

## ANALYSIS OF STUDENTS' MATHEMATICAL LITERACY ABILITY IN VIEW OF GENDER DIFFERENCES

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### Abstract

*The purpose of this study was to describe students' mathematical literacy abilities a review of gender differences in SMA Negeri 3 Brebes, Brebes Regency, academic year 2022/2023 in solving PISA model questions. The approach in this research is qualitative approach with descriptive method. The research subjects were 6 students namely 2 students consisting of male students and female students from each level high, medium, and low mathematical literacy abilities. As for the indicators Mathematical literacy skills in this study refer to process indicators mathematics, namely (1) formulating real situations mathematically, (2) using concepts, facts, procedures, and mathematical reasoning, and (3) Interpret, apply and produce math results. The research results show that (1) ability high mathematical literacy produces an average number ability of 52.92% for female students and an average achievement of 43.6% for students male, in this case can work on questions up to level 4. (2) Literacy ability moderate mathematics resulted in an average achievement rate of 33.51% for participants female students and an average score of 32.78% for male students, in this case can work on questions up to level 4. (3) Literacy ability mathematics resulted in a low average number ability of 20.25% for the participants female students and an average score of 19.76% for male students men in this case can work on questions up to level 1.*

*Keywords: mathematical literacy skills, gender, PISA*

### 1 INTRODUCTION

Education according to the Law of the Republic of Indonesia Number 20 of 2003 concerning the National Education System states that, education is a conscious and planned effort to create a learning atmosphere and learning or training process so that students can develop their potential effectively so that they have spiritual, religious, emotional, self-control, personality, intelligence, noble character, and skills needed by themselves and society (Elfacmi, 2016). Education is currently faced with major challenges in the 21st century, where there are more and more challenges in social life so that self-skills are needed to be able to adapt (Kurniawan, 2020). These challenges are related to human daily activities and one of the human activities is inseparable from mathematics.

Mathematics is the science most often used in everyday life. Mathematics is one of the fields of study that is very important for students to understand in preparing their lives to become part of modern society. Many problems in everyday life require understanding and mathematical reasoning in solving them. Mathematics is one of the fields of study taught in schools, both elementary schools, junior high schools and general high schools. According to Johar (2012), having good mastery of mathematics will help someone in solving problems (Mansur, 2018). Therefore, it is important to know the extent to which students can understand and use mathematics in everyday life.

According to Rika Sukmawati (2018) and Wijaya (2016), one of the objectives of the learning process at school is to be able to improve students' abilities. The ability in the field of mathematics that must be possessed by students is not only the ability to count, but students must also be able to think or reason when solving problems related to mathematics. Literacy-based learning is intended to develop students' ability to understand texts and relate them to contextual personal experiences. Literacy learning will encourage students to think critically and creatively and students are able to process and manage verbal, written, visual, and even digital communication appropriately and effectively (Setiawan et al., 2019).

The term literacy originally meant the ability to read and write. However, as time goes by, the term literacy continues to develop. Literacy is often defined as the state of being 'literate' about a condition. Literacy is also often compared with other words, for example scientific literacy and mathematical literacy. Mathematical literacy according to the 2012 Program for International Student Assessment

(PISA) draft assessment framework is defined as a person's ability to formulate, use and interpret in various contexts. Mathematical literacy is also related to mathematical reasoning and the ability to use mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena. According to Setiawan (2014).

Every student has different thinking abilities and of course there are factors that influence it. Amir Z (2013, p.15) explains that many factors must be considered in studying mathematics, including willingness, ability, certain intelligence, teacher readiness, student readiness, curriculum, method of presentation, and a factor that is no less important is the factor of gender (gender). According to Puspitawati (in Unarti & Subekti, 2016), gender is a trait formed by culture that is learned and socialized since childhood. Gender is the difference between men and women seen from their roles, functions, status, and responsibilities as socio-cultural constructions (Citra, 2020). Gender differences certainly cause physiological differences and affect psychological differences. So that male and female students certainly have many differences in learning mathematics. These differences can be seen from their interest in the learning process and their motivation as well as their ability to grasp so that they can influence the learning process. This gender difference makes a person's differentiating factor in thinking, which includes ways of thinking, ways of learning and determining the resolution of the problems taken. Therefore, different gender differences will certainly affect students' mathematical literacy skills.

