Efektivitas Model Pembelajaran *Missouri Mathematics Project* (MMP) Terhadap Kemampuan literasi Matematika Siswa Ditinjau dari *Self-Efficacy*

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Abstrak

Indonesia merupakan negara dengan kemampuan literasi matematika tergolong rendah. Perbaikan model pembelajaran merupakan suatu tindakan yang dapat dilakukan untuk meningkatkan kemampuan literasi matematika siswa. Pendekatan pembelajaran *Missouri Mathematics Project* (MMP) termasuk pendekatan pembelajaran yang dinilai efektif meningkatkan kemampuan literasi matematika. Selain hal tersebut, *self-efficacy* merupakan faktor lain yang dapat mempengaruhi kemampuan literasi matematika siswa. Tujuan dari penelitian ini yaitu untuk mengetahui efektivitas model pembelajaran *Missouri Mathematics Project (MMP)* terhadap literasi matematika siswa ditinjau dari *self-efficacy*. Penelitian ini menggunakan pendekatan penelitian kuantitatif dengan metode kuasi eksperimen. Instrumen penelitian menggunakan essay tes dan kuesioner. Uji hipotesis menggunakan uji Anova Dua Jalan Sel Tak Sama. Hasil penelitian diperoleh $F_{hitung} = 0,106 < F_{tabel} = 4,001$ yang berarti H_0 diterima. Hal tersebut berarti baik model pembelajaran konvensional maupun model pembelajaran *Missouri Mathematics Project* (MMP) siswa dengan kategori *self-efficacy* tinggi memiliki kemampuan literasi matematika lebih unggul dibandingkankan dengan siswa kategori *self-efficacy* sedang ataupun rendah. Berdasarkan hasil penelitian dapat disimpulkan bahwa terdapat pengaruh model pembelajaran *Missouri Mathematics Project* (MMP) dan *self-efficacy* terhadap literasi matematika siswa.

Kata Kunci: literasi matematika, Missouri Mathematics Project (MMP), self-efficacy

Effectiveness of Missouri Mathematics Project (MMP) Learning Model on Students' Mathematical Literacy Skills in View of Self-Efficacy

Abstract

Indonesia is a country with low mathematical literacy skills. Improving the learning model is an action that can be taken to improve students' mathematical literacy skills. The Missouri Mathematics Project (MMP) learning approach is a learning approach that is considered effective in improving mathematical literacy skills. In addition to this, self-efficacy is another factor that can affect students' mathematical literacy skills. The purpose of this study was to determine the effectiveness of the Missouri Mathematics Project (MMP) learning model on students' mathematical literacy in terms of self-efficacy. This study used a quantitative research approach with a quasi-experimental method. The research instruments used essay tests and questionnaires. Hypothesis testing uses the Two-Way Anova test of Unequal Cells. The results concluded that there was an effect of Missouri Mathematics Project (MMP) learning model and self-efficacy on students' mathematical literacy. The interaction of different learning models and self-efficacy has no effect on students' mathematical literacy skills. The results obtained $F_{count} = 0.106 < F_{table} = 4.001$ which means H_0 is accepted. This means that both conventional learning models and Missouri Mathematics Project (MMP) learning models students with high self-efficacy categories have superior mathematical literacy skills compared to students with moderate or low self-efficacy categories. Based on the research results, it can be concluded that there is an effect of Missouri Mathematics Project (MMP) learning model and self-efficacy on students' mathematical literacy.

