



## Implementation of Missouri Mathematics Project Learning Model on Mathematical Learning Achievement Reviewed From Prior Knowledge

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### ABSTRACT

This study aims to determine whether there are differences in mathematics learning achievement in students who use the Missouri Mathematics Project model and students who use the direct learning model in terms of initial abilities. The study population was conducted in class VII students of SMP Negeri 19 Tegal in the 2018/2019 school year. Sampling using cluster random sampling. Calculation of normality test, homogeneity, and one-way ANOVA test shows that the sample is normally distributed, homogeneous and has an equal sample. Before the hypothesis test, the hypothesis prerequisite test is normality and homogeneity. From the calculations, the samples are normally distributed and homogeneous. Testing continues using the RAK, from the statistical results, there are differences in mathematics learning achievement among students who are taught using the Missouri Mathematics Project model and students who use the direct learning model in terms of initial ability

Keywords: *Missouri Mathematics Project*, Prior Knowledge

### ABSTRAK

Penelitian ini bertujuan mengetahui apakah ada perbedaan prestasi belajar matematika pada siswa yang menggunakan model *Missouri Mathematics Project* dengan siswa yang menggunakan model pembelajaran langsung ditinjau dari kemampuan awal. Populasi penelitian dilakukan pada siswa kelas VII SMP Negeri 19 Kota Tegal tahun ajaran 2018/2019. Pengambilan sampel menggunakan *cluster random sampling*. Perhitungan uji normalitas, homogenitas, serta uji anava satu arah menunjukkan bahwa sampel berdistribusi normal, homogen serta memiliki sampel yang setara. Sebelum uji hipotesis maka dilakukan uji prasyarat hipotesis yaitu uji normalitas dan homogenitas. Dari perhitungan diperoleh sampel berdistribusi normal dan homogen. Pengujian dilanjutkan menggunakan RAK. Hasil statistic menunjukkan bahwa ada perbedaan prestasi belajar matematika pada siswa yang diajar menggunakan model *Missouri Mathematics Project* dengan siswa yang menggunakan model pembelajaran langsung ditinjau kemampuan awal

Kata kunci: *Missouri Mathematics Project*, kemamuan awal

### INTRODUCTION

The potential of human resources is one of the basic assets of national development, so that it can be extracted and developed effectively and directed (Faradhila, 2012). One effort that can create quality human resources is through education. According to the Minister of National Education Regulation No. 22/2006 explains that mathematics is a universal science that underlies



the development of modern technology, has an important role in the discipline, and advancing the power of human thought. As stated by Marliani (2015) that to advance science and technology is needed an understanding of mathematics from an early age.

Based on the results of an interview with Nurul Huda as a mathematics teacher at SMP Negeri 19 Tegal. Obtained information that, in the process of learning mathematics learning models used are direct learning models that are still centered on the teacher. In the learning process, it was obtained the fact that the results of the Final Examinations in the VII grade of the odd semester of the 2018/2019 school year were not satisfactory in mathematics because not a few grades were still below the Minimum Mastery Criteria. It proved that mathematics became one of the difficult subjects for students. The interview process also obtained information that students have difficulty with abstract material that requires visualization, such as geometry material. Entering the semester even quadrilateral material is one of the geometry material in junior high school in grade VII. On the quadrilateral material students only rely on the memorization of formulas and the lack of concepts of broad understanding and circumference of rectangles. So that not a few students who experience errors in placing the formula.

One of the efforts that can be done to improve mathematics learning achievement is the selection of appropriate learning models in student responses and provide opportunities for students to actively work on problems (Widodo, et al, 2018; Sumarni, et al, 2018). Students who master the concept can identify and work on more varied problems (Hamalik, 2008; Faroh, 2017). As formulated about the purpose of learning mathematics by the National Council of Teachers of Mathematics (2000) namely (1) learning to communicate (mathematical communication), (2) learning reasoning, (3) learning to solve problem problems, (4) learning to associate ideas, (5) ) the formation of a positive nature of mathematics. Based on the objectives of learning mathematics, the appropriate learning model is the Missouri Mathematics Project (Good & Grouws, 1979; Latifah & Madio, 2014).

