Gender Differences Influence Student's Numeracy Literacy in Secondary Schools in Kolaka Regency, Indonesia

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Authors' contributions

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ABSTRACT

This study aims to describe students' numeracy literacy skills by gender, and analyze inferentially the differences in numeracy literacy between male and female students. The sample of this study involved 48 students of MTs Negeri 1 Kolaka consisting of 21 male students and 27 female students. Research data were collected using numeracy literacy test instruments, data analysis includes: (1) descriptive analysis that aims to describe students' numeracy literacy ability which includes mean score, standard deviation and variance; and (2) inferential analysis aimed at determining differences in numeracy literacy skills between male students and female students using independent sample t tests on the condition that the normality and homogeneity of the data are met. The results of the study include: (1) descriptively, including: students' numeracy literacy ability is in the low category, and the numeracy literacy ability of female students is higher than that of male students; and (2) inferentially, including: data on students' numeracy literacy ability are normally distributed, and homogeneous, and there is no difference in numeracy literacy ability between male and female students.

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1. INTRODUCTION

Mathematics in the world of education is one of the important sciences and forms the basis for the development of other sciences. Mathematics as a discipline that is needed in all aspects of life. In fact, mathematics is one of the compulsory subjects in schools in primary and secondary education units. This has been stipulated by the government through law of the republic of Indonesia number 20 of 2003 concerning the national education system article 37 paragraph 1 that mathematics is one of the subjects that must be included in the primary and secondary education curriculum [1]. Mathematics equips students with the ability to think logically, analytically, systematically, critically, creatively and the ability to work together so that students have the ability to survive in the era of globalization [2]. Mathematics is very closely related to everyday life, and every life activity, both consciously and unconsciously, is an implementation of mathematics [3]. The implementation is usually presented in the form of numbers or graphs. Therefore, mathematical skills are needed to solve problems in everyday life [4]. One of the math skills is numeracy skills, namely ability, confidence, and willingness to engage with quantitative information in making informed decisions in all aspects of daily life [5]. Numeration and mathematical competence are two different things, even though they are based on the same knowledge and skills. The difference between the two lies in empowering this knowledge and skills [6].

Regulation of the Minister of Education and Culture number 23 of 2015 concerning the development of character which is the basis for the emergence of national issues related to skills that must be mastered in facing 21st century learning including literacy, competence, and character [7]. Literacy has sixth dimensions, namely reading and writing literacy, numeracy literacy, scientific literacy, digital literacy, financial literacy, and cultural and citizenship literacy [8]. Therefore, one of the three skills is literacy including numeracy literacy. Numerical literacy is the knowledge and skill of using various numbers and symbols related to basic mathematics to solve practical problems in various contexts of everyday life and analyzing information presented in various forms, then using the results of the analysis to predict and make decisions [9]. Numeracy literacy is the ability to analyze, solve, formulate, and interpret problems, as well as give reasons and convey ideas in various situations [10]. Numerical literacy is also interpreted as the ability to analyze and understand statements through activities in manipulating mathematical symbols or language in everyday life, as well as expressing them orally and in writing [11]. Numerical literacy is not only limited to the ability to solve mathematical problems. However, the concept of numbers and the ability to operate arithmetic can be applied in everyday life, as well as the ability to explain information about understanding numeracy literacy [12]. Furthermore, numeracy literacy has three indicators, namely: (1) using various numbers and symbols related to basic mathematics to solve problems in various contexts of everyday life; (2) analyzing information analyzing information presented in various forms (graphs, tables, charts, diagrams, and so on); and (3) interpreting the results of the analysis to predict and make decisions [12]. The scope of numeracy literacy is practical, contextual, related to understanding issues in communication, professional in work, recreational and cultural in nature [13].