Keywords: *mathematics literacy; Missouri Mathematics Project (MMP); self-efficacy*

INTRODUCTION

Mathematical literacy is considered a skill that every individual needs to face the challenges of the 21st century (Gunadi & Siti Aisah, 2019). According to Umbara & Suryadi (2019), mathematical literacy is one of the main assets for an individual to carry out daily activities and is a top priority that needs to be continuously improved. In another study, Genc & Erbas (2019) stated that mathematical literacy provides individuals with awareness and understanding of the role of mathematics in the world. Based on these explanations, it can be concluded that mathematical literacy is a competency that individuals should possess to support their lives. However, Indonesia is a country with relatively low mathematical literacy abilities. Referring to the survey conducted by the Program for International Student Assessment (PISA) released by the Organization for Economic Co-operation and Development (OECD, 2018), the mathematical literacy ability of Indonesian students ranked 73rd out of 78 participating countries with a score of 379. The low ranking of Indonesian students in the survey shows that their mathematical problem-solving skills are relatively low (Murtiyasa & Perwita, 2020).

Improving the learning model is an action that can be taken to enhance the mathematical literacy abilities of students. In addition to improving mathematical literacy, improving the learning model is also an effort to improve the quality of education (Nurcahyo & Sudibyo, 2020). The Missouri Mathematics Project (MMP) learning approach is considered an effective approach to improve mathematical literacy abilities. Sofyan (2021) explained in his research that the Missouri Mathematics Project (MMP) learning model is designed to make it easier for students to solve mathematical problems, so they can construct their answers through their experiences in working on practice questions. The skills of solving practice questions, which include reasoning skills, decision-making skills, problem-solving skills, interpreting information, and applying technology, are skills that must be mastered to improve students' mathematical literacy abilities (Suharta & Suarjana, 2018).

The MMP learning model is one of the structured learning models such as the Mathematics Learning Structure, but MMP is developed with well-structured steps (Rini & Purwanti, 2021). According to Nurussobah, Nuryani, & Fitriani (2021), the MMP model is a mathematics learning model that provides guided practice in the form of group projects so that students can construct their own knowledge, as well as practice problems in group and independent work so that students are trained in applying their knowledge and skills to solve various kinds of problems. In line with Harianda & Junedi (2021) who states that the Missouri Mathematics Project learning model is a learning model designed to improve students' ability to solve mathematical problems so that in the end students are able to compile their own answers because of the many experiences students have in solving practice problems.

According Nurhaidah (2017), Missouri Mathematics Project (MMP) learning model in its implementation can save time in learning because the Missouri Mathematics Project Learning model contains learning syntax that can save learning time. With the diversity of differences in learning styles of students, the Missouri Mathematics Project learning model is considered capable of improving students' thinking skills. According to Pratiwi, Astawa, & Mahayukti (2019) the Missouri Mathematics Project learning model gives students the opportunity to develop their skills to understand a concept and increase self-confidence by increasing practice problems both individually and in groups. Based on this theory, it can be concluded that the Missouri Mathematics Project learning model is one of the learning methods that requires students to be active in the learning process which aims to develop and improve students' skills in the ability to solve mathematical problems.

Furthermore, self-efficacy is another factor that can affect students' mathematical literacy ability. When considering students' mathematical literacy ability, there are external factors that influence it, specifically related to students' previous experiences, intellectual skills, and motivation construction (Hiller, Kitsantas, Cheema, & Poulou, 2021). Coskun (2019) in his research revealed that the concept of self-efficacy in mathematical literacy is students' belief in their ability to solve mathematical problems. In agreement with Utari, Kartasasmita, & Julika (2019) who explained that

one component of mathematical problem-solving is self-efficacy. The research results of Busnawir, Misu, Sudia, Idris, & Sadikin (2021) concluded that self-efficacy is directly proportional to students' literacy ability, which means that students' mathematical literacy ability increases as their self-efficacy increases. The advantage of students with high self-efficacy lies in their mathematical literacy capabilities. Students with high self-efficacy can communicate, mathematize, and represent, although not perfectly, while students with low self-efficacy are not yet able to do so.