Missouri Mathematics Project learning model contains five steps of learning, namely (1) Reviewing the material (daily review) the stage of reviewing the past material, what teachers and students have covered in the previous lesson, some things that need to be reviewed in this activity are apperception, motivation and lesson objectives (2) Development (development) The teacher presents new ideas and expansion of previous mathematical concepts. Students are told the learning objectives that have about the objectives of the lesson. (3) Controlled exercises or cooperative learning in this step student's work on exercises supervised by the teacher. Students are asked to respond to a series of questions in a group, while the teacher observes if a misconception occurs. (4) Self-training (Seatwork) Self-training phase (seatwork) students are asked to work on a series of questions in order to develop material by solving problems individually. (5) Assignments (homework assignment) at this stage the teacher gives assignments to students to be done at home (homework). This homework will then be a material for review in further learning (Isrok'atun, 2018; Siregar & Handayani, 2019; Dewi, Noornia, & Wiraningsih, 2018).

In addition to the learning model, solving problem problems also requires students' initial ability to become one of the internal factors that influence learning achievement, because the initial ability is a depiction of student readiness in following a lesson. The initial ability to provide instructions for students in remembering to improve knowledge and align new knowledge learned with prior knowledge (Van Blankenstain, Dolmans, Van der Vleuten & Schmidt 2013; Hati, Sapri, & Wasidi, 2019; Aprisal & Abadi,2018).

Based on research conducted by Suhandi (2017) in the study, completeness above KKM 75 exceeded 55%. Meanwhile, according to Marliani (2016) states that the Missouri Mathematics Project learning model influences the improvement of mathematical creative thinking abilities and can foster collaboration between students, so that the Missouri Mathematics Project model can improve mathematics learning achievement (Siregar & Handayani, 2019; Novalia, Makmuri, & Sudrajat, 2018). Based on the description that has been stated above, the researcher is interested in conducting research that is different from previous studies, namely to find out the success of the Missouri Mathematics Project model when learning is seen from the students' initial abilities.

## METHOD

This research uses a quantitative approach with a randomized group design. The author's research plan is summarized in table 1.

Tabel 1. Randomized Block Design

Learning Model (A)	<i>Missouri Mathematics Project</i> (A <sub>1</sub> )	direct learning model (A <sub>2</sub> )
Prior Knowledge (B)		
High (B <sub>1</sub> )	A <sub>1</sub> B <sub>1</sub>	A <sub>2</sub> B <sub>1</sub>
Low (B <sub>2</sub> )	A <sub>1</sub> B <sub>2</sub>	A <sub>2</sub> B <sub>2</sub>

Note:

A<sub>1</sub> B<sub>1</sub> : Student achievement with the Missouri Mathematics Project learning model at high initial ability

A<sub>2</sub> B<sub>1</sub> : Student achievement with direct learning models at high initial ability

A<sub>1</sub> B<sub>2</sub> : Student achievement with the Missouri Mathematics Project learning model at low initial ability

A<sub>2</sub> B<sub>2</sub> : Student achievement with a direct learning model at low initial ability.

The population of the study was 7 classes totaling 221 students. Consisting of the experimental class there were 64 students, the control class there were 62 students, and the test class there were 32 students. The study was conducted in class VII SMP Negeri 19 Tegal at odd semester in the 2018/2019 school year. The sampling technique used is Cluster Random Sampling. Sampling techniques in this area to determine the sample if the object under study or the source of data is very broad (Lestari & Yudhanegara, 2015). There are 5 classes that are sampled, they are Class VII B and F which are used for the experimental class using the Missouri Mathematics Project model, Class VII A and VII G are used for the control class by using direct learning and for Class VII C are used as an instrument test class.

The independent variables in this study are the Missouri Mathematics Project learning model and the direct learning model. Mathematics learning achievement is used as a dependent variable.

Meanwhile the moderator variable uses students' initial abilities. Research data sources in the form of tests, interviews, and documentation.

