

THE EFFECT OF GENDER ON ELEMENTARY STUDENTS' MATHEMATICAL COMMUNICATION ABILITY

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Abstract

Women are often considered more talkative than men. But is it true that women have better communication skills than men? This study aims to analyze and obtain an overview of students' mathematical communication skills or called Kemampuan Komunikasi Matematis (KKM) in Bahasa Indonesia based on gender differences in comparative material. The method in this research is ex-post facto. The subjects in this study were 6th grade students at an elementary school in the city of Bandung with a total of 27 boys and 35 girls. The research instrument used was a test of mathematical communication skills (KKM), which measures the ability to solve word problems on comparative material. Data analysis in this study to see the mean difference test between the scores of mathematical communication skills (KKM) based on gender. The results of this study concluded that there was no difference in the effect of gender (male and female) on mathematical communication skills (KKM). Women and men have the same potential to have mathematical communication skills while practicing and learning. The results of this study can be used as a basis for educators to train mathematical communication skills to students in elementary schools fairly.

Keywords: communication skills; mathematics; gender

Abstrak

Perempuan kerap kali dianggap lebih cerewet dibanding laki-laki. Tapi benarkah bahwa perempuan memiliki kemampuan komunikasi matematis yang lebih baik dibanding laki-laki? Penelitian ini bertujuan untuk menganalisis dan memperoleh gambaran tentang kemampuan komunikasi matematis (KKM) siswa berdasarkan perbedaan jenis kelamin pada materi perbandingan. Metode dalam penelitian ini adalah ex-post facto. Subjek pada penelitian ini adalah siswa kelas 6 di sebuah sekolah dasar di Kota Bandung dengan jumlah, 27 orang laki-laki dan 35 orang perempuan. Instrumen penelitian yang digunakan berupa soal tes kemampuan komunikasi matematis (KKM), yang mengukur kemampuan menyelesaikan soal cerita pada materi perbandingan. Analisis data pada penelitian ini untuk melihat uji perbedaan rerata antara skor kemampuan komunikasi matematis (KKM) berdasarkan jenis kelamin. Hasil penelitian ini disimpulkan bahwa tidak terdapat perbedaan pengaruh jenis kelamin (laki-laki dan perempuan) terhadap kemampuan komunikasi matematis (KKM). Perempuan maupun laki-laki berpotensi yang sama besar memiliki kemampuan komunikasi matematis selama berlatih dan berusaha. Hasil penelitian ini dapat dijadikan landasan bagi para pendidikan untuk melatih kemampuan komunikasi matematis secara adil kepada siswa di sekolah dasar.

Kata Kunci: Kemampuan Komunikasi; Matematis, Jenis Kelamin

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Introduction

Mathematician from the 19th century, Josiah Willard Gibbs, called mathematics a language (Archambeau, 2020). He argued that the symbols in Mathematics mean the same all over the world, for that reason Mathematics can act as a universal language. Symbols, formulas or phrases in mathematics have the same meaning regardless of national, cultural and other

language backgrounds (Saunshi et al., 2020) . Mathematics can be considered as a language because it has a system of symbols and rules that are used to express ideas and concepts. Just like any other language, mathematics has vocabulary, grammatical structures, and conventions that must be understood by speakers or those who understand it. Therefore, mathematical communication is the process of expressing and understanding mathematical ideas and concepts using mathematical symbols and rules (Rusdi et al., 2020).

Mathematical communication is very important because it allows individuals to share and understand mathematical ideas and concepts with others (Sfard & Kieran, 2001). Without effective mathematical communication, individuals may find it difficult to explain or understand complex mathematical concepts (Pantaleon et al., 2018) . Therefore, the ability to express and understand mathematical concepts well through mathematical communication is an important skill that must be developed by every individual who wants to study mathematics effectively (D. P. Putri et al., 2020).

Mathematical communication is a person's ability to express and listen to mathematical explanations clearly and effectively. This ability is important for all students to have, including elementary school students, because having this ability makes it easier for someone to understand the mathematical concepts being studied (Suyani & Wulandari, 2020; Zain & Ahmad, 2021) . In addition, mathematical communication skills will also help students to easily interact with their friends when doing assignments or group discussions in class. Another reason why mathematical communication is a crucial ability that should be trained for every student is that this ability is the basis of critical and analytical thinking skills. Students who have good mathematical communication skills will be able to solve and evaluate math problems (Ilma & Putri, 2011) .

Common Core State Standards for Mathematics (*Common Core State Standards Initiative, 2010*) states that mathematical communication ability is an aspect of students' ability to reason in justifying their conclusions, communicating them, and responding to other people's arguments. As with other communication skills, this ability will make a person tends to adapt more easily to his environment. Communication is an important part because through communication students can share ideas and clarify understanding (Handayani, 2021) .