Numerical literacy consists of three aspects, including: (1) numeracy, namely the ability to count an object verbally and the ability to identify the number of objects; (2) numeration relations, namely the ability to distinguish the quantity of an object; and (3) arithmetic operations, namely the ability to carry out basic mathematical operations in the form of addition and subtraction [5]. Numerical literacy is important to develop and master because the essence of learning mathematics is finding solutions to everyday contextual problems [13]. But in fact, the numeracy literacy of Indonesian students at the international level is still relatively low. Based on the results of the Programme for International Student Assessment (PISA) test, in 2015 Indonesia obtained a score of 386 for mathematics from the mean score for each country, namely 487. Meanwhile, in 2018, the acquisition of the PISA score for mathematics in Indonesia has decreased, namely 379 from the mean score for each country, namely 489 [14]. This shows that the numeracy literacy skills of Indonesian students are still low. Several things cause the low numeracy literacy skills of Indonesian students, namely the numeracy literacy skills of the students themselves, only a

small number of them utilize numeracy literacy in everyday life, students' skills in applying concepts to real conditions or solving unstructured problems are neglected, and the lack of practice numeracy literacy questions [15].

Much research related to numeracy literacy has been carried out in an effort to increase numeracy literacy, including efforts to increase numeracy literacy through e-modules containing ethno-mathematics [16], efforts to increase numeracy literacy through blended learning [6], a study of numeracy literacy from the aspect of reflective-impulsive cognitive style [17], and in early childhood [18], as well as a study of strengthening numeracy literacy through adaptation of technology in learning [19] strengthening numeracy literacy through technological adaptation in learning, and as an innovation in learning mathematics [20]. However, all of these studies neglect one important factor related to numeracy literacy, namely the gender factor. Gender differences cause physiological differences and affect psychological differences in learning [21]. According to Richardson & Woodley [22] that women can achieve higher learning outcomes than men because women are more persistent and committed than men. In many countries, the mathematical literacy of male students is superior to that of female students. However, in several countries, such as Thailand and Hong Kong, the mathematical literacy of female students is higher than that of male students. According to Chen, Yang, and Hsiao, women score higher on course design appreciation in mathematics, while men score higher on system quality [23]. Therefore, the aim of this study was to describe students' numeracy literacy based on gender, and to analyze statistically the differences in numeracy literacy between male and female students.

2. METHODOLOGY

This research is a quantitative study involving all students of Madrasah Tsanawiyah (MTs) Negeri 1 Kolaka as the population. The sample included 48 students of class VIII consisting of 21 males and 26 females. Name of the instrument is numeracy literacy test instrument. The collected data were analyzed descriptively and inferentially. Descriptive analysis includes averages, standard deviations, variances, percentages, descriptions based on numeracy literacy indicators, and data trend tests. The calculation of the data trend test is calculated using the ideal average (Mi) and ideal standard deviation (SDi) with the following categories [24].

Table 1. Categorization of numeracy literacy

Intervals	Category
$x > M_i + 1,5SD_i$	Very high
$M_i + 0,5SD_i < x \leq M_i + 1,5SD_i$	High
$M_i - 0,5SD_i < x \leq M_i + 0,5SD_i$	Moderate
$M_i - 1,5SD_i < x \leq M_i - 0,5SD_i$	Low
$x \leq M_i - 1,5SD_i$	Very low

with:

$$M_i = \frac{\text{Ideal High Score + Ideal Lowest Score}}{2}$$

$$SD_i = \frac{\text{Ideal High Score } - \text{ Ideal Lowest Score}}{6}$$

Inferential analysis used independent sample t-test to test differences in numeracy literacy of male and female students. The decision making criterion is if the sig. (2-tailed) < α = 0.05 [25]. Independent sample t-test is carried out if it meets the normality and homogeneity requirements. Shapiro-Wilk test was used to check for normality because the sample size is less than 50 with the decision criterion being if the Sig. α > α, with α = 0.05, the data is normally distributed [26]. Levene test was used for Homogeneity. The decision making criterion is if Sig. α > α = 0.05, then the data has a homogeneous variance [25].

3. RESULTS AND DISCUSSION

The results of the descriptive analysis of student numeracy literacy data are presented in Table 2.

Table 2. Description of student numeracy literacy

Statistic Item	All Sample	Male	Female
Number of Sample	48	21	27
Minimum	26	26	40
Maximum	100	100	100
Mean	59.67	56.86	61.85
Standard Deviation	18.05	19.48	16.90
Variance	325.67	379.43	285.52

Based on the information in Table 1, it was obtained that the mean of numeracy literacy of 48 students (male and female) was 59.67, with the lowest score being 26 and the highest score being 100, and the variance value of 325.67. The mean numeracy literacy of male students was 56.86 and that of female students was 61.85. That is, descriptively the mean literacy of female students is higher than that of male students, or in other words, the numeracy literacy of female students is better than that of male students. This is supported by the smaller numeracy literacy variance value of female students, because the smaller the variance value, the better the results will be [27]. Furthermore, the categorization of numeracy literacy of male and female students is described, as presented in Table 3, and Fig. 1.