Made Ngurah Suragangga (2017) and Utama Putra (2018) explained that PISA is an official international scale activity carried out by the Organization for Economic Cooperation and Development (OECD) which prioritizes in measuring literacy skills which include assessing science, reading and math skills (Masjaya, 2018). According to Utama Putra (2018), the activities carried out by PISA aim to assist in making education policies around the world by quickly improving the education system and measuring students' knowledge and skills as a comparison with other countries. This resulted in the existence of PISA activities, all countries could improve and enhance the abilities of all students in their countries (Setiawan et al., 2019).

PISA results according to (Setiawan et al., 2019) regarding literacy skills in mathematics in 2003, Indonesia was ranked 38 out of 41 countries with a score of 360, in 2006 the score rose to 391 with a ranking of 50 out of 57 countries, and in 2009 it experienced the score decreased to 371 by being ranked 61st out of 65 countries (Hawa, Anni Malihatul, 2014). In 2012, Indonesia was ranked second from the bottom with a score of 375 out of 63 countries that took the test (Wulandari & Hasanah, 2015). In 2015, Indonesia was ranked 10th from the lowest position with a score of 386 out of 72 countries that took the test (Komala et al., 2017). This situation shows that the mathematical literacy skills of Indonesian students are still very low compared to other countries in terms of PISA study success standards. The PISA study is a program implemented by the OECD since 2001 which aims to conduct research to examine the mathematical literacy abilities of 15 year old students in 65 countries (Delyanti Azzumarito Pulungan, et al, 2014).

According to Asrama, et al (2017), there is a special feature in PISA questions, namely the presence of cognitive abilities in mathematics. There are seven mathematical cognitive abilities including communication, mathematization, representation, reasoning and argumentation, designing strategies to solve problems, language and symbolic operations, and using mathematical tools (Setiawan et al., 2019). PISA questions are very demanding of reasoning and problem solving skills. A person is said to be able to solve a problem if he can apply previously acquired knowledge to a new, unfamiliar situation (Wardhani, 2005).

The PISA study shows that in several participating countries men outperform women in terms of mathematical literacy. This can be seen from the data obtained in PISA 2006 as many as 35 countries out of 57 participating countries had men superior to women, in PISA 2009 of 65 participating countries 35 countries had men superior to women and in the PISA 2015 study namely all participating countries as many as 37 countries out of 70 participating countries show that men are superior to women in terms of mathematical literacy (Mahiuddin et al., n.d.).

Based on the results of interviews that were conducted with the class X math teacher at SMA Negeri 3 Brebes, the teacher already knew about students' mathematical literacy skills. However, we don't yet know how to specifically measure students' mathematical literacy abilities using PISA model question indicators. At the school itself, tests have never been held to measure mathematical literacy skills, only giving routine questions in the form of stories for students to work on. Previously, no one had researched mathematical literacy skills using PISA model literacy questions. In addition, students have never taken the PISA model literacy test, so they do not know how the PISA model questions are

tested by the Organization for Economic Co-operation and Development (OECD). Therefore, this study aims to describe students' mathematical literacy abilities from a gender perspective in solving PISA model questions.

## 2 METHODOLOGY

This research is a qualitative research with a descriptive design. This research was conducted at SMA Negeri 3 Brebes in June 2023. This research will explain in detail how the ability to solve problems in statistical material for class X SMA Negeri 3 Brebes by giving a mathematical literacy test based on the mathematical process indicators of the PISA model mathematical literacy test to 95 students. Followed by an analysis of mathematical literacy skills with research subjects based on answers that are clustered into three levels, namely high, medium, and low mathematical literacy abilities. Then the subject of this research will be taken to represent male and female students. The subjects consisted of male and female subjects (Low Category), the subjects consisted of male and female subjects (Medium Category), the subjects consisted of male and female subjects (High Category). Furthermore, it was confirmed by an interview process with research subjects regarding the answers they had written.

## 3 RESULTS

Based on the results of the mathematical literacy test, the following is a grouping of categories of levels of mathematical literacy ability.

Table 1. Qualification results for mathematical literacy skills

Mathematical Literacy Ability	Height (H)	Medium (S)	Low (R)
Criteria	$s \geq \bar{x} + SD$	$\bar{x} - SD \leq s < \bar{x} + SD$	$s < \bar{x} - SD$
Results	27 students	40 students	28 students

Based on Table 1, it shows that the results of the mathematical literacy ability test of 95 students in class X Phases E-5, E-7, and E-10. There were 27 students in the high mathematical literacy ability group, 40 students in the medium mathematical literacy ability group, and 28 students in the low mathematical literacy ability group. Based on the results of the mathematical literacy ability test for each category, two subjects who have high mathematical literacy ability consisting of one woman and one man with the highest score will be taken, two subjects who have moderate mathematical literacy ability consisting of one woman and one man with the highest score, and two subjects who have low mathematical literacy skills consisting of one woman and one man with the highest score. The following is a list of names of students who were research subjects.

