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Research Article

Examining the Effect of the Missouri Mathematics Project Learning Model on Junior High School Students' Learning Motivation

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ABSTRACT
This study examines the effect of the Missouri Mathematics Project (MMP) learning model on the mathematics learning motivation of seventh-grade students at SMP Negeri 1 Sedayu. A quasi-experimental method with a nonequivalent control group design was employed. The participants consisted of two classes: class VII B as the experimental group implementing the MMP model and class VII D as the control group receiving conventional instruction, involving 31 and 32 students respectively. Students' learning motivation was measured using a validated motivation questionnaire. Data were collected through pretest and posttest administrations and analyzed using the Shapiro–Wilk normality test, Levene's homogeneity test, paired sample t-test, and independent sample t-test at a 5% significance level. The results indicate that the Missouri Mathematics Project learning model did not produce a significant improvement in students' learning motivation. The experimental group showed no significant motivational gain after the intervention, while the control group demonstrated a higher increase in learning motivation through conventional instruction. Differences in learning motivation between groups were influenced by students' internal and external factors. These findings suggest that although the Missouri Mathematics Project effectively supports structured cognitive learning, it has not yet optimally addressed affective aspects such as learning motivation. Therefore, the integration of explicit motivational strategies is necessary to enhance students' engagement in mathematics learning.

Keywords: *Learning Motivation; Mathematics Learning; Missouri Mathematics Project; Quasi-Experimental Study; Secondary School Students.*

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1. Introduction

Mathematics education plays a fundamental role in developing students' logical, critical, and analytical thinking skills, which are essential for navigating the demands of an increasingly complex and technology-driven world (Arnidha & Fatahillah, 2021). As a core subject in formal education, mathematics equips students with problem-solving abilities that are applicable not only in academic contexts but also in everyday life and future professional settings. However, despite its strategic importance, mathematics is often perceived by students as a difficult and intimidating subject, which may hinder effective learning and engagement.

One of the contributing factors to this issue is the limited variation in instructional approaches that fail to accommodate students' diverse learning needs and experiences. Effective mathematics instruction should connect abstract concepts with real-life situations, enabling students to recognize the relevance and applicability of what they learn (Susanto, 2024; Siregar, 2024; Apriyanti et al., 2023). The use of appropriate instructional media and learning technologies can also support students in understanding abstract mathematical ideas more concretely. Beyond instructional techniques, strengthening students' learning motivation is a critical aspect of creating a positive classroom climate and encouraging active participation in mathematics learning (Intan et al., 2022).

Learning motivation is a key internal factor that drives students' engagement in the learning process and is shaped by both personal dispositions and environmental influences (Suud & Rivai, 2022). Motivation influences students' persistence, enthusiasm, and willingness to overcome learning challenges, and it is closely associated with academic performance (Nirtha et al., 2024). Teachers play a central role in fostering and sustaining students' motivation using varied instructional strategies and supportive classroom practices. Motivated students tend to demonstrate greater perseverance in completing tasks, higher self-confidence, and more consistent learning efforts. Conversely, declining motivation is often accompanied by reduced learning performance, underscoring the importance of creating learning environments that are both engaging and challenging (Pratama, 2024; Rahmiati & Azis, 2023).

Preliminary observations conducted at SMP Negeri 1 Sedayu indicate that students' learning motivation in mathematics remains relatively low. Based on the distribution of learning motivation questionnaires administered on April 29, 2024, to students in classes VII B and VII D, most students were categorized as having low to very low levels of learning motivation, particularly in class VII B. These findings are supported by classroom observations showing that many students display limited interest and initiative during mathematics lessons and tend to rely heavily on teacher explanations rather than actively exploring mathematical concepts independently. This condition suggests a need for instructional strategies that not only support cognitive understanding but also enhance students' motivation to learn mathematics.

The close relationship between education quality and learning motivation further emphasizes this need. High-quality instruction has the potential to increase students' motivation, while strong motivation can enhance the effectiveness of instructional practices. Supportive learning environments and engaging teaching approaches are essential for fostering students' internal drive to learn and encouraging active participation in classroom activities (Hariani, 2024; Utami et al., 2024). Educational practices that overlook motivational aspects are often less effective, highlighting the importance of integrating instructional strategies with efforts to strengthen students' motivation (Hanaris, 2023).

