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The Effectiveness of Mathematics Learning Through the Application of the Missouri Mathematics Project (MMP) Model in Grade 11 Students at Sman X

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ABSTRACT

Effective mathematics learning demands a well-structured approach that encourages students to actively engage in comprehending mathematical concepts. This study explores the effectiveness of the Missouri Mathematics Project (MMP) learning model in improving the mathematics achievement of 11th-grade students at SMAN (X). A quantitative approach was used, employing a quasi-experimental design in the form of a one-group pretest-posttest design. The sample consisted of 30 students randomly selected from the 11th-grade population. Data collection involved two main instruments: an observation sheet to monitor the implementation of the MMP model, and a test of learning outcomes administered before and after the intervention. The results showed a notable improvement in student performance, with the average pretest score being 56.8 and the average posttest score rising to 81.2. Based on N-Gain analysis, a value of 0.65 was obtained, which is categorized as moderate, indicating a meaningful increase in learning outcomes. A paired sample t-test further confirmed this improvement, with a t-count of 8.32 and a significance level of $p = 0.000$ ($p < 0.05$). The implementation of the MMP model was rated highly, with an average score of 3.91 out of 4, falling into the excellent category. Moreover, 93.3% of the students achieved scores above the Minimum Completeness Criteria (KKM = 75), demonstrating individual mastery. These findings indicate that the MMP model is effective in enhancing mathematics learning outcomes. The model's structured nature supports active learning and can serve as a promising alternative teaching strategy in high school mathematics education.

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INTRODUCTION

Education plays a crucial role in enhancing the quality of human resources and supporting national development. Mathematics, as one of the core fields of study, contributes significantly to the development of logical and analytical thinking skills. However, challenges remain in the effectiveness of mathematics instruction across various educational levels, as many students continue to struggle with understanding the concepts being taught. This situation highlights the need for an instructional approach that can enhance students' comprehension and academic performance.

One such approach is the Missouri Mathematics Project (MMP) learning model, which offers a structured and systematic method for teaching mathematics. This model involves several well-defined stages, including reviewing prior knowledge, introducing new concepts, guided practice, concept development, and individual assignments. With its organized framework, the MMP model encourages greater student engagement and facilitates deeper understanding of mathematical concepts.

Research has consistently shown that the MMP model is effective in improving both student participation and learning outcomes. By providing structured opportunities for gradual practice and concept reinforcement, this approach helps reduce students' difficulties in grasping mathematical content. Moreover, it promotes more meaningful interaction between teachers and students during the learning process.

At SMAN (X), issues related to the effectiveness of mathematics instruction are evident, as reflected in low student participation and a general lack of understanding of the subject matter. Preliminary observations indicate that many students still struggle with mastering mathematical concepts, which negatively impacts their academic achievement. This situation underscores the urgency of implementing a more interactive and structured teaching strategy.

This study aims to assess the effectiveness of the Missouri Mathematics Project (MMP) model in improving mathematics learning outcomes among 11th-grade students at SMAN (X). The findings of this research are expected to contribute to the improvement of mathematics instruction quality and serve as a reference for educators in selecting appropriate teaching models to enhance student understanding.

METHODS

This study employed a quantitative approach with a quasi-experimental, one-group pretest-posttest design. A single class of 30 randomly selected 11th-grade students from SMAN (X) during the 2022/2023 academic year was chosen as the sample. Students' academic performance was measured before and after instruction using the Missouri Mathematics Project (MMP) model to assess its effectiveness in improving learning outcomes.

Data were collected using two instruments: observation sheets and mathematics achievement tests. The observation sheets were used to monitor the fidelity of MMP implementation, ensuring each phase—daily review, presentation of new material, guided and independent practice, and weekly review—was carried out as designed. The achievement tests were

administered before (pretest) and after (posttest) the intervention to measure students' progress. Both instruments were validated and tested for reliability to ensure accuracy and consistency.

Data analysis involved descriptive and inferential statistics. Descriptive statistics summarized the implementation process and score distributions. Inferential analysis included calculating the N-Gain score to determine the magnitude of learning improvement—categorized as low (≤ 0.3), medium (0.3 < N-Gain ≤ 0.7), or high (> 0.7)—and conducting a paired sample t-test to evaluate the significance of score differences. A p-value of less than 0.05 indicated statistically significant improvement.