Table 2. List of names of research subjects

Code Name	Subject Name	Subject Code	Mark	Mathematical Literacy Ability Category
A – 75	Sekar Nikmatuzahra	H1	81	Height (Female)
A – 92	Yurcel Zada	H2	70	Height (Male)
A – 2	Aisyah Nur Arsinta	M1	50	Moderate (Female)
A – 14	Azka Ridho P.	M2	49	Moderate (Male)
A – 53	Naila Septia Ramadhany	L1	27	Low (Female)
A – 90	Yaka Nasta Afan Syah	L2	29	Low (Male)

The research subjects that have been determined will then be analyzed for mathematical literacy abilities. Each indicator of mathematical literacy ability will be coded as follows.

Table 3. Mathematical literacy ability code

No	Indicator	Code
1	Formulate the situation mathematically	IDK 1
2	Apply concepts, facts, procedures and mathematical reasoning	IDK 2
3	Interpret, apply, and evaluate results	IDK 3

Based on Table 3 Indicators Formulating situations mathematically is written with IDK 1, Indicators Applying concepts, facts, procedures and mathematical reasoning are written with IDK 2, Indicators Interpreting, applying, and evaluating results are written with IDK 3. From the indicators of mathematical literacy it can be said that students have mathematical literacy ability if it meets 3 indicators of mathematical literacy according to PISA 2012 namely formulating situations mathematically, applying the concept of procedural facts and mathematical reasoning, interpreting applying and evaluating results.

**1. High Mathematical Literacy Ability**

The achievement of subjects with high mathematical literacy abilities in terms of gender differences between female students and male students can be seen in the image below:

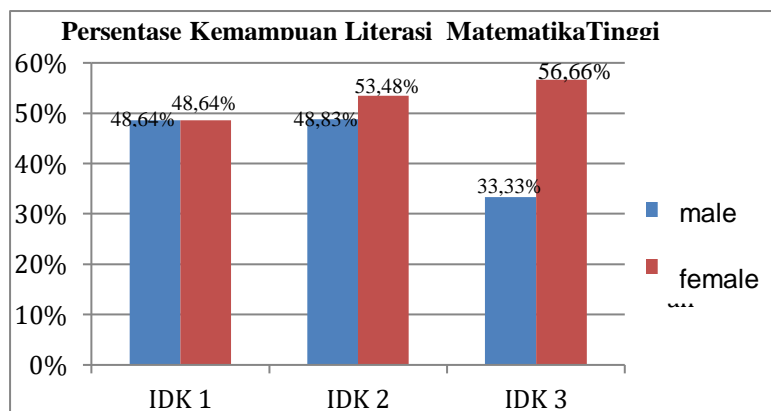


Figure 1. Percentage of high mathematical literacy abilities

achievement of 48.64% for male students. Female tall subjects and male tall subjects were able to write down information that was known and asked about the problem before solving it to facilitate problem solving. Female subjects have a neat and orderly nature in answering questions, this is evident from the question and answer sheet where the subject writes down what is known, asked and answered. During interviews, female subjects and male subjects were very communicative in explaining what information was known on existing problems so that in this study the female subjects and male subjects from a high level of mathematical literacy were able to meet the indicators of ability to formulate situations mathematically ( formulas). Based on this explanation, this research is in line with Karmila's statement (2019) which states that female students in solving mathematical literacy questions are able to state information that is known and asked about from the problem. This research is also in line with research that has been conducted (Risywandha & Siti Khabibah) that subjects with male gender in solving questions are able to identify several important mathematical aspects of the given problem and are able to simplify the problem so that it is easy to analyze mathematically. At IDK 2 or in this case the ability to apply the concept of procedural facts and mathematical reasoning resulted in an achievement of 53.48% for female students and an achievement of 48.83% for male students. Tall female subjects and tall male subjects re is a difference in solving the number of questions where the female subjects are more likely to solve the number of questions, namely 7 questions compared to the male subjects only 6 questions, the mathematical concepts applied are in accordance with the problem at hand. . This research is in line with research by Julisra, et al (2019) that female students are able to use concepts, facts and procedures that are appropriate and lead to solutions. And this research is in line with research by Setiawan, et al (2020) which states that male