Ulya & Hidayah (2016) concluded that students with high self-efficacy were proficient in understanding problems, formulating them, devising solutions, and solving them. Therefore, the Missouri Mathematics Project (MMP) learning model associated with high self-efficacy students effectively improved problem-solving skills. Khoirunnisa, Salsabila, & Santi (2021) also revealed that high self-efficacy students who implemented the MMP learning method had higher critical thinking skills compared to using conventional learning methods. In their research, Rini & Purwanti (2021) concluded that high self-efficacy students who correctly and completely comprehended problems, designed problem-solving, and re-checked the solution, together with the MMP learning model, effectively improved mathematics problem-solving skills.

Based on the descriptive above, researchers are interested to know the effectiveness of the Missouri Mathematics Project (MMP) learning model on students' mathematical literacy skills in terms of self-efficacy. The purpose of this study is to determine the effectiveness of the MMP learning model on students' mathematical literacy in terms of self-efficacy.

METHOD

This study used a quantitative research approach with a quasi-experimental method. This research was conducted using two subjects, namely the experimental class and the control class. The experimental class used Missouri Mathematics Project (MMP) learning model and the control class used conventional learning model. At the end of the study, each class will be given a test to measure students' mathematical literacy skills after treatment. Quantitative data were obtained from the results of essay tests and questionnaires.

The study was conducted at SMA Negeri 1 Gemolong, Sragen. The population of this study was all students in grade XI MIPA consisting of five classes with each class containing an average of 36 students. Sampling technique in this study using cluster random sampling or area random sampling, the sample of this study was class XI MIPA 1 as the control group and XI MIPA 3 as the experimental group with each class containing an average of 36 students. Prior to the study, a balancing test was conducted to determine the similarity of the abilities of both classes using Semester Final Exam data with a t-test.

The research instruments used were essay tests and questionnaires. The essay test is a test that contains questions related to the material of geometric rows and series. The test data collection technique was used to obtain students' mathematical literacy scores after receiving Missouri Mathematics Project (MMP) learning model treatment in the experimental class and conventional learning model treatment in the control class. The questions used to measure students' mathematical literacy were in the form of descriptions. After completing the essay test, the students were required to fill out a questionnaire to determine their level of self-efficacy. To determine the level of self-efficacy, an interval measurement scale was used, which was converted into a nominal scale with high, moderate, and low categories.

The instruments must first be tested for reliability using Cronbach's Alpha and for validity using the Product Moment before being used. The descriptive analysis technique in this study aims to describe student scores in the implementation of both learning models in the form of mean, median, mode, and standard deviation, as well as inferential analysis techniques that function as hypothesis testing with an unequal cell two-way Anova test.

The research instruments include a test instrument to measure students' mathematical literacy abilities and a questionnaire instrument to measure students' self-efficacy. Both instruments were tested on 33 try-out students (non-samples) to determine their validity and reliability. The validity test of the test questions using the Product Moment technique and a significance level of 5% with N = 33, and rtable = 0.344 showed that all three questions were valid as the rxy value for each question

was greater than rtable. As for the validity test of the questionnaire questions, using the Product Moment technique and a significance level of 5% with N = 32, and rtable = 0.349, five out of 30 questions were not valid. The reliability test of the questions using the Alpha Cronbach technique and a significance level of 5% with N = 33, and r_{table} = 0.344, with r_{11} = 0.615 showed that all three questions were reliable as $r_{11} > r_{table}$. As for the reliability test of the questionnaire questions using the Alpha Cronbach technique and a significance level of 5% with N = 32, and r_{table} = 0.349, with r_{11} = 0.887. The results indicate that 30 items are considered reliable because $r_{11} > r_{tabel}$. Based on the test results, both instruments can be considered valid and reliable, and then both instruments were tested on the research sample to obtain data on students' mathematical literacy and self-efficacy.

RESULTS

The balance test of the two classes, the experimental class and the control class, needs to be conducted before the study to ensure that both classes have the same initial ability. The balance test uses t-test with the data of the Final Semester Exam (UAS) scores and a significance level of 5%. The result of the balance test showed t_{count} = 1.284 and t_{table} = 1.690. Based on the calculation, $t_{count} < t_{table}$, which means H_0 is accepted. It indicates that both classes have the same initial skill.

