valid criteria where the Aiken index score is more than 0.5. In this study, the test instrument was also tested empirically to measure its validity and reliability of the test instrument.

The trial was conducted on students in class VIII.8, a total of 28 people at SMP Negeri 1 Bengkulu City, for the 2021/2022 academic year. Validity analysis uses the product moment formula, and a reliability analysis uses the Cronbach alpha formula. The empirical validity analysis results show that the value of r_xy ranges from 0.439 to 0.784. The calculated value of the validity of the questions is greater than the value of r_table, namely 0.374, with a significance level of $\alpha = 5\%$, stating that the test questions compiled are said to be valid. In addition, the reliability analysis results obtained a Cronbach alpha value of 0.633, which means that the test items have a high level of reliability with the criteria. Student learning motivation questionnaires were analyzed empirically by testing validity with factor analysis where the KMO value was 0.659. So it can be concluded that the questionnaire instrument meets the valid criteria, while the reliability value of the questionnaire instrument is 0.70 with reliable criteria.

Data analysis method

Data analysis methods consist of descriptive statistical analysis and inferential statistics. Descriptive statistical analysis is used to describe students' mathematical connection abilities. This statistic describes literacy data, including (1) average, (2) minimum value, (3) maximum value, and (4) standard deviation. Student learning motivation is described in descriptive statistics as a percentage level or level of student learning motivation determined with the following criteria.

Table 4. Criteria and category of the instrument (Arikunto, 2018)

Category	Criteria
High	$X \geq \bar{X} + SD$
Medium	$\bar{X} - SD < X < \bar{X} + SD$
Low	$X \leq \bar{X} - SD$

The relationship between gender and mathematical connection ability and the relationship between learning motivation and mathematical connection ability can be analyzed with a *crosstab analysis* (cross-tabulation), and *a chi-square test* was

conducted. This research will be presented with cross-tabulation to identify and find out whether there is a relationship between gender, learning motivation, and students' mathematical connection abilities. The contingency table will be analyzed descriptively. In addition, a *chi-square* test will be conducted to test whether there is a relationship between gender, learning motivation, and students' mathematical connection abilities.

The decision-making criterion is If $\chi^2{}_{hitung} > \chi^2{}_{tabel}$ is H_0 rejected (Nuryadi et al., 2017). However, a significant level was used because the *chi-square test* in this study was calculated using SPSS 23. Suppose the significance value is *chi-square* $<$ 0,05; then H_0 is rejected. It means a significant relationship exists between gender and learning motivation in students' mathematical connection abilities. In this test, the correlation coefficient will also be seen, and this aims to find out how strong the relationship is between learning motivation and mathematical connection ability. If the correlation value is positive, then the relationship between the two variables is unidirectional, meaning that if the motivation to learn is high, the mathematical connection ability is also higher. If the correlation value is negative, the relationship between the two variables is opposite, meaning that if learning motivation is high, then the ability to make mathematical connections is lower (Sarwono, 2006). The following are the criteria for interpreting the correlation coefficient that will be used:

Table 5. Correlation coefficient interpretation criteria

Correlation coefficient intervals	Relationship Level
0.00 – 0.199	Very low
0.20 – 0.399	Low
0.40 – 0.599	Currently
0.60 – 0.799	Strong
0.80 – 1.000	Very strong

▪ RESULT AND DISSCUSSION

Gender Relations and Mathematical Connection Ability

The average score of the students' mathematical connection ability is presented in Figure 1.

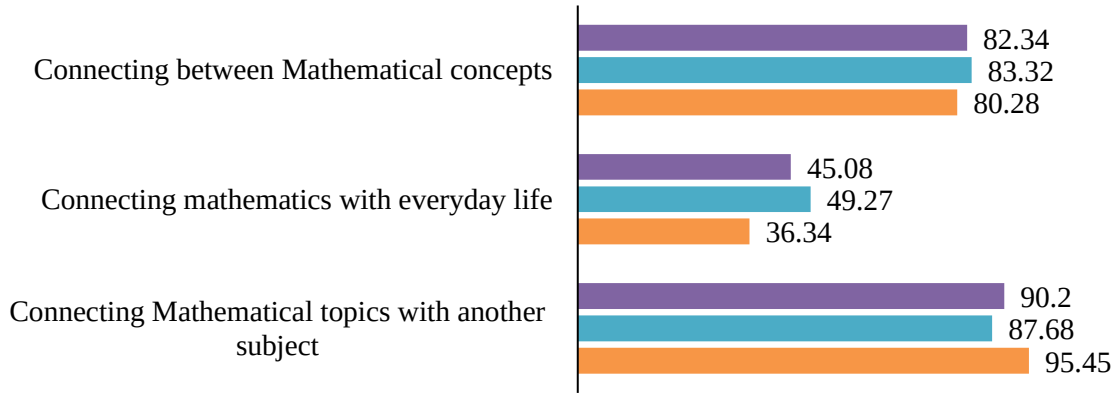

Figure 1. Students' mathematical connection ability. Female, male and all students' average score is presented in blue, orange, and purple color.