students appear to be able to determine the steps to solve and draw conclusions on mathematical literacy test questions correctly. IDK 3, or in this case the ability to interpret, apply and evaluate results, produces an achievement of 56.66% for female students and an achievement of 33.33% for male students. Tall female subjects and tall male subjects were able to interpret, evaluate and provide conclusions from the problems in the questions. This research is in line with research by Nurani, et al (2020) that female students have mastered indicators of mathematical literacy skills in interpreting mathematics to solve problems. Although this research is not in line with Krutetski's opinion in Nafi'an (2011) which explains that men are superior in reasoning and have better mechanical abilities than women. High mathematical literacy skills result in an average achievement of 52.92% for female students and an average achievement of 43.6% for male students.

Based on the analysis of tests and interviews that have been conducted, it can be concluded that female students and male students who have a high level of literacy ability have differences in solving questions, including female students can solve 7 questions well while male students can only solve 6 questions. This shows that subjects with high mathematical literacy skills can work on questions up to level 4.

**2. Moderate Mathematical Literacy Ability**

The achievement of subjects with moderate mathematical literacy skills in terms of gender differences between female students and male students can be seen in the picture below:

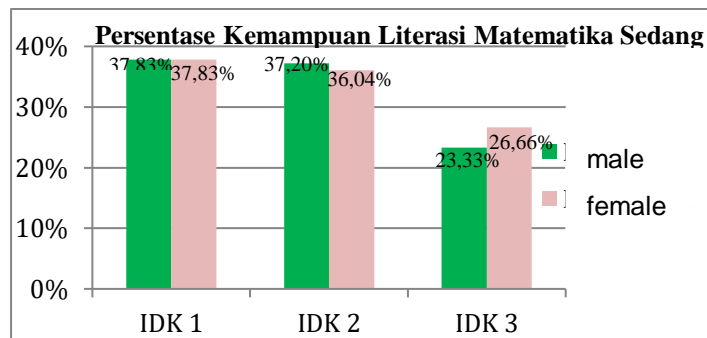


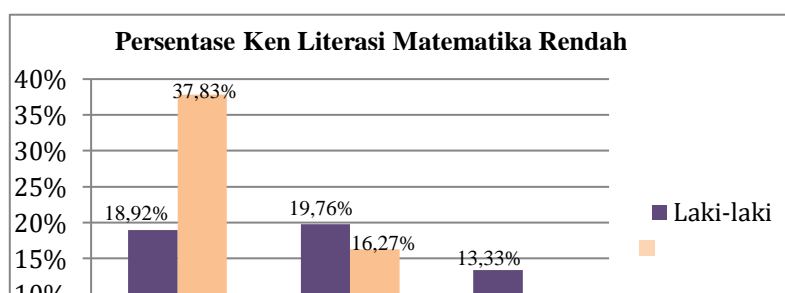
Figure 2. Percentage of moderate mathematical literacy ability

Based on Figure 2, you can see the percentage results for each indicator of mathematical literacy ability. In IDK 1 or in this case the ability to formulate situations mathematically resulting in an achievement of 37.83% for female students and an achievement of 37.83% for male students. Female subjects and male subjects were able to write down the information they knew and asked about the problem before solving it to make problem solving easier. Female subjects have a neat and orderly nature in answering questions, this is evident from the question and answer sheet where the subject writes down what is known, asked and answered. During interviews, female subjects and male subjects were very communicative in explaining what information was known on existing problems so that in this study the female subjects and male subjects from a high level of mathematical literacy were able to meet the indicators of ability to formulate situations mathematically ( formulas). Based on this explanation, this research is in line with Karmila's statement (2019) which states that female students in solving mathematical literacy questions are able to state information that is known and asked about from the problem. This research is also in line with research that has been conducted (Risywandha & Siti Khabibah) that subjects with male gender in abilities than women. Medium mathematical literacy skills produce an average achievement of 33.51% for female students and an average achievement of 32.78% for male students.

Based on the analysis of tests and interviews that have been carried out, it can be concluded that female students and male students who have a moderate level of literacy ability have similarities in solving questions, including female students and male students who can solve the same 4 questions well. This shows that subjects with moderate mathematical literacy skills can work on questions up to level 4.