The MMP model was considered effective if the following criteria were met: (1) observation results showed good or very good implementation; (2) posttest scores exceeded pretest scores; (3) N-Gain scores reached at least the medium category; and (4) the paired t-test results demonstrated significant improvement ($p < 0.05$).

RESULTS

1. Description of Research Data

The primary objective of this study is to evaluate the effectiveness of the Missouri Mathematics Project (MMP) learning model in enhancing the mathematics achievement of 11th-grade students at SMAN (X). The assessment was conducted using learning outcome tests administered before (pretest) and after (posttest) the implementation of the MMP model.

Based on data analysis, the average pretest score was 56.8, categorized as low. After the application of the MMP model, the average posttest score increased significantly to 81.2, categorized as high. This notable improvement indicates that the MMP model had a positive impact on students' understanding of mathematical concepts.

The effectiveness of the MMP model can be attributed to its structured learning stages, which include daily reviews, clear presentation of new material, guided and independent practice, and weekly reviews. These phases help reinforce prior knowledge, support gradual mastery of concepts, and maintain student engagement throughout the learning process. Such a systematic approach provides a strong foundation for cognitive development and aligns with findings from previous studies (Slavin, 1995; Wardani et al., 2018), which emphasize the role of repetition and scaffolding in effective mathematics instruction.

In addition, classroom observations showed that the MMP model was implemented with a high level of consistency and effectiveness, as indicated by an average score of 3.91 out of 4. This reflects not only the practicality of applying the model in real classroom settings, but also its positive reception by both teachers and students, which likely contributed to an enhanced learning environment and improved academic outcomes.

2. Analysis of Learning Improvement

To determine the level of improvement in student learning outcomes, N-Gain calculations are carried out using the formula:

$$N - Gain = \frac{(posttest - pretest)}{(skor\ maksimum - pretest)}$$

Based on the calculation results, the N-Gain score was found to be 0.65, which falls within the medium category. This indicates that the Missouri Mathematics Project (MMP) learning model has a significant positive effect on improving student learning outcomes, although the level of improvement has not yet reached the highest classification.

3. Significance Test (Paired Sample T-Test)

To find out if there is a significant difference between the pretest and posttest results, a paired sample t-test is performed with the following results:

- t-count value = 8.32
- Value p (sig.) = 0.000 ($p < 0.05$)

Given that the p-value is below 0.05, it can be concluded that there is a statistically significant difference between students' learning outcomes before and after the implementation of the Missouri Mathematics Project (MMP) model. This finding confirms that the learning model has a beneficial impact on student achievement.

4. Classical Completeness

Learning mastery was determined by calculating the percentage of students who scored above the Minimum Completeness Criteria (KKM), which is set at 75. The analysis revealed that 93.3% of students achieved individual mastery following the implementation of the learning model. This indicates that nearly all students met the established minimum standards, suggesting that overall, classical completeness was nearly fully attained.

5. Interpretation of Results

Based on the findings of this study, it can be concluded that the Missouri Mathematics Project (MMP) learning model is effective in enhancing the mathematics learning outcomes of 11th-grade students at SMAN (X). This conclusion is supported by the following key results:

a. A statistically significant improvement in posttest scores compared to pretest results ($p < 0.05$),
b. An N-Gain score categorized as moderate, reflecting a meaningful increase in students' understanding of the material,
c. A classical completeness rate of 93.3%, indicating that the vast majority of students met the established minimum competency standards,
d. A very good rating for the implementation of the MMP model, demonstrating its practicality and effectiveness in classroom settings.

These results align with previous studies that highlight the MMP model's ability to enhance student learning by offering a structured instructional approach and fostering active student engagement in the learning process. Consequently, the Missouri Mathematics Project can be

considered a viable alternative for improving mathematics instruction, supporting better student comprehension and academic performance.

