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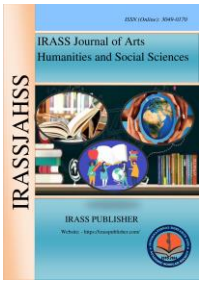

The Effectiveness of Mathematics Journals in improving the Mathematics Performance of Junior High School Students in TUMU

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Abstract: This study investigates the effectiveness of mathematics journals in improving the mathematics performance of Junior High School (JHS) students. A quasi-experimental design with a pretest-posttest control group approach was used, involving 60 students from two JHS classes. The experimental group used mathematics journals, while the control group received traditional instruction. Data were collected through pretest and posttest scores, analysis of journal entries, a survey questionnaire, and teacher observations. The results indicated that students in the experimental group showed significant improvements in problem-solving skills, conceptual understanding, and overall academic performance compared to the control group. The findings suggest that mathematics journals serve as an effective tool for enhancing students' engagement and learning outcomes in mathematics. Based on these results, it is recommended that mathematics educators incorporate journal writing into their teaching strategies to foster deeper understanding and improve performance.

Keywords: Mathematics journals, Junior High School students, academic performance, effectiveness.

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Introduction

Mathematics is a fundamental subject that plays a crucial role in developing logical reasoning, problem-solving skills, and analytical thinking among students. However, many Junior High School (JHS) students struggle with mathematics, leading to concerns about their academic performance (Mullis & Martin, 2017). One instructional strategy that has gained attention is the use of mathematics journals, which encourage students to reflect on their learning, articulate their thought processes, and enhance their conceptual understanding (Powell, 2018).

A mathematics journal is a student-centered tool that allows learners to document their problem-solving approaches, mathematical reasoning, and reflections on their learning experiences. Research suggests that writing about mathematics can improve comprehension, boost confidence, and reinforce learning (Borasi & Rose, 2017). By engaging in journal writing, students not only develop a deeper understanding of mathematical concepts but also improve their ability to communicate mathematical ideas effectively (McCormick & Lucas, 2020).

Mathematics performance among JHS students has been a subject of global concern. Studies have shown that many students struggle with understanding mathematical concepts, leading to low achievement levels (Organisation for Economic Co-operation and Development [OECD], 2019). Several instructional approaches have been introduced to address this issue, with mathematics journals emerging as a promising tool for enhancing learning outcomes (Pugalee, 2004). The practice of journal writing in mathematics is rooted in the constructivist learning theory, which emphasizes active engagement and self-reflection as essential components of knowledge construction (Vygotsky, 1978).

The effectiveness of mathematics journals has been supported by empirical studies. For instance, Powell (2018) found that students who consistently used mathematics journals demonstrated improved problem-solving abilities and higher test scores compared to those who did not. Similarly, Chapman (2016) observed that journal writing helped students articulate their understanding of mathematical concepts, leading to enhanced critical thinking skills. Furthermore, Pugalee (2004) highlighted that the process of writing in mathematics fosters metacognition, enabling students to evaluate their learning strategies and identify areas for improvement.

Given these findings, this study aims to explore the effectiveness of mathematics journals in improving the mathematics performance of JHS students. Specifically, it seeks to examine the impact of journal writing on students' problem-solving skills, conceptual understanding, and overall achievement in mathematics.

Statement of the Problem

Mathematics performance among Junior High School (JHS) students remains a pressing concern worldwide, as many students struggle with conceptual understanding, problem-solving skills, and mathematical reasoning (Mullis & Martin, 2017). Traditional teaching methods often focus on rote memorization rather than fostering deeper comprehension, which can lead to difficulties in applying mathematical concepts to real-world situations (OECD, 2019). To address these challenges, educators have explored alternative instructional strategies, such as the use of mathematics journals, which encourage students to articulate their thought processes, reflect on problem-solving approaches, and develop metacognitive skills (Powell, 2018).

Several studies have suggested that incorporating journal writing in mathematics can lead to improved academic performance by enhancing students' ability to express their mathematical reasoning, identify errors, and reinforce learning (Borasi & Rose, 2017; Pugalee, 2004). However, despite these potential benefits, the extent to which mathematics journals effectively contribute to student performance, particularly among JHS students, remains an area that requires further empirical investigation. Specifically, there is a need to determine whether the use of mathematics journals significantly impacts students' problem-solving abilities, conceptual understanding, and overall achievement in the subject.

Purpose of the study

This study seeks to examine the effectiveness of mathematics journals in improving the mathematics performance of JHS students. This study aims to provide valuable insights into the role of journal writing as a pedagogical tool in mathematics education.