After obtaining data on students' mathematical literacy and self-efficacy, normality test and homogeneity test were conducted to fulfill the analysis requirements. The normality test was carried out to determine whether the sample taken from the population is normally distributed or not. The normality test was calculated using the Lilliefors test with a significance level of 5%. The data from the normality test calculation is presented in Table 1 below.

Table 1. Normality Test Results Data

Group	L_{hitung}	$L_{\alpha,n}$	Decision	Decision
Conventional	0,005	0,154	H_0 accepted	The sample comes from a normally distributed population
MMP	0,102	0,154	H_0 accepted	
Tall	0,018	0,173	H_0 accepted	
Currently	0,060	0,174	H_0 accepted	
Low	0.162	0,220	H_0 accepted	

The results of the normality test, as shown in Table 1, indicate that Lobserved < Lcritical, which means that H_0 is accepted. This proves that the sample comes from a normally distributed population. To determine whether the variances are equal or not, a homogeneity test needs to be performed. The homogeneity test is calculated using the Bartlett test and a significance level of 5%. The data calculation of the homogeneity test is presented in the following Table 2.

Table 2. Data on Homogeneity Test Results

Group	K	X^2_{count}	$X^2_{\alpha;k-1}$	Decision	Decision
Learning model	2	2,140	3,841	H_{0A} accepted	Both groups have the same variance
Self-efficacy	3	0,236	5,991	H_{0B} accepted	The three groups have the same variance

The data from the homogeneity test in Table 2 proves that $X^2_{count} < X^2_{\alpha;k-1}$ which means that H_{0A} dan H_{0B} are accepted. This proves that the learning model group and self-efficacy have equal variances. Based on both tests, it can be stated that the obtained data has fulfilled the prerequisite test. After meeting the prerequisite test, hypothesis testing is conducted using a two-way analysis of variance with unequal cell sizes and a significance level of 5%. The results of the two-way analysis of variance test with unequal cell sizes are presented in Table 3 below.

Table 3. Data from the analysis of variance of two different cell lines

Source	JK	DK	RK	F_{hitung}	F_{tabel}	Decision
Learning model (A)	255,565	1	255,565	58,241	4,001	H_{0A} rejected
Self-efficacy (B)	1345,469	2	672,734	153,311	3,150	H_{0B} rejected
Interaction (AB)	0,933	2	0,466	0,106	2,368	H_{0AB} accepted
Error	263,282	60	4.388	-	-	-
Total	542679,000	66	-	-	-	-

The result of the two-way analysis of variance with unequal sample sizes in Table 3 shows that $F_A = 58,241 > F_{tabel} = 4,001$ indicating that H_{0A} rejected. This proves that there is a significant influence of the conventional learning model and the Missouri Mathematics Project (MMP) on mathematical literacy. To determine which learning model has a more significant effect on mathematical literacy, it can be seen in the marginal means table below.

Table 4. Marginal Means of Learning Methods and Self-Efficacy on Mathematical Literacy

Learning model	*Self-efficacy*			Marginal Average
	High	Medium	Low	
Conventional	93,556	87,875	80,714	87,382
MMP	97,571	92,056	85,375	91.667
Marginal Average	95,563	95,563	83,045	

Based on Table 4, it can be stated that the marginal mean of the conventional learning model is 87.382, while the marginal mean of the Missouri Mathematics Project (MMP) learning model is 91.002. Based on these marginal means, it can be concluded that the class treated with the MMP learning model has better mathematical literacy skills compared to the class treated with the conventional learning model. This is because the MMP learning model emphasizes the development of students' skills in solving mathematical problems.