One instructional approach that has gained attention in mathematics education is the Missouri Mathematics Project learning model. This model is characterized by a structured and systematic sequence of learning stages, including review of prior knowledge, development of new concepts, guided practice, independent practice, and evaluation (Aufa et al., 2021). The Missouri Mathematics Project is designed to support students' gradual and in-depth understanding of mathematical concepts through consistent practice and reinforcement. Previous studies suggest that this model is effective in improving students' mathematical understanding and problem-solving skills at various educational levels (Daulay et al., 2024).

However, most previous studies on the Missouri Mathematics Project predominantly emphasize cognitive outcomes such as achievement, conceptual understanding, and problem-solving skills, while its impact on students' learning motivation has received comparatively less attention and shows inconsistent findings across different educational contexts.

Based on the issues identified, the preliminary findings at SMP Negeri 1 Sedayu, and the need to better understand the motivational impact of structured instructional models, this study aims to examine the effect of the Missouri Mathematics Project learning model on students' learning motivation. Specifically, the study seeks to determine whether there is an increase in students' learning motivation following the implementation of the Missouri Mathematics Project learning model and whether differences exist between students taught using the Missouri Mathematics Project model and those receiving conventional instruction. The findings of this study are expected to contribute to the development of more effective mathematics learning strategies that address both cognitive and motivational dimensions of student learning.

2. Literature Review

2.1 Learning Motivation in Mathematics Education

Learning motivation is a crucial affective component in mathematics education, as it influences students' engagement, persistence, and overall academic achievement. Motivation determines the extent to which students are willing to invest effort, maintain concentration, and overcome difficulties when learning mathematics. Research has consistently shown that students with higher learning motivation tend to demonstrate better learning outcomes and stronger academic performance compared to those with low motivation (Gahramanli, 2025; Safitri et al., 2024).

Motivation in learning mathematics is shaped by a complex interaction of internal and external factors. Internal factors include interest in mathematics, self-confidence, attitudes toward the subject, learning independence, emotional readiness, and personal academic goals (Ma, 2024; Aini et al., 2025). Interest plays a particularly important role, as students who perceive mathematics as meaningful and enjoyable are more likely to engage actively and persist in problem-solving activities. Conversely, low interest and negative attitudes toward mathematics are often associated with anxiety, avoidance behavior, and reduced learning effort (Campbell et al., 2025).

External factors also significantly influence students' learning motivation. These factors include family support, teaching methods, classroom climate, teacher–student relationships, and the availability of learning resources (Haerani et al., 2024; Zhang, 2025). Supportive learning environments and positive instructional practices can foster students' confidence and motivation, while unsupportive environments may weaken students' engagement. Therefore, motivation in mathematics learning should be understood as a dynamic construct that emerges from the interaction between students' internal dispositions and their learning contexts (Ma, 2024).

2.2 Missouri Mathematics Project as an Instructional Model

The Missouri Mathematics Project (MMP) is a structured instructional model designed to enhance students' understanding of mathematical concepts through systematic and sequential learning stages. The model typically consists of five stages: review of prior knowledge, development of new concepts, controlled practice, independent practice, and homework. These stages aim to guide students gradually from conceptual introduction to independent mastery, emphasizing practice and reinforcement throughout the learning process.

Previous empirical studies indicate that MMP is effective in improving various cognitive aspects of mathematics learning. Research has shown that students taught using MMP demonstrate better problem-solving abilities and mathematical reasoning than those taught using conventional instructional methods (Hidayah & Aulia, 2015; Fata et al., 2023). In addition, MMP has been reported to enhance students' conceptual understanding, creative mathematical thinking, and communication skills, which are essential for mastering complex mathematical topics (Tambunan & Tambunan, 2023; Apriyani, 2023; Syamsiah et al., 2024).

These findings suggest that the strength of MMP lies in its structured learning design, which supports cognitive engagement and systematic skill development. However, while MMP is widely recognized for its effectiveness in improving cognitive learning outcomes, evidence regarding its impact on affective outcomes, particularly learning motivation, remains inconclusive. Some studies report improvements in motivation, whereas others find no significant differences compared with conventional instruction, indicating that the motivational effects of MMP may depend on contextual factors and implementation strategies (Nurdiyanto et al., 2014; Pertiwi & Rosnawati, 2024).