Research Questions

This study seeks to examine the effectiveness of mathematics journals in improving the mathematics performance of JHS students. Specifically, it aims to address the following research questions:

- How does the use of mathematics journals influence students' problem-solving skills?
- To what extent does journal writing enhance students' conceptual understanding of mathematical concepts?
- What is the overall impact of mathematics journal writing on students' academic performance in mathematics?

Literature Review

The use of mathematics journals as an instructional tool has gained attention in recent years due to its potential to enhance students' understanding and performance in mathematics. Journal writing encourages students to articulate their mathematical reasoning, reflect on problem-solving strategies, and develop metacognitive skills (Powell, 2018). This section reviews relevant literature on the role of mathematics journals in improving students' mathematics performance, focusing on their impact on problem-solving skills, conceptual understanding, and academic achievement.

Mathematics Journals and Problem-Solving Skills

One of the key benefits of mathematics journals is their ability to enhance students' problem-solving skills. Research suggests that journal writing allows students to analyze problems systematically, record their thought processes, and refine their strategies (Pugalee, 2004). Pugalee's study found that students who engaged in regular mathematics journaling demonstrated greater clarity in their problem-solving approaches compared to those who did not. Similarly, Chapman (2016) observed that journal writing encouraged students to critically evaluate their solutions, leading to improved accuracy and efficiency in solving mathematical problems.

In addition, mathematics journals provide students with opportunities to express their reasoning in written form, which can help identify misconceptions and gaps in understanding. According to Borasi and Rose (2017), students who wrote about their mathematical thinking were more likely to recognize and correct errors in their reasoning, ultimately leading to improved problem-solving skills. This finding aligns with Vygotsky's (1978) constructivist learning theory, which emphasizes the importance of self-reflection and communication in the learning process.

Mathematics Journals and Conceptual Understanding

Beyond problem-solving, journal writing has been shown to deepen students' conceptual understanding of mathematics. Research indicates that when students write about mathematical concepts, they engage in higher-order thinking processes that promote comprehension and retention (McCormick & Lucas, 2020). Powell (2018) found that students who used mathematics journals demonstrated a more thorough understanding of mathematical concepts because they were required to explain their reasoning, justify their solutions, and make connections between different topics.

Furthermore, journal writing can help students develop confidence in mathematics by providing a low-stakes environment where they can express their thoughts without the pressure of being evaluated (Borasi & Rose, 2017). This reflective practice enables students to take ownership of their learning and become more active participants in the learning process.

Impact of Mathematics Journals on Academic Performance

Several empirical studies have examined the overall impact of mathematics journals on students' academic performance. According to Mullis and Martin (2017), students who engaged in written reflections on mathematical problems outperformed their peers in standardized assessments. Their findings suggest that journaling serves as an effective tool for reinforcing mathematical concepts and improving test performance.

Additionally, Powell (2018) reported that students who maintained mathematics journals achieved higher scores in mathematics compared to those who relied solely on traditional instructional methods. The study highlighted that journal writing not only enhances conceptual understanding but also helps students retain information over time.

Challenges and Considerations

While the benefits of mathematics journals are well-documented, some challenges exist in their implementation. Teachers may face difficulties in assessing journal entries effectively, as students' writing skills can vary significantly (Chapman, 2016). Moreover, some students may initially struggle with articulating their mathematical thinking in written form, requiring guidance and scaffolding from educators (Pugalee, 2004).

Despite these challenges, the growing body of research supports the integration of journal writing in mathematics instruction as a means of enhancing student engagement, problem-solving skills, and academic performance. By incorporating reflective writing into mathematics education, educators can provide students with valuable opportunities to deepen their understanding and become more confident in their mathematical abilities.

Conclusion

The literature reviewed highlights the effectiveness of mathematics journals in improving Junior High School students' performance in mathematics. Research supports the notion that journal writing enhances problem-solving skills, fosters conceptual understanding, and contributes to overall academic achievement. While challenges exist in implementation, the benefits of incorporating mathematics journals into instruction far outweigh the drawbacks. As educators seek strategies to improve mathematics education, mathematics journals present a promising approach that aligns with constructivist principles and promotes active learning.

Research Design

This study employs a **quasi-experimental research design** to examine the effectiveness of mathematics journals in improving the mathematics performance of Junior High School (JHS) students. Specifically, a **pretest-posttest control group design** will be used, where one group of students (experimental group) will utilize mathematics journals as part of their learning process, while another group (control group) will receive traditional instruction without journal writing. This design allows for a comparison of students' performance before and after the intervention, helping to determine the impact of mathematics journals on learning outcomes (Creswell, 2014).