**3. Low Mathematical Literacy Ability**

The achievement of subjects with low mathematical literacy skills can be seen in the image below:



male  
female

Figure 3. Percentage of low math literacy skills

that is known and asked about the problem before solving it to facilitate problem solving. During interviews, female subjects and male subjects were very communicative in explaining what information was known on existing problems so that in this study the female subjects and male subjects from a high level of mathematical literacy were able to meet the indicators of ability to formulate situations mathematically ( formulas). Even though there was a difference in working on the number of questions where the female subject worked on 4 questions and the male subject worked on 3 questions. Based on this explanation, this research is in line with Karmila's statement (2019) which states that female students in solving mathematical literacy questions are able to state information that is known and asked about from the problem. This research is also in line with research that has been conducted (Risywandha & Siti Khabibah) that subjects with male gender in solving questions are able to identify several important mathematical aspects of the given problem and are able to simplify the problem so that it is easy to analyze mathematically. At IDK 2 or in this case the ability to apply the concept of procedural facts and mathematical reasoning resulted in an achievement of 16.27% for female students and an achievement of 19.76% for male students. Female low subject and male low subject have differences in solving questions that affect the percentage of indicators where the percentage of male subjects is more than the percentage of female subjects, female subjects do not meet the indicators because the subjects are less able to apply mathematical concepts and strategies in solving problems, this can be seen in the answer sheet that out of the 4 questions worked out only 1 question met the IDK 2 indicator. Meanwhile for male subjects were able to use the right problem solving concepts and strategies and could write down the steps in solving the problem in the questions out of the 3 questions worked out only 2 questions fulfilled IDK 2. This research is not in line with research by Julisra, et al (2019) that female students are able to use concepts, facts, and procedures that are appropriate and lead to solutions. And this research is in line with research by Setiawan, et al (2020) which states that male students appear to be able to determine the steps to solve and draw conclusions on mathematical literacy test questions correctly. At IDK 3 or in this case the ability to interpret, apply and evaluate the results resulted in an achievement of 6.66% for female students and an achievement of 13.33% for male students. Low female subjects and low male subjects have differences in the percentage of indicators where the percentage of male subjects is more than the percentage of female subjects, female subjects do not meet the indicators because the subjects are unable to interpret and apply the right solutions to solve existing problems, this It can be seen in the answer sheet that out of the 4 questions worked out only 1 question met the IDK 3 indicator while male subjects were able to complete 2 questions that met IDK 3. This research is not in line with the research of Nurani, et al (2020) that female students have master indicators of mathematical literacy skills in interpreting mathematics to solve problems. This research is not in line with Krutetski's opinion in Nafi'an (2011) which explains that men are superior in reasoning and have better mechanical abilities than women. Low mathematical literacy skills resulted in an average score of 20.25% for female students and an average score of 17.33% for male students.

Based on the analysis of the tests and interviews that have been carried out, it can be concluded that female students and male students who have a low literacy level have differences in solving questions, including female students can only complete 1 question well out of 4 questions that are worked on because of question number 1 has fulfilled IDK 1, IDK 2, and IDK 3. Meanwhile, male students were able to solve 2 questions well out of the 3 questions they worked on. This shows that subjects with low mathematical literacy skills can work on questions up to level 1.

## 4 CONCLUSIONS

The conclusion of the research is that between female students and male students have different mathematical literacy abilities of each group, namely the high, medium, and low mathematical literacy ability groups in terms of mathematical literacy indicators according to PISA 2012, namely in formulating situations mathematics, applying concepts of procedural facts and mathematical reasoning, interpreting, applying and evaluating results. **1) Students who have a high level of literacy skills.** High mathematical literacy skills produce an average score of 52.92% for female students and an average achievement of 43.6% for male students. female students can solve questions number 1, 2, 3, 4, 5, 7, and 9 well while male students can solve questions number 1, 2, 3, 4, 5, and 9. This shows that subject students with high mathematical literacy ability can work on questions up to level 4. **2) Students who have a moderate level of literacy ability.** Moderate mathematical literacy skills produce an average score of 33.51% for female students and an average achievement of 32.78% for male students. Can solve questions number 1,2,3,4 well. This shows that the subjects of students with moderate mathematical literacy skills can work on questions up to level 4. **3) Students who have a low level of literacy ability.** Low mathematical literacy skills produce an average score of 20.25% for female students and an average achievement of 17.33% for male students. Can solve question number 1 well. This shows that the subject of students with low mathematical literacy skills can work on questions up to level 1. Similar and more in-depth research should be carried out with different content and contexts considering the importance of mathematical literacy skills for students.