From Table 3 and Fig. 1, information was obtained that there were 2 (4.17%) male students and 3 (6.26%) female students with very high categories. For the high category, there are 2 (4.17%) male students and 4 (8.33%) female students. For the moderate category, there are 4 (8.33%) male students and 7 (14.58) female students. For the low category, there were 7 (14.58%) male students and 9 (18.75%) female students. As well as for the very low category, there were 6 (12.5%) male students and 4 (8.33%) female students. This shows that students' numeracy literacy skills are in the low category.

Next, the numeracy literacy data of students are described based on their indicators. Indicators of numeracy literacy ability consist of 3 aspects. A description of students' numeracy literacy skills per indicator is presented in Table 4.

Based on Table 4, information was obtained that the mean score of female students in all indicators is higher than that of male students. In the first indicator, although both are in the high category, the mean score of female students is 76.54 greater than the mean score of male of 70.79. In the second indicator, the mean score of female students is 57.41 or the medium category is higher than the mean score of male students of 52.14 or the low category. In the third indicator, the mean score of female students was 48.89 or the low category was higher than the mean score of male students of 42.54 or the very low category. Another piece of information obtained is that both male students and female students are still lacking in the second and third indicators. This means that most students are less able to analyze information in various forms, and interpret the results of its analysis to predict and make decisions. On the other hand, both male students and female students, have been able to use a wide variety of numbers and symbols related to basic mathematics to solve everyday problems with high ability categories.

Table 3. Data and percentage of student's numeracy literacy categories

Category	Frequency		Percentage (%)	
	Male	Female	Male	Female
Very High	2	3	4.17	6.26
High	2	4	4.17	8.33
Moderate	4	7	8.33	14.58
Low	7	9	14.58	18.75
Very Low	6	4	12.50	8.33
Total	**21**	**27**	**43.75**	**56.25**

Table 4. Description of numeracy literacy per indicator

No	Indicator	Mean (Category)	
		Male	Female
1.	Using a wide variety of number and symbols related to basic mathematics to solve problems in a wide variety of contexts of everyday life	70.79 (High)	76.54 (High)
2.	Analyze information displayed in various forms (graphs, tables, charts, diagrams, and others)	52.14 (Low)	57.41 (Moderate)
3.	Interpret the results of such analysis to predict and make decisions	42.54 (Very Low)	48.89 (Low)
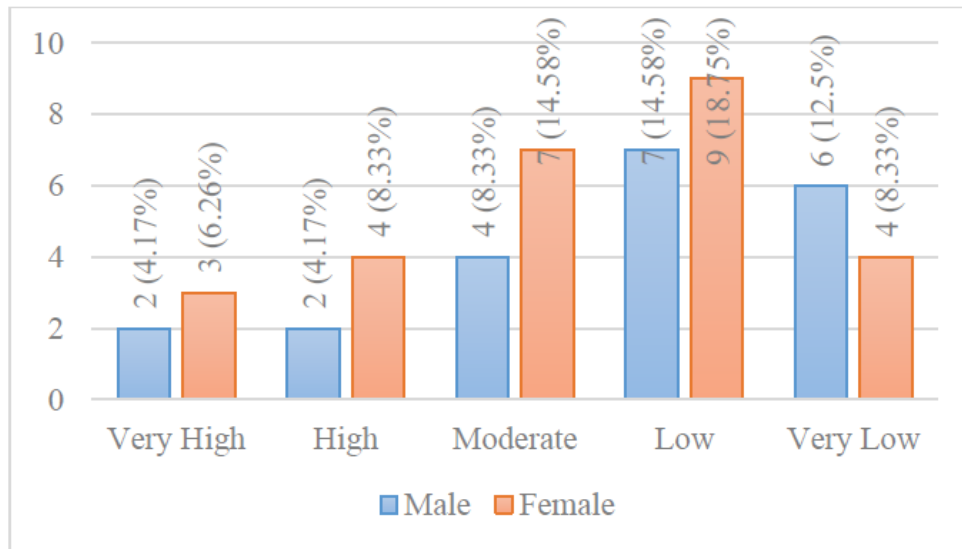
Fig. 1. Category and percentage of student's numeracy literacy with gender