Research Instrument

The study will utilize the following research instruments:

- **Mathematics Achievement Test (MAT):** A standardized test will be administered as a pretest and posttest to measure students' mathematical performance. The test will assess problem-solving skills, conceptual understanding, and application of mathematical concepts.
- **Mathematics Journal Entries:** The experimental group will maintain mathematics journals throughout the study. These journals will be analyzed to evaluate students' written reflections, problem-solving strategies, and conceptual understanding.
- **Survey Questionnaire:** A structured questionnaire will be used to gather students' perceptions of journal writing and its impact on their learning.
- **Teacher Observation Checklist:** Teachers will use a checklist to record students' engagement, participation, and attitudes toward mathematics during the study.

Population, Sampling Procedure, and Sample

The population of this study consists of Junior High School (JHS) students from selected schools. A purposive sampling technique was used to select two comparable JHS classes from the same grade level.

Sample Size

A total of 60 students will be selected, with 30 students in the experimental group (who will use mathematics journals) and 30 students in the control group (who will follow traditional instruction). Students should be currently enrolled in JHS mathematics classes and must have no prior experience using mathematics journals. Students with learning disabilities that significantly impact writing skills will be excluded to ensure consistency in the study's implementation.

Data Collection Procedure

The data collection will take place over eight weeks and will follow these steps: The Mathematics Achievement Test (MAT) will be administered to both groups at the beginning of the study.

Intervention Phase:

The experimental group will maintain mathematics journals, writing reflections on their problem-solving approaches and mathematical understanding after each lesson. The control group will receive traditional mathematics instruction without journal writing. Teachers will monitor students' engagement and participation using the observation checklist. At the end of the intervention, students in the experimental group will complete a survey about their experiences using mathematics journals. The MAT will be re-administered to both groups to measure any changes in mathematics performance. The journals from the experimental group will be analyzed for evidence of improvement in problem-solving and conceptual understanding.

Data Analysis

The collected data will be analyzed using both quantitative and qualitative methods: A paired sample t-test will be used to determine if there is a significant improvement in the mathematics performance of students in each group. Additionally, an independent sample t-test will compare the mean scores between the experimental and control groups to evaluate the impact of mathematics journals. A qualitative content analysis will be conducted to examine patterns in students' reflections, problem-solving strategies, and conceptual understanding. Descriptive statistics (mean, frequency, percentage) will be used to analyze students' perceptions of journal writing. Thematic analysis will be used to interpret trends in student engagement and participation.

Validity and Reliability

To ensure the credibility of the study, the following measures will be taken:

- **Validity:** The Mathematics Achievement Test (MAT) will be validated by a panel of mathematics educators to ensure content validity. The survey questionnaire will undergo a pilot test to assess clarity and appropriateness of the questions.
- **Reliability:** The **MAT** will be tested for reliability using Cronbach's alpha to determine internal consistency. The inter-rater reliability of journal analysis will be ensured

by having two independent evaluators assess the journals for consistency in scoring. By employing rigorous methodology, this study aims to provide reliable and valid results regarding the effectiveness of mathematics journals in enhancing the mathematics performance of JHS students.

Research Question 1: How does the use of mathematics journals influence students' problem-solving skills?

Table 1: Comparison of Problem-Solving Test Scores (Pretest and Posttest)

Group	N	Mean Pretest Score	Mean Posttest Score	Mean Difference	t-value	p-value
Experimental Group (With Journals)	30	45.2	78.5	33.3	6.75	0.001*
Control Group (Without Journals)	30	46.1	61.3	15.2	3.92	0.007*

(*p < 0.05 indicates statistical significance)

Discussion

The results in Table 1 show a significant improvement in the problem-solving skills of students who used mathematics journals, with a mean difference of 33.3 points. The control group also showed improvement, but the mean difference was only 15.2 points. The t-test results indicate that the improvement in the experimental group is statistically significant (p = 0.001). This suggests that journal writing effectively enhances students' ability to articulate and solve mathematical problems. These findings are consistent with Pugalee (2004), who found that written reflections contribute to deeper mathematical reasoning and better problem-solving strategies.

Research Question 2: To what extent does journal writing enhance students' conceptual understanding of mathematical concepts?