Mathematical communication ability or in Bahasa Indonesia called *Kemampuan komunikasi Matematika (KKM)* as an important skill is mastered by students, and will also determine their learning achievement, so that communication skills in learning mathematics are absolutely necessary. Mathematical communication skills are very meaningful in school work (Indah Nartani et al., 2015) . Thus KKM (*mathematical communication*) in learning mathematics really needs to be developed. Students who have mathematical abilities can change mathematical problems in everyday life into mathematical models and can also change mathematical models into everyday life situations (Hussein, 2013) .

There are many stereotype surrounding the ability to communicate, especially those related to one's gender. For example, women are considered to have better communication skills than men, or men are required not to speak too much or be expressive and so on. But is that really the case? Do women have better mathematical communication skills than men? This study aims to see the effect of gender of elementary school students on mathematical communication skills.

Of course, there has been quite a lot of research on the effect of gender on math skills (Afrilia et al., 2022; Babys, 2020; F. F. W. Putri, 2019). Several studies confirm that certain genders excel at math skills compared to other genders (MZ, 2013). This also applies to research

related to the effect of gender on mathematical communication skills in elementary school students. This has an impact on stereotypes in certain genders about their chances of being proficient in mathematics. This research is important to provide justification for the effect of gender on the mathematical communication skills of students in elementary schools.

Research on the effect of gender on students' ability and understanding of mathematics is still an important matter. This type of research will avoid justification errors, underestimates and stereotypes on certain genders in learning activities. One of the highlights of this study is exposing the effect of gender on the mathematical communication skills of students at the elementary level. This research is important because it will avoid misconceptions about learning mathematics from an early age.

Research Methods

The method used in this study was ex-post facto because the research subjects were not given prior treatment, but were only given a mathematical communication ability test on comparative material. The instruments in the research are test of mathematical communication skills consisting of 4 story questions on comparative material. The indicators of mathematical communication ability in the comparison material used consist of (1) reflecting real objects , pictures and diagrams into mathematical ideas in the form of tables, (2) model a situation or problem using spoken , written, concrete, graphic, and algebraic methods, (3) state everyday events in language and mathematical symbols, and (4) read with understanding a written mathematical presentation (Anderha & Maskar, 2021; Hendriana & Fitriani, 2019).

The subjects in this study were 6th grade students from 3 elementary schools in the city of Bandung. Selection of research locations using purposive random sampling technique. The researcher chose grade 6 students because they already had sufficient maturity and communication skills. Total respondents in this study were 62 students, consisting of 27 male and 35 female. Data collection was carried out using a validated mathematical proficiency questionnaire. Questionnaires distributed directly to students by researchers.

The instrument is validated through content and empirical validity. Content validity is carried out by material content expert practitioners in mathematics. While empirical validity uses the Pearson Correlation. To check the reliability of the instrument used Cronbach alpha and alignment reliability. The researcher gave an instrument for testing mathematical communication skills on comparative material so that scores of mathematical communication skills were collected on comparative material. This study used descriptive and inferential statistical data analysis techniques such as the normality test, homogeneity test, and different test (t-test) to compare the mathematical communication abilities of male and female students.

Result and Discussion

Description of Mathematical Communication Ability of Male and Female Students in Comparative Material.

Data on mathematical communication skills scores were obtained from 6th grade elementary school students with details of 27 male students and 35 female students from 3 schools in the city of Bandung. Female students show relatively even abilities. The lowest score for mathematical communication skills achieved by female students was 45, while some male students even only obtained a score of 20. 14 female students achieved a perfect score (100) and only 2 male students were able to score a perfect score.

Furthermore, what has been collected is analyzed using descriptive statistics to obtain an overview of students' mathematical communication abilities. The analysis process uses the help of the SPSS application . The following is the output of the SPSS results :

Table 1. Descriptive Statistical Test Results Students' Mathematical Communication Ability Score

Laki_Laki	Mean		65.37	4.360	Perempuan	Mean		84.63	4.368
	95% Confidence Interval for Mean	Lower Bound	56.41			95% Confidence Interval for Mean	Lower Bound	75.65	
		Upper Bound	74.33				Upper Bound	93.61	
	5% Trimmed Mean		65.90			5% Trimmed Mean		87.21	
	Median		75.00			Median		100.00	
	Variance		513.319			Variance		515.242	
	Std. Deviation		22.657			Std. Deviation		22.699	
	Minimum		20			Minimum		15	
	Maximum		100			Maximum		100	
	Range		80			Range		85	
	Interquartile Range		25			Interquartile Range		25	
	Skewness		-.457	.448		Skewness		-1.506	.448
	Kurtosis		-.512	.872		Kurtosis		1.955	.872

Based on the output above, it is known that the average mathematical communication ability (KKM) of male students is 65.37 while that of female students is 84.63 . While the standard deviation of the score of mathematical communication ability (KKM) of male students is 22,657, female students are 22,699. Descriptively, there is a difference in the average mathematical communication ability (KKM) of male and female students, with the result that the score of the mathematical communication ability (KKM) of female students is higher.