Data analysis techniques to test the mathematics learning achievement instruments include validity tests using the biserial point formula used for multiple-choice questions, reliability tests, difficulty level test and different power tests. The initial data analysis used is the normality test, homogeneity test and sample equality test, it aims to determine the students' initial ability before being given treatment. After getting the value of mathematics learning achievement, the data are analyzed for normality and homogeneity tests. In testing the hypothesis used a randomized group design test analysis to determine differences in treatment between groups.

## RESULT AND DISCUSSION

### Result

Table 2. The normality of a student's mathematics learning achievement test

	Variable	N	L <sub>count</sub>	L <sub>table</sub>	Conclusion
Missouri Mathematics Project	Low prior knowledge	32	0,1416	0,1566	Normal
	High prior knowledge	32	0,1405	0,1566	Normal
Direct Instruction	Low prior knowledge	31	0,1547	0,1591	Normal
	High prior knowledge	31	0,1316	0,1591	Normal

Before testing hypotheses, data normality tests are performed using the Liliefors test and homogeneity tests using the Bartlett test as a data analysis requirement, data are obtained from student achievement test scores. The summary results of the calculation of normality tests and homogeneity tests of the author's data are detailed in table 2.

Table 3. Homogeneity test results of mathematics learning achievement

$\chi^2_{count}$	$\chi^2_{table}$	Conclusion
5,5608	7,8147	Homogent

Based on calculations, it is known that the data on the learning achievement scores of quadrilateral in mathematics stated that the data is normally distributed and has the same variation. Then the test continued using the Random Design Group analysis of a 5% significance level. This research on the initial ability variable of the data is taken from the value before being given the Missouri Mathematics Project learning model treatment which is summarized in table 4.

Table 4. RAK analysis test results

Source	df	JK	RK	$F_{account}$	$F_{tabel}$	conclusion
Group	1	13619.841	13619.841	1809.301	161.4476	H <sub>0</sub> Rejected
Treatment	1	3471.333	3471.333	461.142	161.4476	H <sub>0</sub> Rejected
error 1	1	7.528	7.528	0.106	3.919	H <sub>0</sub> Accepted
error 2	122	8700.504	71.316			
Total	125	25799.206				

Based on calculations with the RAK test with a significance level of 5%, it is known that  $F_{count} = 461.142$  and  $F_{table} = 161.4476$  then obtained  $F_{count} > F_{table}$  namely  $161.44476 > 461.142$  so it can be concluded that there are differences in student achievement taught using the Missouri

Mathematics Project model and direct learning models in terms of the initial capabilities can be seen in table 5.

The average difference in mathematics learning achievement, wherein the experimental class was given the treatment of the Missouri Mathematics Project learning model reached an average of 79.5313. Whereas in the control class that was given the direct learning model treatment the average mathematics learning achievement only reached 69.0363. So it can be said that the mathematics learning achievement of students taught using the Missouri Mathematics Project learning model is higher than the mathematics learning achievement of students taught using the direct learning model.

Table 5. Mathematics Learning Achievement Data Description

Data	Group			
	Experiment		Control	
	High	Low	High	Low
Mean	89.6875	69.375	79.67742	58.3871
Median	85	75	80	60
Modus	85	75	90	65
Max	100	80	90	65
Min	80	45	65	45
Reach	20	35	25	20
Variance	64.4153	97.9839	79.8925	42.3118
St. Deviation	8.0259	9.8987	8.9383	6.5048
CV	0.0895	0.1427	0.1122	0.1114

## Discussion

Implementation of learning using different models produces differences in classroom conditions, learning in the experimental class applying the Missouri Mathematics Project model begins with (1) daily review that is reviewing past material, teachers and students what has been covered in previous lessons (2) development i.e. the teacher presents a new idea and an expansion of mathematical concepts (3) cooperative learning, namely students doing exercises supervised by teachers, students are asked to respond to a series of questions in a group (4) independent practice, namely students are asked to do a series of exercises to develop material by solving problems individually (5) homework is the assignment of a teacher to give assignments to students to do at home (homework). This homework will then be material for review in further learning.