Based on the hypothesis test results $F_B = 153,311 > F_{tabel} = 3,150$ which means that H_{0B} is rejected. From this data, it can be stated that self-efficacy has a significant effect on mathematical literacy. This is in line with Ananda & Wandini (2022) findings, who stated that self-efficacy significantly affects students' mathematical literacy. Istiqomah, Kamid, & Effendi-Hasibuan (2022) concluded in their study that students' self-efficacy can independently influence their mathematical literacy ability. To determine the self-efficacy category that yields the best literacy results, a comparison test between columns is needed.

Table 5. Summary of Inter-Column Comparison Test Results

H_0	H_1	Fcount	$2(F_{table})$	Decision
$\mu_1 = \mu_2$	$\mu_1 \neq \mu_2$	3,91	0,452	H_0 rejected
$\mu_1 = \mu_3$	$\mu_1 \neq \mu_3$	11,48	0,452	H_0 rejected
$\mu_2 = \mu_3$	$\mu_2 \neq \mu_3$	7,57	0,452	H_0 rejected

Based on Table 5, it can be stated that students with high, moderate, and low self-efficacy categories have different levels of mathematical literacy. Students with high self-efficacy category are superior in mathematical literacy compared to those with moderate or low self-efficacy categories. This is evidenced by the mean value of students in the high self-efficacy category, which is 95.563. This value is higher compared to the mean value of students in the moderate or low self-efficacy categories. Students with moderate self-efficacy category have better mathematical literacy ability than those with low self-efficacy category. This is shown by the mean value of students in the moderate category, which is 95.563. This value is higher compared to the mean value of students in the low self-efficacy category, which is 83.045. Students with high self-efficacy category can translate contextual problems into mathematical expressions, design mathematical strategies to solve problems, and define problems mathematically using symbolic expressions and formula manipulation.

DISCUSSION

The results in Table 3 indicate a significant effect between conventional learning models and the Missouri Mathematics Project (MMP) on mathematical literacy. According to Ginanjar & Akmal (2021), using appropriate teaching techniques or models can increase students' mathematical literacy and make them enthusiastic and confident in solving mathematical problems. Susanto & Sapti (2006) also stated that one of the syntaxes of the conventional learning model is providing problems along with their solutions using theory, as well as providing evaluation problems. Similarly, the Missouri Mathematics Project (MMP) model includes controlled exercises, independent exercises, and homework assignments (Nurhaidah, 2017). Consistent with Hidayah & Aulia (2015), the main focus of the Missouri Mathematics Project (MMP) is to improve students' problem-solving skills through practice problems both in groups and independently and through giving homework assignments. According to Sari & Asmara (2021), improving students' mathematical literacy skills can be achieved through providing appropriate practice problems.

Winardi & Dwijanto (2017) stated that the Missouri Mathematics Project (MMP) learning model aims to cultivate students' perseverance in solving problems both independently and in groups, resulting in students' mathematical literacy skills. This statement is supported by Jamil, Anggoro, & Gunawan (2021) study, which concluded that the Missouri Mathematics Project (MMP) learning model is a model that focuses on practice problems and assignments, which can simultaneously affect students' mathematical literacy skills.

In their research, Geraldine & Wijayanti (2022) concluded that students with high self-efficacy in mathematics literacy are able to formulate and identify problems and translate them into mathematical language, as well as design and apply algorithms in problem-solving. Another study by Purwanti & Mujiasih (2021) found that self-efficacy affects students' mathematics literacy abilities, as observed from seven mathematics literacy indicators, including skills in understanding story problems, skills in generating questions related to problems, ability to convert and calculate mathematical problems, and ability to provide conclusions at the end of their answers.