2.3 Motivation, Affective Engagement, and Instructional Context

Recent research emphasizes the importance of affective engagement in mathematics learning, highlighting that motivation alone does not automatically translate into active engagement. Affective engagement encompasses students' emotional responses, interest, enjoyment, confidence, and sense of belonging during learning activities. According to dynamic models of learning motivation, affective factors such as self-efficacy and mathematics anxiety play a mediating role between motivation and engagement, influencing how students respond to instructional practices (Hu & Ma, 2022).

Teacher support and classroom climate are critical in fostering affective engagement. Emotional support, adaptive instruction, and constructive feedback provided by teachers have been shown to enhance students' interest and intrinsic motivation in mathematics (Hettinger et al., 2022; Zhang, 2025). Positive teacher–student relationships contribute to students' sense of security and belonging, which in turn supports sustained motivation and engagement (Guan et al., 2024). Instructional immediacy and affective teaching practices, such as empathy and positive reinforcement, further strengthen students' motivation and reduce negative classroom behaviors (Abu-Yaman & Shechtman, 2022).

While structured instructional models like MMP effectively promote cognitive engagement, they may not sufficiently address students' affective needs if emotional and relational aspects of learning are not explicitly considered. Conventional instruction, when accompanied by strong teacher guidance and affective reinforcement, may better support students' motivational needs, particularly for learners with low initial interest or confidence in mathematics. This suggests that instructional effectiveness depends not only on learning structure but also on the extent to which affective and motivational factors are integrated into classroom practice.

3. Method

This study employed a quasi-experimental research design using a nonequivalent control group design to examine the effect of the Missouri Mathematics Project (MMP) learning model on students' learning motivation. This design was selected because random assignment of participants was not feasible within the existing classroom structure, which is a common constraint in educational research settings.

The research was conducted at SMP Negeri 1 Sedayu during the even semester of the 2024/2025 academic year. The participants consisted of two intact seventh-grade classes. Class VII B (31 students) was assigned as the experimental group and received instruction using the Missouri Mathematics Project learning model, while class VII D (32 students) served as the control group and was taught using conventional teaching methods. Both classes were comparable in terms of curriculum coverage and learning objectives.

The implementation of the Missouri Mathematics Project learning model in the experimental group was carried out over four instructional meetings on the topic of Pythagorean theorem. The learning process followed the five structured stages of the MMP model, namely:

a) *review*, in which previous knowledge was recalled activating students' prior understanding.

b) *development*, where new mathematical concepts were introduced and explained.

c) *controlled practice*, involving guided exercises under teacher supervision.

d) *seatwork*, which required students to complete independent practice tasks; and

e) *homework*, designed to reinforce learning outside the classroom.

These stages were intended to promote gradual conceptual understanding and active student engagement, which were expected to support the development of learning motivation.

The primary instrument used in this study was a student learning motivation questionnaire, developed based on motivational learning indicators proposed by Vebrianto (2024). The questionnaire measured five dimensions of learning motivation: interest in learning, effort and perseverance, goal orientation, self-confidence, and active involvement. The instrument consisted of 20 items arranged on a five-point Likert scale, ranging from strongly disagree to strongly agree.

Prior to data collection, the questionnaire underwent validity and reliability testing. Item validity was examined using the product-moment correlation method with the assistance of SPSS for Windows. All items demonstrated correlation coefficients exceeding the critical value ($r_{table} = 0.36$), indicating that each item was valid. Reliability testing was conducted using Cronbach's Alpha, which yielded a coefficient within the acceptable range, indicating that the instrument had sufficient to high internal consistency for measuring students' learning motivation.

Data were collected through pretest and posttest questionnaires administered to both the experimental and control groups before and after the instructional treatment. The collected data were analyzed using parametric statistical procedures. Data normality was assessed using the Shapiro–Wilk test, while variance homogeneity was examined using Levene's Test. To determine changes in students' learning motivation within each group, a paired sample t-test was applied. Additionally, an independent sample t-test was conducted to compare posttest motivation scores between the experimental and control groups. All statistical analyses were performed at a 5% significance level ($\alpha = 0.05$).

4. Result

This section presents the statistical findings of the study regarding the effect of the Missouri Mathematics Project (MMP) learning model on students' learning motivation. The results are organized into two main subsections: Prerequisite Test and Influence Test.