Based on figure 1, it is found that the mathematical connection ability of male students is higher than that of female students. Then male and female students have an advantage in connecting mathematical concepts with other fields and still need to improve on connecting mathematics with everyday life. The average value of students' mathematical connection abilities based on learning motivation is as follows.

Crosstab analysis was conducted to see and determine the relationship between gender and mathematical connection ability. The following results are from the crosstab between gender and the mathematical connection abilities of Grade VIII.1 students. Based on the crosstab, the mathematical connection abilities of male and female students in class VIII 1, totalling 34 people, tend to be in the medium category. Among them, out of 11 male students, 1 person had a high ability, nine people had a low ability, and one person had a low ability. In comparison, out of 23 female students, 1 person had a high ability, 21 people had a medium ability, and one person had a low ability. Then the chi-square test was carried out to determine whether there was a relationship between gender and students' mathematical connection abilities. The following results are from calculating the chi-square test between gender and mathematical connection ability using SPSS 23.

Table 6. *Chi-Square* test results between gender and mathematical connection ability

Significance	Real level
0.724	0.05

Based on these results, it can be seen that the significant value on the chi-square test > real level, that is, 0,724>0,05, then H_0 accepted. Based on the chi-square test results between gender and mathematical connection ability in class VIII.1, it is known that there is no relationship between gender and mathematical connection ability. The results of the two tests show no difference in the mathematical connection ability between male and female students. It is because based on the average value of the mathematical connection ability of male students and female students is not much different, namely with a difference of 2.73 points.

This difference needs to be more significant to conclude that the mathematical connection abilities of male and female students have differences. Because overall, the average value of students' mathematical connection ability is the same, which is classified in the medium category. This study's results differ from the results of Yuniawatika's research (2018), which shows that there are differences in mathematical connection abilities; that is, women's abilities are better than men's. Meanwhile, the results of this study follow the results of previous research, which showed no difference in the ability of mathematical connections between male and female students (Karim & Sumartono, 2015; Musriliani & Anshari, 2015).

If we look at the indicator of connecting mathematical concepts, male and female students have the same mathematical connection ability, which is classified as in the medium category. It means that, in general, students have been able to connect and use interrelationships between mathematical concepts, namely connecting concepts in circle material as well as connecting concepts outside circle material, such as the concepts of the Pythagorean theorem, comparisons, and triangles with concepts in circle material namely circle circumference, area circle, and the common tangent of two circles

exactly. The results of this study are different from those of Warih et al. (2016), which show that class VIII junior high school students in Probolinggo City have low mathematical connection abilities in the indicator of connecting between mathematical concepts, in this case, namely connecting the Pythagorean concept with previously studied material. Due to a lack of effort to develop mathematical thinking abilities and a propensity to present calculating methods as a trait of mathematics, pupils' limited mathematical connections ability is a common sign of their poor understanding of mathematical topics. Additionally, learning does not create connections between fresh mathematical ideas and previously understood mathematical constructs (Acharya, 2017; Samo et al., 2021)

In the indicator connecting mathematics with everyday life, male and female students also get almost the same average score, which is in the low category. Students need to relate everyday life's problems with the circle concept correctly. Some of the causal factors are that students need help understanding the questions, are unable to find links between the circle concept and the problems of everyday life, and there are errors in using the related circle concept to solve everyday problems. These results are in line with the results of previous research students still need help working on questions related to everyday life problems (Manalu & Zanthy, 2020; Nugraha, 2018; Zuyyina et al., 2018).

While on the indicator of connecting mathematics with other fields, male and female students' average mathematical connection ability is slightly different. Male students are classified in the high category. In contrast, female students are classified as in the medium category. However, this difference is insignificant because the average difference is not much different, only 7.77 points. It means that male and female students can connect mathematics with other fields, namely, correctly connecting the concept of the circumference with the concept of speed. This result is different from the results of research by Utami & Effendi (2019), which states that students' mathematical connection abilities are low in the indicator of connecting mathematics with other fields, in which students are unable to relate concepts in cube material to the concept of density. Another study establishing that there are disparities between how well men and women can connect mathematical ideas. Female students who comprehend mathematical principles but are unable to apply them to other concepts are a frequent reason (Sari et al., 2020).