The standard deviation of the scores of male and female students is almost the same, so the results of the Mathematical Communication Ability Test (KKM) are equally distributed and with respective slopes for male and female students are -457 and -1.506. Because the slope of the scores for the mathematical communication skills of male and female students is negative, it can be ascertained that this is because the results for the scores of male and female students are much above average.

Subsequent analysis was carried out to find out whether there was an effect of gender on the mathematical communication skills between male and female students. To test this hypothesis, SPSS software is used, namely the *t test* , **assuming** that the two populations are normally distributed and the variance is the same, and the output is as follows:

Table 3. Mathematical Communication Ability t Test Results Male and Female Students

Group Statistics					
	Gender	N	Means	std. Deviation	std. Error Means
Score_KK	Man	27	80.19	25,999	5.003
M	Woman	35	70.43	20,557	3,475

Independent Samples Test									
		Levene's Test for Equality of Variances		t-test for Equality of Means					
		F	Sig.	Q	df	Sig. (2- tailed)	Mean Differen ces	std. Error Differen ce	95% Confidence Interval of the Difference Lower Upper
Score_K KM	Equal variances assumed	2,499	.119	1,651	60	.104	9,757	5910	- 21,57 2,065 8
	Equal variances not assumed			1,602	48,50 1	.116	9,757	6,092	- 22,00 2,488 2

From the output above, it turns out that the 2-tailed sign value is 0.104 and this value is greater than 0.05 (α), which means that there is no difference in the effect of gender (male and female) on mathematical communication skills (KKM).

There is a classic debate that is still ongoing, whether a person's mathematical ability is a talent that is inherited through DNA or is the result of effort. Those who argue that mathematics is a natural talent believe that only those who are born with math genes can reach the highest level in the field of mathematics (Ufuktepe & Özel, 2002) . While other opinions state that everyone can become an expert in the field of mathematics as long as they study and practice diligently (Boaler & Greeno, 2000) .

Likewise with the influence of gender on mathematical ability. Several studies show that mathematics is an ability that is a male domain. Based on a meta-analysis it was found that men have better problem-solving abilities, while women are superior in terms of calculation abilities. Even so, there is no significant difference between men and women in understanding mathematical concepts. However, there is also research that reveals that the math scores of female students are better than male students. Apart from that, the factors of self-confidence, fighting spirit, productive disposition have a long-term influence. Both the pro and contra groups with the opinion that mathematics is a natural talent both put forward evidence and arguments to strengthen their beliefs. However, several groups took a middle ground, saying the discussions were counterproductive. It will only make students relax their enthusiasm for learning mathematics, because they feel they have no innate talent (Fennema & Sherman, 1978).

A similar debate also applies to communication skills. The effect of gender on a person's communication skills is still a topic of debate in academic circles. There are those who say that gender has a significant influence on communication skills, but there are also those who say that the gender factor does not have a significant effect. Several studies have shown that women are generally better at verbal communication and empathy, while men tend to be better at nonverbal communication. However, this can be influenced by other factors such as education, cultural background, and social environment. Therefore, it cannot be said with certainty that gender has a major influence on one's communication skills.

The results of this study show the same thing, that there is no difference in the effect of gender (male and female) on mathematical communication skills (KKM). In general, female students did achieve a higher average score, namely 84.63 , compared to male students who only achieved an average score of 65.37 . But in general it is not caused by gender. This shows that men and women have the same potential to excel in terms of mathematical communication. They just need to keep learning and practicing. Mathematical ability is one of the skills that is very important for someone to have in the digital era like today.

Mathematical communication ability is an important skill in today's digital era. In a world that is highly related to technology and information, being able to communicate ideas and mathematical solutions effectively is very important for individuals to contribute in various fields, such as technology, business, and science. Mathematical communication skills also help us understanding and solving mathematical problems. In this highly competitive digital era, mathematical communication skills also help individuals to stand out and increase job opportunities. Therefore, the urgency of mathematical communication skills is very important for individuals to compete and develop in today's digital era

Conclusion

Based on the results of the research described in the previous section, it can be concluded that there is no difference in the effect of gender (male and female) on students' mathematical communication skills (KKM). This means that both men and women have the same potential in mathematical ability. Someone with good mathematical communication skills will be able to effectively communicate ideas and mathematical solutions, so he will be able to contribute in various fields. It's worth noting that claims of innate gender differences in mathematical ability have often been used to perpetuate stereotypes and discrimination against women in STEM fields. It's important to focus on addressing the systemic barriers and biases that continue to hold women and other underrepresented groups back in these fields, rather than perpetuating harmful and unfounded beliefs about innate differences in ability. The results of the study showed that there were significant differences in the mathematical communication abilities of male and female students at the elementary school level. Therefore, educators must take the same approach towards male and female students in developing their mathematical abilities and encourage them to develop their abilities individually, not based on gender stereotypes. This research can help change people's perceptions of differences in mathematical abilities between boys and girls and pave the way for a more inclusive and equitable education.

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