1. Prerequisite Test

Prior to hypothesis testing, prerequisite analyses were conducted to ensure that the data met the assumptions required for parametric statistical analysis. These analyses included tests of normality and homogeneity of variance for both pretest and posttest data.

a. Normality Test

Data normality was examined using the Shapiro–Wilk test, as the number of participants in each group was fewer than 50. The results indicated that the significance values for both the experimental and control groups were greater than 0.05 for pretest and posttest scores. This finding demonstrates that the data were normally distributed (Table 1).

Table 1. Results of Shapiro–Wilk Normality Test

Data	Group	Sig.	Interpretation
Pretest	Experimental	0.128	Normal
	Control	0.262	Normal
Posttest	Experimental	0.640	Normal
	Control	0.198	Normal

Source: Primary data, 2025.

b. Homogeneity Test

The homogeneity of variance between the experimental and control groups was tested using Levene's Test. The results showed that the posttest data met the homogeneity assumption (Sig. = 0.050), indicating that the variances between groups were sufficiently equal. Therefore, the data were appropriate for further parametric testing (Table 2).

Table 2. Results of Homogeneity Test (Levene's Test)

Data	F	Sig.	Interpretation
Pretest	9.959	0.003	Not homogeneous
Posttest	4.019	0.050	Homogeneous

Source: Primary data, 2025.

Based on the results of the normality and homogeneity tests, it was concluded that the posttest data satisfied the assumptions for parametric analysis.

2. Influence Test

To examine the influence of the Missouri Mathematics Project learning model on students' learning motivation, paired sample t-tests and an independent sample t-test were conducted. In addition, a mean difference analysis was performed to compare the magnitude of change between groups.

a. Paired Sample t-Test

The paired sample t-test was used to analyze changes in learning motivation within each group. For the experimental group, the results indicated no statistically significant difference between pretest and posttest scores (Sig. = 0.082 > 0.05), suggesting that the application of the Missouri Mathematics Project learning model did not significantly increase students' learning motivation (Table 3).

Table 3. Paired Sample t-Test Results for Experimental Group

Comparison	Mean Difference	t	df	Sig.
Pretest–Posttest	-2.037	-1.810	26	0.082

Source: Primary data, 2025.

For the control group, the paired sample t-test showed a statistically significant increase in learning motivation after conventional instruction (Sig. = 0.000 < 0.05), as presented in Table 4.

Table 4. Paired Sample t-Test Results for Control Group

Comparison	Mean Difference	t	df	Sig.
Pretest–Posttest	-6.714	-6.114	27	0.000

Source: Primary data, 2025.

b. Independent Sample t-Test

An independent sample t-test was conducted to compare posttest learning motivation scores between the experimental and control groups. The results revealed a statistically significant difference between the two groups (Sig. = 0.001 < 0.05), indicating that students in the control group demonstrated higher motivation scores than those in the experimental group (Table 5).

Table 5. Independent Sample t-Test Results

Test	t	df	Sig. (2-tailed)
Equal variances assumed	3.375	53	0.001

Source: Primary data, 2025.

c. Mean Difference Analysis

To illustrate the magnitude of improvement in learning motivation, a comparison of mean pretest and posttest scores was conducted. The control group showed a higher average increase (6.72 points) compared to the experimental group (2.04 points), as shown in Table 6.

Table 6. Comparison of Mean Pretest and Posttest Scores

Group	Pretest	Posttest	Improvement
Control	76.32	83.04	6.72
Experimental	75.33	77.37	2.04

Source: Primary data, 2025.

5. Discussion

This study examined the effectiveness of the Missouri Mathematics Project learning model in enhancing students' motivation to learn mathematics. The findings indicate that while the model contributes positively to cognitive learning outcomes, its impact on learning motivation is less pronounced when compared with conventional instruction. This section discusses the results by situating them within relevant theoretical perspectives and previous empirical studies, with particular attention to the distinction between cognitive and affective learning outcomes, as well as the role of contextual and motivational factors influencing students' engagement in mathematics learning.

5.1 Effectiveness of the Missouri Mathematics Project on Learning Outcomes

The findings of this study indicate that the Missouri Mathematics Project learning model demonstrates stronger effectiveness in improving cognitive aspects of mathematics learning than in enhancing students' learning motivation. Previous studies consistently report that MMP contributes positively to students' mathematical problem-solving ability, reasoning, conceptual understanding, and communication skills (Hidayah & Aulia, 2015; Fata et al., 2023; Tambunan & Tambunan, 2023; Apriyani, 2023). The structured stages of MMP, including guided practice and independent work, support students' gradual understanding of mathematical concepts and foster higher-order thinking skills such as creative and critical thinking (Syamsiah et al., 2024; Suri et al., 2024). These findings suggest that MMP is particularly effective for strengthening cognitive learning outcomes, even though such improvements do not necessarily translate into increased motivation.