Based on the description above, it is concluded that there is no difference in the ability of mathematical connections between male and female students. So the results of this study refute the results of research by Yuniawatika (2018) and the results of research by Rahmawati et al. (2022), which state that there are differences in the ability of mathematical connections between men and women. Thus, the teacher can treat male and female students differently in learning activities. However, teachers and students must strive to improve students' mathematical connection abilities to become better.

Relationship of Learning Motivation to Mathematical Connection Ability

The learning motivation questionnaire was given to class VIII students. 1 via a google form distributed through the class Whatsapp Group. The result of the student learning motivation has a range of 33-136. However, the assessment results in table 9 below have been converted into a value range of 1-100. In general, the average score of

class VIII.1 student's learning motivation is 75 or belongs to the medium motivation category. It is known that the minimum value is 61 and the maximum value is 94, with a standard deviation of 8.5.

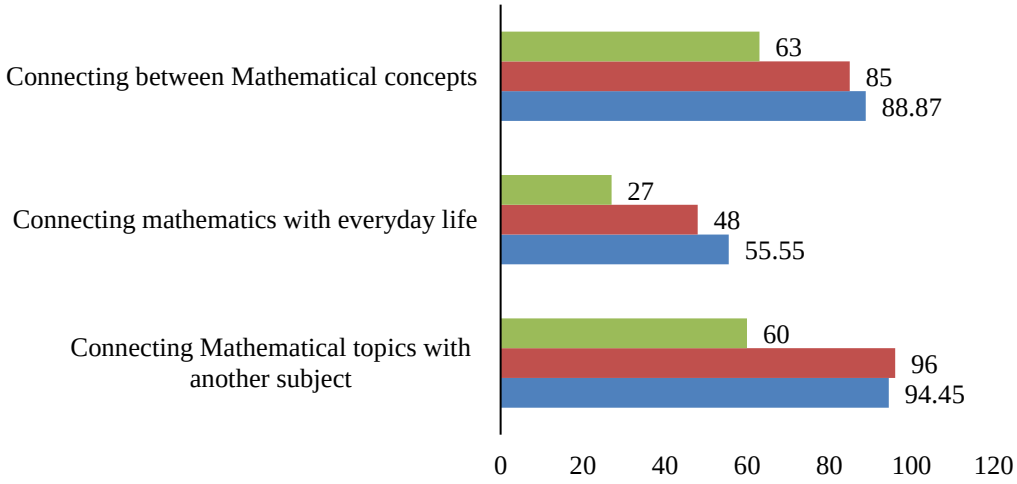

Figure 2. Students' average mathematical connection ability based on learning motivation. Low, moderate, and high learning motivation is presented in green, red, and blue color.

Based on Figure 2. show that students with high learning motivation tend to have an average score of higher mathematical connection abilities than those with medium and low learning motivation. Crosstab analysis was carried out to see and determine the relationship between learning motivation and mathematical connection abilities. The following results from the crosstab between learning motivation and students' mathematical connection abilities.

Table 7. Crosstab results of learning motivation and mathematical connection ability

		Mathematical Connection Ability			**Total**
		Tall	**Currently**	**Low**	
Motivation to learn	Tall	1	5	0	6
	Currently	1	22	0	23
	Low	0	3	2	5
Total		2	30	2	34

Table 16 shows that the percentage of students with moderate learning motivation have more mathematical connection abilities in the moderate category compared to other learning motivation categories. In general, class VIII 1 students have moderate learning motivation, with students' mathematical connection abilities tending to belong to the medium category as well. A chi-square test was carried out to analyze the relationship between learning motivation and students' mathematical connection abilities. The following results from the *chi-square test calculation* between learning motivation and mathematical connection ability using SPSS 23.

Table 8. *Chi-Square* test results and correlation coefficients relationship between learning motivation and mathematical connection ability

Significance	Information	Korf. Correlation	Interpretation
0.008	H_0rejected	0.537	Currently

Table 17 shows that the significant value on the *chi-square test* <real level, that is $0{,}008 < 0{,}05$, then H_0rejected. It means that there is a relationship between learning motivation and mathematical connection abilities. The correlation coefficient value obtained is positive(+), with the interpretation of the strength of the relationship being moderate; this means that learning motivation and mathematical connection abilities have a unidirectional relationship with moderate strength. Based on the *chi-square test* results between learning motivation and mathematical connection ability in class VIII 1, there is a fairly strong relationship between learning motivation and mathematical connection ability. It is based on the average value of the students' mathematical connection ability, which is getting higher, accompanied by high learning motivation. Likewise, students with low learning motivation also have low mathematical connection abilities.