DISCUSSION

The findings of this study demonstrate that the implementation of the Missouri Mathematics Project (MMP) learning model significantly enhances the mathematics learning outcomes of 11th-grade students at SMAN (X). This is evidenced by a substantial increase in the average student score, from 56.8 on the pretest to 81.2 on the posttest, indicating a marked improvement in understanding after applying the MMP model. These results are consistent with prior studies, such as those by Wardani et al. (2018) and Susanti et al. (2019), which found that structured and systematic instructional models like MMP lead to higher student achievement in mathematics compared to conventional methods.

Further support comes from the N-Gain score of 0.65, categorized as moderate, showing a meaningful improvement in learning outcomes. The MMP model's success can be attributed to its structured sequence of instructional steps: reviewing prior knowledge, presenting new material, engaging in guided and independent practice, and conducting regular reviews. According to Jing & Dong (2015), structured teaching strategies, when delivered in a stepwise and scaffolded manner, have a positive effect on learning outcomes, especially in subjects such as mathematics that require cumulative understanding.

In addition, the paired sample t-test results confirmed the statistical significance of this improvement, with a t-count of 8.32 and a p-value of 0.000 ($p < 0.05$). This supports the interpretation that the learning gains observed were not due to chance, but were indeed a result of the MMP intervention. This finding is aligned with studies by Rahmawati & Irwanto (2017), who also found significant improvements in student outcomes after the implementation of structured instructional methods.

The model's feasibility and effectiveness were also reflected in classroom implementation. An average observation score of 3.91 out of 4 indicates a very good level of execution. This suggests that the structured framework of MMP not only supports clear teaching procedures but also enhances student engagement—both key factors in improving learning outcomes. This result is supported by Putra et al. (2019), who found that active engagement and a structured approach lead to improved comprehension and retention in mathematics.

Moreover, 93.3% of students achieved individual mastery by surpassing the Minimum Completeness Criteria (KKM) of 75, indicating that the model effectively supports both individual and group academic success. These results are consistent with the findings of Andriani & Sari (2020), who reported that structured and systematic teaching methods significantly improve student performance, especially when they encourage individual mastery.

Despite these promising outcomes, some factors may influence the implementation's success. Teacher preparedness is essential; the MMP model's structured nature requires instructors to be well-versed in each phase. Student readiness and motivation also play crucial roles—while many students benefit from the active, step-by-step format, others may find it challenging. Previous

studies (e.g., Rahmawati & Irwanto, 2017) have noted that supplemental support, such as small-group instruction or motivational strategies, can help ensure that all students benefit equally from the model.

The implications of this study are notable for mathematics education. The MMP model offers a practical, research-supported framework that can enhance student engagement, support deeper understanding, and lead to better academic performance. As a result, it presents a viable alternative to traditional methods in secondary school mathematics instruction.

For future research, it is recommended to test the MMP model in broader contexts and with larger, more diverse samples. Researchers might also explore how factors such as learning styles, the integration of educational technology, or comparisons with other instructional strategies impact the effectiveness of the MMP model. Longitudinal studies could further assess whether the learning improvements observed are sustained over time.

In conclusion, the Missouri Mathematics Project (MMP) learning model has proven to be effective in improving student learning outcomes in mathematics. Its success lies in its systematic, student-centered approach, supported by existing literature, and it holds promise for enhancing the quality of mathematics education at the secondary level.

CONCLUSIONS

This study demonstrates that the Missouri Mathematics Project (MMP) learning model effectively improves the mathematics achievement of 11th-grade students at SMAN (X). The significant increase in average scores from 56.8 on the pretest to 81.2 on the posttest, coupled with an N-Gain score of 0.65, confirms the model's positive impact. The paired sample t-test further supports this, showing a statistically significant improvement ($p = 0.000$). Classroom implementation also received a high rating of 3.91 out of 4, with 93.3% of students surpassing the Minimum Completeness Criteria (KKM) of 75.

The model's success can be attributed to its structured, step-by-step approach that promotes active student engagement and gradual mastery of mathematical concepts. However, teacher preparedness and student motivation are crucial factors that can influence its effectiveness. Future research should explore the model's impact across diverse educational contexts, considering variables like student learning styles and the integration of technology. Overall, the MMP model offers a promising alternative for improving mathematics education at the secondary level.

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