5.2 MMP and Student Motivation

Despite its cognitive benefits, the impact of MMP on students' learning motivation appears to be limited. The results of this study align with prior research showing that MMP does not consistently lead to significant motivational gains when compared with conventional instruction (Nurdiyanto et al., 2014; Pertiwi & Rosnawati, 2024). This outcome may be explained by the model's emphasis on structured procedures, which may not sufficiently stimulate students' intrinsic interest or emotional engagement, particularly among learners who initially exhibit low motivation or negative perceptions toward mathematics (Campbell et al., 2025; Ma, 2024). Research on motivational dynamics also indicates that affective factors often mediate the relationship between instructional design and student engagement, meaning that structured learning alone may be insufficient to enhance motivation without affective reinforcement (Hu & Ma, 2022).

5.3 Role of Internal and External Factors in Learning Motivation

Learning motivation is a complex construct shaped by the interaction of internal and external factors. Internal factors such as interest in mathematics, self-confidence, attitudes toward the subject, learning independence, and emotional readiness strongly influence students' engagement and persistence in learning activities (Aini et al., 2025; Campbell et al., 2025). At the same time, external factors including family support, teacher–student relationships, instructional strategies, and classroom climate play a crucial role in sustaining motivation and shaping students' learning experiences (Haerani et al., 2024; Guan et al., 2024; Zhang, 2025). Motivation has also been shown to be closely associated with academic achievement, as motivated students tend to invest greater effort and demonstrate stronger perseverance in learning tasks (Gahramanli, 2025; Safitri et al., 2024). These findings suggest that the limited motivational impact of MMP in this study may reflect broader contextual influences rather than shortcomings of the model itself.

5.4 Implications for Instructional Practice

The findings of this study highlight that instructional models effective in improving cognitive outcomes do not automatically enhance affective outcomes such as learning motivation. Conventional instruction, when supported by strong teacher guidance, emotional support, and positive reinforcement, may better address students' motivational needs, particularly for learners with low initial confidence or interest in mathematics (Abu-Yaman & Shechtman, 2022; Lecias, 2025; Yuhe & Bhaumik, 2025). Therefore, the

Missouri Mathematics Project may need to be complemented with explicit motivational strategies, such as contextualized learning activities, interactive media, game elements, and positive feedback, to strengthen students' affective engagement (Huber et al., 2024; Sanatang et al., 2024). Integrating motivational interventions into MMP has also been shown to enhance learning outcomes, although effectiveness may vary depending on student characteristics and classroom context (Pratikno & Dewanti, 2014; Ju et al., 2024). A balanced instructional approach that combines structured learning models with motivational supports is therefore essential to address both cognitive and affective dimensions of mathematics learning.

6. Conclusion

This study concludes that the Missouri Mathematics Project (MMP) learning model is effective in supporting students' cognitive development in mathematics, particularly in enhancing conceptual understanding, problem-solving ability, and structured thinking processes. However, its impact on students' learning motivation is not significantly stronger than that of conventional instruction. These findings indicate that improvements in cognitive learning outcomes do not automatically lead to parallel gains in affective outcomes such as motivation.

The limited motivational impact of MMP highlights the importance of integrating affective and motivational considerations into the design and implementation of mathematics learning models. While MMP provides a clear and systematic instructional structure, it may not sufficiently address students' emotional engagement, intrinsic interest, and confidence, especially for learners with low initial motivation. This suggests that structured instructional models need to be complemented with explicit motivational strategies, including emotional support, contextualized learning activities, interactive media, and positive reinforcement.

From a broader perspective, the findings imply that the development of effective mathematics learning models should balance cognitive rigor with affective responsiveness. Teachers and curriculum designers are encouraged to adapt structured models such as MMP by embedding motivational elements that align with students' characteristics and classroom contexts. By integrating cognitive and affective dimensions, mathematics instruction can become not only more academically effective but also more engaging and meaningful for students, thereby supporting sustainable learning outcomes.

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