Whereas the direct learning model has stages (1) orientation phase, namely the teacher provides the framework and objectives of the lesson (2) the presentation stage, namely the teacher can present the subject matter, either in the form of concepts or skills (3) guided exercises, namely the teacher plans and provides guidance to students to do the initial exercises (4) steps to check to understand and provide feedback (5) self-training namely students do the training activities independently and the teacher provides feedback for student success.

In this study the Missouri Mathematics Project learning process for students who have high initial ability tends to be more active in expressing new opinions or ideas compared to students who have the low initial ability. In addition, the Missouri Mathematics Project model provides an

opportunity for students who have high initial and low initial ability to actively practice the questions and train student cooperation and independence.

Meanwhile, the control class taught using the direct learning model begins with the teacher providing the subject matter along with solving the problem to students. Students who have a low initial ability in the learning process are less likely to respond to teacher questions and complain if given a new assignment or problem.

Before the mathematics learning achievement test is carried out, the test instrument is tested first in class VII C in order to know the appropriateness of the instrument when given in the experimental class and the control class. Furthermore, the researchers tested the instrument with several tests including the test of validity, reliability, different power and difficulty levels.

Based on the analysis of hypothesis test data it can be said that there are differences in mathematics learning achievement of students taught using the Missouri Mathematics Project model and students taught using the direct learning model. This is in line with research conducted by (Winardi & Dwijanto, 2017) that the Missouri Mathematics Project model is an alternative mathematical learning model that can encourage the ability to think creatively to increase student activity and improve student mathematics learning achievement.

Missouri Mathematics Project learning is given more practice exercises ranging from ordinary questions too difficult practice questions. In addition, in the Missouri Mathematics Project model there is a phase of training student collaboration in solving questions given by researchers. So students can get used to working on questions that aim to practice understanding of material, skills and group assignments.

This is also reinforced by research conducted by Suhandi (2017) entitled "Experimenting the Missouri Mathematics Project Learning Model with the Open-Ended Approach to Students' Mathematics Learning Achievement" from the results of the study concluded that the Missouri Mathematics Project is one of the learning models that can improve achievement student learning by combining independence and cooperation between groups.

Based on the experimental results of student achievement using the Missouri Mathematics Project model which has high initial ability shows higher average results than student achievement using the direct learning model. In the learning process of the Missouri Mathematics Project model students who have high initial abilities can practice thinking systematically and creatively in working on the questions given by the researcher. In addition, it can increase the level of mastery of students in understanding the material or ideas that are in the thinker.

The average value of students taught using the Missouri Mathematics Project model in terms of low initial ability is higher than students who are taught using the direct learning model in terms of low initial ability. Therefore, it can be said that student achievement using the Missouri Mathematics Project learning model is better than student learning achievement using a direct learning model in terms of low initial ability. This is reinforced because the Missouri Mathematics Project learning process has advantages according to Jannah & Ekana (2013), one of which is to train cooperation between students in cooperative work steps. Cooperative learning conducted in class aims to make students more active during the learning process, interact and be able to work

together with their respective groups, group learning also aims so that smart students can teach students who are less able to understand and work on the problems given by the teacher, so the process of learning how to group is one alternative in improving student learning achievement.

## CONCLUSION

Based on the calculation of the research hypothesis. So, there is a difference in students' mathematics learning achievement who are taught using the Missouri Mathematics Project model and students who are taught using the direct learning model in terms of initial ability. Based on this description it can be said that the Missouri Mathematics Project learning model is more effective when compared to the direct learning model.