Based on the results of the third hypothesis $F_{AB} = 0,106 < F_{tabel} = 2,368$ which means that H_{0AB} is accepted. Therefore, it can be concluded that the interaction between different learning models and self-efficacy does not affect students' mathematics literacy abilities. This means that students with high self-efficacy in both conventional and Missouri Mathematics Project (MMP) learning models have better mathematics literacy abilities than those with medium or low self-efficacy. Additionally, students with medium self-efficacy have better mathematics literacy skills compared to those with low self-efficacy. Furthermore, the average mathematics literacy score was higher for the Missouri Mathematics Project (MMP) learning model than for the conventional learning model. Thus, it can be concluded that the Missouri Mathematics Project (MMP) learning model is more effective than the conventional learning model, regardless of the level of self-efficacy (high, medium, or low).

Based on research conducted the application of the Missouri Mathematics Project (MMP) learning model with high self-efficacy category students are able to fulfill the aspects of students' mathematical literacy which include communication, mathematization, representation, reasoning and argumentation, designing strategies to solve problems, using language and symbolic, formal, technical, and operation, and being able to use mathematical tools. Students with moderate self-efficacy category mostly have not been able to fulfill aspects of mathematical literacy that design strategies to solve problems and use language and symbolic, formal, and operation. And students with low self-efficacy category have not been able to fulfill aspects of mathematical literacy which include representation, reasoning and argumentation, designing strategies to solve problems, using language and symbolic, formal, technical, and operation.

The statement is consistent with the study by Rusdiyana (2018), which suggests that the Missouri Mathematics Project (MMP) is a new and interesting learning model that can determine the success of a learning process. The effectiveness of the Missouri Mathematics Project (MMP) can be seen from its systematic learning model, which develops ideas and expands concepts in mathematics through structured exercises (Rahman & Nasryah, 2020). This is in line with the views of Ummah &

Sari (2018), who suggest that the Missouri Mathematics Project (MMP) is a learning model that supports teacher effectiveness in implementing mathematics exercises.

In addition to affecting students' mathematical literacy, the Missouri Mathematics Project (MMP) learning model also has an effect on students' mathematical problem solving. According to Nurussobah et al. (2021) in the Missouri Mathematics Project (MMP) learning model there is direction and guidance by the teacher so that students' ability to solve mathematical problems is increasingly trained. This is consistent with Harianda & Junedi (2021) which states that in the Missouri Mathematics Project (MMP) learning model there are controlled exercises both independently and in groups with various problem exercises so that students' ability to solve mathematical problems is increasingly honed. Rini & Purwanti (2021) stated that in improving students' mathematical solution skills, the Missouri Mathematics Project (MMP) learning model is considered better when compared to conventional learning models.

CONCLUSION

Based on the results and discussion that has been described, the following conclusions can be drawn. (1) Mathematical literacy is significantly influenced by the Missouri Mathematics Project (MMP) learning model and conventional learning models. The marginal average of the Missouri Mathematics Project (MMP) learning model is greater than the conventional learning model. So it can be said that the Missouri Mathematics Project (MMP) learning model is more effective than conventional learning models. (2) Self-efficacy has a significant effect on mathematical literacy. Compared to students in the medium and low self-efficacy categories, students in the high self-efficacy category have superior mathematical literacy abilities. Students in the moderate self-efficacy category have superior mathematical literacy abilities compared to students in the low self-efficacy category. So, it can be said that students' mathematical literacy is influenced by self-efficacy. (3) The interaction of different learning models and self-efficacy does not affect students' mathematical literacy skills. This means that both the conventional learning model and the Missouri Mathematics Project (MMP) learning model, students in the high self-efficacy category have superior mathematical literacy skills compared to students in the medium and low self-efficacy categories, and students in the moderate self-efficacy category have more mathematical literacy skills. superior compared to students in the low self-efficacy category. Besides being able to improve students' mathematical literacy abilities, the Missouri Mathematics Project (MMP) learning model can also improve students' mathematical problem solving abilities. This is because in the Missouri Marhaetics Project (MMP) learning model there are practice questions both independently and in groups that are guided and directed by the teacher so that students' mathematical problem solving abilities will continue to increase.

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