The next step is to test the difference in numeracy literacy skills between male students and female students using an independent sample t test. However, before the t test step is carried out, it must meet the requirements of normality and homogeneity. The results of the normality test showed that the Sig. value of male students was $0.090 > α = 0.05$ and female students $= 0.095 > α = 0.05$. This means that, both male students and female students, their numeracy literacy data is normally distributed. From Table 2, the variance scores of male students were 379.43 and female students were 285.52. This means that the numeracy literacy ability data of male students varies more than that of female students. In other words, students' numeracy literacy ability data are more homogeneous than male students. However, inferentially obtained the value of sig = $0.834 > α = 0.05$. This means that the numeracy literacy ability data of male and female students are homogeneous.

The conditions of normality and homogeneity have been met, then the mean difference test is carried out. The results of the t test show that the value of Sig (2-tailed) = $0.347 > α = 0.05$. This means that there is no difference in numeracy literacy skills between male and female students. This result is in accordance with previous research, namely that there is no difference in numeracy literacy skills between male and female students [28,29]. Although inferentially there is no difference in numeracy literacy ability between male and female students, if you pay attention to the mean score of numeracy literacy

ability of female students, it is higher than that of male students. This is due to female students having better learning achievements than male students, as well as differences in the tendency of male and female students to understand certain materials in mathematics [30], such as geometry, algebra, numerical and discrete which affect students' mastery of mathematics, especially in terms of gender [31]. This is because girls are more motivated and more diligent in doing schoolwork than boys [21].

When you see at numeracy literacy indicators, students already have the ability to use a variety of numbers and symbols related to basic mathematics to solve problems in various contexts of daily life with high categories. This means that students' ability to understand problems is relatively high, because before using various symbols in solving problems, they must first be able to understand problems. If it is not able to understand the problem, then the student will not be able to solve the problem. This is in line with the results of Noviani's research [32] that the stage of understanding the problem is an important stage in solving the problem, because if you do not understand the problem, it will be problematic at the next stage. In the second and third indicators, both male and female students are still relatively low. The low ability of students to analyze information, and interpret the results of analysis in predicting and making decisions causes low numeracy literacy skills of students.

Efforts to improve student numeracy literacy continue to be carried out. Some things that

need to be considered are student learning motivation, because with high learning motivation, students are eager to improve their abilities, and high learning motivation can improve mathematical communication skills in particular, as well as learning outcomes in general [33]. Therefore, it takes teacher innovation and creativity in learning in order to motivate students to learn. In addition, using the concept of ethnomathematics in learning, because ethnomathematics can perceive mathematics to be more contextual and meaningful which is one of the characteristics of numeracy literacy [16]. Habituation of students in solving non-routine mathematical problems. This means that the math problems given to students are PISA-based mathematics problems or are included in the high order thinking skills (HOTS) category so as to improve students' high thinking skills and ultimately have an impact on numeracy literacy skills which do require high-level thinking skills. This is in accordance with Sugiman's opinion [34] that mathematics problems whose level of difficulty is slightly above the ability but should not be outside the Zone of Proximal Development (ZPD) can give rise to students' desire to find solutions, and have a potential effect on students' logical, critical and creative thinking abilities and mathematical problem solving [35].

4. CONCLUSION

Based on the analysis, there was no difference in numeracy literacy skills between male and female students in MTs Negeri 1 Kolaka. However, descriptively, the mean score numeracy literacy ability of female students is higher than that of male students. Based on the indicators of numeracy literacy ability, the ability of female students in each indicator is higher than that of male students. In the first indicator, both male students and female students have a high ability to understand and solve problems related to the context of daily life. However, the mean score of female students is higher than that of male students. Likewise, in the second and third indicators, the mean score of numeracy literacy ability of female students is higher than that of male. But both are still relatively low. Therefore, efforts to improve numeracy literacy are recommendations for further research by considering cognitive, psychomotor, and affective aspects, as well as the technicalities of their improvement, and increasing the number of variables to enrich the research.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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