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## DAFTAR PUSTAKA

- Aprisal, A., & Abadi, A. M. (2018). Improving students' mathematical reasoning and self-efficacy through Missouri mathematics project and problem-solving. *Beta: Jurnal Tadris Matematika*, 11(2), 191-208.
- Dewi, R. F. A., Noornia, A., & Wiraningsih, E. D. (2018). The Influence of Learning Model and Student Self-Concept Toward the Mathematical Problem-Solving Ability (Experimental Study on Students of Tangerang City State Junior High School). *Al-Jabar: Jurnal Pendidikan Matematika*, 9(2), 189-198.
- Faradhila, N., Sujadi, I., & Kuswardi, Y. (2013). Eksperimentasi Model Pembelajaran *Missouri Mathematics Project* (MMP) pada Materi Pokok Luas Permukaan Serta Volume Prisma dan Limas Ditinjau dari Kemampuan Spasial Siswa Kelas VIII Semester Genap SMP Negeri 2 Kartasura Tahun Ajaran 2011/2012. *Jurnal Pendidikan Matematika Solusi*, 1(1), 1-8.
- Faroh, N. (2017). Pemanfaatan TIK Guna Menunjang Karakter Kemandirian dan Pemecahan Masalah Matematika dengan Model MMP. *Zeta-Math Journal*, 3(1), 22-26.
- Good, T. L., & Grouws, D. A. (1979). The Missouri Mathematics Effectiveness Project: An experimental study in fourth-grade classrooms. *Journal of educational psychology*, 71(3), 355.
- Hamalik, O. 2003. *Proses Belajar Mengajar*. Jakarta: PT Bumi Akasara
- Hati, R., Sapri, J., & Wasidi, W. (2019). The Effect Of Missouri Mathematics Project Learning Model And Self Regulated Learning Toward Student Achievement. *Jurnal Ilmiah Teknologi Pendidikan*, 8(1), 34-47.
- Isrok'atun, A. R. (2018). *Model-Model Pembelajaran Matematika*. Jakarta: PT Bumi Aksara
- Jannah, M., & Ekana, H. (2013). Penerapan model missouri mathematics project (MMP) untuk meningkatkan pemahaman dan sikap positif siswa pada materi fungsi. *Jurnal pendidikan matematika solusi*, 1(1), 61-66.
- Latifah, D., & Madio, S. S. (2014). Meningkatkan Kemampuan Pemecahan Masalah Matematis Siswa Melalui Model Pembelajaran Missouri Mathematics Project (MMP). *Mosharafa: Jurnal Pendidikan Matematika*, 3(3), 159-168.
- Lestari, K. E., & Yudhanegara, M. R. (2015). Penelitian pendidikan matematika. *Bandung: PT Refika Aditama*.
- Marliani, N. (2015). Peningkatan Kemampuan Berpikir Kreatif Matematis Siswa Melalui Model Pembelajaran *Missouri Mathematics Project* (MMP). *Formatif: Jurnal Ilmiah Pendidikan MIPA*, 5(1)
- Novalia, R., Makmuri, M., & Sudrajat, A. (2018). Application of Type Cooperative Learning Models Missouri Mathematics Project (Mmp) to Increase Learning Results Math. *American Journal of Educational Research*, 6(8), 1085-1092.

- Siregar, M. A. P., & Handayani, A. T. 2019. Pengaruh Model Pembelajaran Missouri Mathematics Project Terhadap Pemahaman Matematis Mahasiswa. *Jurnal Matheducation Nusantara* Vol. 2 (2)
- Sumarni, S., Fatimah, S., Widodo, S., & Riyadi, M. (2018). Mathematics Content Knowledge Prospective Teachers Through Project-Based Learning Assisted By GeoGebra 5.0. In *Proceedings of the 1st International Conference on Science and Technology for an Internet of Things*. European Alliance for Innovation (EAI).
- Van Blankenstein, F. M., Dolmans, D. H., Van der Vleuten, C. P., & Schmidt, H. G. (2013). Relevant prior knowledge moderates the effect of elaboration during small group discussion on academic achievement. *Instructional Science*, 41(4), 729-744.
- Winardi, W., & Dwijanto, D. (2017). Analisis Kemampuan Literasi Matematika melalui Model Missouri Mathematics Project dengan Pendekatan Open-Ended. *Unnes Journal of Mathematics Education Research*, 6(2), 175-183.
- Widodo, S., Irfan, M., Leonard, L., Fitriyani, H., Perbowo, K., & Trisniawati, T. (2018). Visual Media in Team Accelerated Instruction to Improve Mathematical Problem-Solving Skill. In *Proceedings of the 1st International Conference on Science and Technology for an Internet of Things*. European Alliance for Innovation (EAI).