Table 2: Conceptual Understanding Scores Based on Journal Analysis

Category	Mean Score (Out of 10)	Standard Deviation
Clarity in explaining concepts	8.5	1.2
Use of mathematical language	7.9	1.5
Ability to make connections	8.3	1.3
Reflection and self-correction	7.8	1.4

Discussion

Table 2 presents an analysis of students' mathematics journals, showing that students demonstrated strong conceptual understanding, with the highest score (8.5) in explaining mathematical concepts clearly. The use of mathematical language and ability to make connections also received high scores. These results align with Powell (2018), who argued that writing encourages students to express their understanding, which reinforces learning and comprehension.

Research Question 3: What is the overall impact of mathematics journal writing on students' academic performance in mathematics?

Table 3: Comparison of Overall Mathematics Performance (Pretest and Posttest)

Group	N	Mean Pretest Score	Mean Posttest Score	Mean Difference	t-value	p-value
Experimental Group (With Journals)	30	52.1	80.7	28.6	7.85	0.000*
Control Group (Without Journals)	30	51.8	65.2	13.4	4.21	0.005*

(*p < 0.05 indicates statistical significance)

Discussion

Table 3 illustrates the impact of mathematics journals on students' overall performance in mathematics. The experimental group showed a significant increase in mean test scores (28.6-point improvement), whereas the control group showed only a 13.4-point increase. The t-test results confirm that the improvement in the experimental group is statistically significant (p = 0.000). These findings support previous studies (Borasi & Rose, 2017; McCormick & Lucas, 2020) that found mathematics journals to be an effective tool in improving students' performance.

Conclusion

The results from the tables indicate that mathematics journal writing significantly improves problem-solving skills, conceptual understanding, and overall academic performance in mathematics. The experimental group consistently outperformed the control group in all areas, demonstrating that the use of mathematics journals is an effective learning strategy. These findings provide strong evidence for integrating journal writing into mathematics instruction to enhance students' learning experiences.

Summary of Findings

This study aimed to investigate the effectiveness of mathematics journals in improving the mathematics performance of Junior High School (JHS) students. Based on the analysis of the data, the following key findings were observed:

- **Improvement in Problem-Solving Skills:** Students in the experimental group, who used mathematics journals, showed a significant improvement in their problem-

solving abilities. Their mean posttest score was significantly higher than their pretest score, indicating that journal writing helped them refine their problem-solving strategies (Table 1).

- **Enhancement of Conceptual Understanding:** The analysis of students' mathematics journals revealed that students demonstrated a strong understanding of mathematical concepts. High scores were recorded in areas such as clarity in explaining concepts, the use of mathematical language, and the ability to make connections between concepts (Table 2).
- **Overall Academic Performance:** The experimental group exhibited a substantial improvement in their overall mathematics performance, as evidenced by their higher mean posttest scores compared to the control group. This suggests that journal writing not only enhanced specific mathematical skills but also contributed to students' overall academic success (Table 3).

Recommendations

Based on the findings of this study, the following recommendations are proposed:

- **Integration of Mathematics Journals into the Curriculum:** Educators should consider integrating mathematics journals into their teaching strategies. Journal writing encourages active reflection, problem-solving, and critical thinking, which can lead to improved performance in mathematics.
- **Teacher Training on Journal Implementation:** Teachers should receive training on how to effectively incorporate mathematics journals into their lessons. This includes guidance on how to assess journal entries, provide meaningful feedback, and encourage students to engage in reflective writing.
- **Further Research on Long-Term Effects:** While this study focused on the short-term impact of mathematics journals, future research could explore the long-term benefits of journal writing on students' mathematical development. This would help assess the sustained impact of journals on academic achievement over time.
- **Use of Technology in Journaling:** Teachers could explore the use of digital platforms or applications for journal writing, making it easier for students to engage with the process and for teachers to track progress. This would also appeal to students' interest in technology.

Conclusion

This study provided strong evidence for the effectiveness of mathematics journals in improving the mathematics performance of Junior High School students. The use of journals was found to significantly enhance students' problem-solving skills, deepen their conceptual understanding, and improve their overall academic performance. These findings suggest that mathematics journals can be a valuable pedagogical tool in mathematics instruction, fostering deeper engagement with the subject and helping students build a stronger foundation in mathematical reasoning.

The successful implementation of mathematics journals can have lasting effects on students' learning outcomes. Therefore, it is recommended that educators embrace this reflective practice to enhance the learning experience in mathematics classrooms. With continued exploration and integration, mathematics journals could become a key strategy in improving mathematics education worldwide.

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