Students with high and moderate learning motivation have mathematical connection abilities that are classified in the medium category. However, the average score of students with high motivation is slightly higher than students with moderate learning motivation. It shows that students with high learning motivation can solve problems on all indicators of mathematical connections but tend to get higher average scores on connecting mathematics with other fields. Students with moderate learning motivation can solve problems on indicators of connecting mathematical concepts and indicators of connecting mathematics with other fields. However, they tend to have low mathematical connection abilities when connecting mathematics with everyday life.

While students with low learning motivation have low mathematical connection abilities with an average value belonging to the low category, students with low learning motivation can solve problems on indicators of connecting mathematical concepts and mathematics with other fields, high and medium. Students with low learning motivation also tend to have low mathematical connection abilities when connecting mathematics with everyday life.

Based on the description above, it is concluded that good learning motivation will improve students' mathematical connection abilities. Because students with good learning motivation will always try to achieve their goals, this shows a positive relationship between learning motivation and mathematical connection ability. This result is in line with the results of previous research, which stated that there is a positive relationship between learning motivation and mathematical connection abilities (Ulya & Irawati, 2016), which means that when learning motivation is high, students' mathematical connection abilities are also high. Therefore, in learning mathematics, the teacher must always provide interesting learning experiences to motivate students to become more enthusiastic about learning. Thus the ability of students' mathematical connections will increase. If the mathematical connection ability increases, student learning outcomes will also increase. Additionally, those who can draw links between mathematical concepts can solve mathematical problems and relate new concepts to pertinent ones (Zengin, Y. ,2019) By the statement of Utami & Effendi (2019),

mathematical connections play a role in improving student learning outcomes. It is also supported by the results of previous studies, which show that learning motivation has a positive relationship with learning outcomes or learning achievement in mathematics (Syafi'i, 2021; Waritsman, 2020).

Description of Student Answers on the Mathematical Connection Ability Test

Example students' answer to the question is presented in Figure 3.

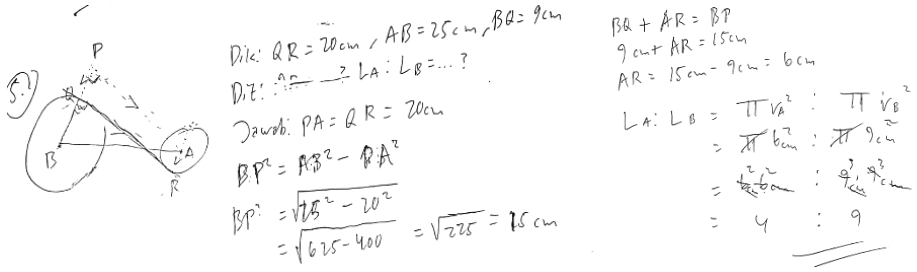

Figure 3. DFZ subject's answer to question

Moreover, the following is an excerpt from an interview with the DFZ subject related to question number 5.

Researcher	:	Do you understand the meaning of question number 5? What is asked in the question?
DFZ	:	Got it, ma'am. What is asked in the question is the ratio of the areas of circles A and B.
Researcher	:	What was the first step you took to solve the problem?
DFZ	:	Based on the formula for the area of a circle, namely πr^2 using the radius, the radius of B is already known, namely $BQ = 9\,cm$. However, the radius of circle A is not known, namely AR. Therefore I find the radius of circle A using the concept of a common tangent to the two circles. Nevertheless, in my answer here, I have changed it a little to use the Pythagorean theorem theory.
Researcher	:	After obtaining the radius of circle A, what steps do you take next?
DFZ	:	When you have obtained the radius of A, which is 15 cm, a comparison is made, Ma'am, namely L_A: L_B. I just obtained the results of the comparison, namely 4: 9.

Based on the results of test number 5 of the DFZ subject in the picture above, it can be seen that the DFZ subject solved the problem with indicators of connecting mathematical concepts well. It can be seen in the sketches made that the DFZ subject uses the concept of the Pythagorean theorem to find the radius of circle A. The DFZ subject also writes the Pythagorean formula correctly. After obtaining radius A, the DFZ subject look for a comparison of the areas of circles A and B by applying the concept of comparison. Based on the results of interviews, DFZ subjects were able to understand the questions well, were able to connect and explain the links between the circle concept and the Pythagorean concept, and the concept of comparison, and were

able to explain the steps in solving the problem in a precise, clear and enthusiastic manner.

▪ CONCLUSION

Based on the results of research and discussion of students' mathematical connection abilities in solving problems on circle material in terms of gender and learning motivation, several conclusions are obtained, namely as follows. 1) there is no significant relationship between gender and mathematical connection ability. 2) there is a significant relationship between learning motivation and mathematical connection ability. The mathematical connection abilities of male and female students have the same ability, while students with high learning motivation can solve mathematical connection ability questions well.

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