## REFERENCES

- Abidin, Y., Mulyati, T., & Yunansah, H. 2018. Pembelajaran Literasi Strategi Meningkatkan Literasi Matematika, Sains, Membaca, dan Menulis. Jakarta: Bumi Aksara.
- Arikunto. 2015. *Prosedur Penelitian: Suatu Pendekatan Matriks*. Rineka Cipta, Jakarta.
- Citra, Y. 2020. Analisis Kemampuan Literasi Matematis Siswa Ditinjau dari Perspektif Gender dalam Menyelesaikan Soal PISA. *Skripsi Universitas Siliwangi*, 7.
- Dilla, S. C., Hidayat, W., & Rohaeti, E. E. 2018. *Faktor gender dan resiliensi dalam pencapaian kemampuan berpikir kreatif matematis siswa sma*. 2(1), 129–136.
- Elfacmi, A. 2016. *Pengantar Pendidikan*. Jakarta: Penerbit Erlangga.
- Hidayati, M. 2022. Analisis Kemampuan Literasi Matematika Ditinjau dari Indikator Soal Model PISA. *Skripsi Universitas Pancasakti Tegal*, 15.
- Ibrahim, M.,A., 2018. *Metodologi Penelitian Kualitatif*. Bandung: ALFABETA.
- Komala, E., Nur, S., Qintani, S., & Suryakancani, U. 2017. *Pembelajaran dengan Pendekatan Metacognitive Guidance (MG) Untuk Meningkatkan Literasi Matematis*. 3(2), 155–166.
- Kurniawan, H. 2020. *PEMBELAJARAN ERA 4.0*. Yogyakarta: Media Akademi.
- Mahiuddin, W. P., Masi, L., & Anggo, M. (n.d.). *Analisis Kemampuan Literasi Matematis Siswa SMP Di Kabupaten Konawe Dalam Perspektif Gender*. 55–65.
- Mansur, N. 2018. *Melatih Literasi Matematika Siswa dengan Soal PISA*. 1, 140–144.
- Masjaya & Wardono. 2018. Pentingnya Kemampuan Literasi Matematika untuk Menumbuhkan Kemampuan Koneksi Matematika dalam Meningkatkan SDM. *Prisma*, 1(1).
- Nilasari, N. T., & Anggreini, D. 2019. *Kemampuan Literasi Matematika Siswa dalam Menyelesaikan Soal PISA Ditinjau dari Adversity Quotient*. 5(2), 206–219.
- <https://doi.org/10.29408/jel.v5i2.1342>
- Prabawati, M. N. (n.d.). *Analisis Kemampuan Literasi Matematik Mahasiswa Calon Guru Matematika*. 7, 113–120.
- Satori, D., & Komariah, A. 2010. *Metodologi penelitian kualitatif* (Cet. 2 ed.). Bandung: Alfabeta.
- Sepriyanti, N. 2019. *Kemampuan Literasi Matematis Peserta Didik Dalam Perspektif Gender di Kelas X MIA 7 SMAN 10 PADANG*. Citra, Y. (2020). Analisis Kemampuan Literasi Matematis Siswa Ditinjau dari Perspektif Gender dalam Menyelesaikan Soal PISA. *Skripsi Universitas Siliwangi*, 7.

- Saraswati, E. 2015. Perbedaan Hasil Belajar Siswa Laki-laki dan Perempuan dalam Mata Pelajaran Matematika Kelas iii semester 2 Materi Sudut dan Pecahan di SD Negeri se-desa Caturharjo, Kecamatan Sleman, Kabupaten Sleman.
- Satori, D., & Komariah, A. 2010. *Metodologi penelitian kualitatif* (Cet. 2 ed.). Bandung: Alfabeta.
- Sepriyanti, N. 2019. *Kemampuan Literasi Matematis Peserta Didik Dalam Perspektif Gender di Kelas X MIA 7 SMAN 10 PADANG*. 3(2), 195–206.
- Setiawan, A., Inganah, S., Ummah, S. K., & Malang, U. M. 2019. *Analisis kemampuan literasi matematis siswa dalam penyelesaian soal pisa ditinjau dari gender*. 6(1), 43–48.
- Untarti, R., & Subekti, F. E. Kemampuan Komunikasi Matematis mahasiswa ditinjau dari Gender pada mata kuliah telaah kurikulum SMP. 5(2), 139-150.