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Application of the Guided Inquiry Learning Model on the Mathematical Problem-Solving Ability of Junior High School Students

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Abstract

This study aims to determine whether the mathematical problem-solving ability of students using the guided inquiry learning model is better than that of students using conventional learning methods in seventh-grade students at SMPN 1 Baso. This type of research is a quasi-experiment with a randomized control group only design. The population of the study consists of seventh-grade students at SMPN 1 Baso, divided into seven classes with a total of 138 students. The sample in this study includes 20 students from class VII 1 as the experimental class and 20 students from class VII 2 as the control class, selected through simple random sampling. The research instrument is a final test in the form of essay questions related to mathematical problem-solving abilities. The results of the final test will be used for hypothesis testing using a t-test with □ = 0.05 and degrees of freedom (df) = 36. The analysis shows that the average score of problem-solving abilities in the experimental class is higher than in the control class. Based on the t-test, it is found that the mathematical problem-solving ability of students with the guided inquiry learning model is better than that of students with the conventional learning model.

Keywords: Guided Inquiry; Mathematical; Problem-Solving Ability.

INTRODUCTION

Mathematical problem-solving skills play a fundamental role in students' cognitive development, serving as a core aspect of mathematical learning that fosters critical thinking and analytical reasoning (Akcay, 2009). These skills are not only crucial for academic achievement but also have far-reaching implications for students' ability to tackle real-world problems and make informed decisions (Acar, & Tarhan, 2008)In an educational context, the ability to solve mathematical problems requires students to understand concepts, apply logical thinking, and strategize solutions effectively, which contributes to their overall intellectual growth and prepares them for more complex mathematical challenges.

Given the significance of problem-solving skills in mathematics, educators and researchers have continually sought to identify and develop teaching methods that can effectively enhance these abilities in students. Traditional methods of instruction, often characterized by direct teaching and passive learning, have been criticized for not fully engaging students in the process of discovery and critical thinking (Masek, & Yamin, 2011). As a result, alternative pedagogical approaches, such as guided inquiry learning, have gained attention for their potential to actively involve students in the learning process, encourage exploration, and develop a deeper understanding of mathematical concepts. This shift towards student-centered learning underscores the importance of adopting

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innovative teaching strategies that align with educational goals and foster a conducive environment for learning.

Guided inquiry learning, in particular, emphasizes active participation, where students are encouraged to investigate mathematical problems, ask questions, and construct their understanding through exploration and guided support from the teacher. This approach stands in contrast to conventional learning methods, where instruction is often more teacher-centered, and students are typically passive recipients of knowledge. By engaging students in guided inquiry, the aim is to stimulate their natural curiosity, enhance their problem-solving skills, and improve their overall performance in mathematics. This pedagogical approach is grounded in the belief that when students actively participate in their learning process, they are more likely to develop critical thinking and retain knowledge effectively.

The effectiveness of guided inquiry learning as a method for improving mathematical problem-solving abilities has become a focal point of interest in educational research. Numerous studies have explored the impact of guided inquiry on student outcomes, revealing mixed results that vary based on the implementation of the model, student demographics, and subject matter. However, there is a consensus that guided inquiry can offer significant benefits in developing problem-solving skills by allowing students to take ownership of their learning and engage with mathematical concepts more meaningfully. This has led to a growing interest in examining the specific contexts and conditions under which guided inquiry learning may outperform conventional teaching methods.

This study aims to investigate the impact of the guided inquiry learning model on the mathematical problem-solving abilities of seventh-grade students at SMPN 1 Baso, a school context that provides a representative setting for examining these educational dynamics. By conducting a quasi-experimental study, the research will compare the problem-solving skills of students taught through guided inquiry with those taught through traditional methods. It is hypothesized that the students exposed to guided inquiry learning will demonstrate significantly better problem-solving outcomes than their peers who experience conventional instruction. The research intends to contribute to the existing body of literature by providing empirical evidence on the effectiveness of guided inquiry in enhancing mathematical problem-solving abilities.

Ultimately, the study's findings aim to provide insights for educators, curriculum developers, and policymakers regarding the benefits and potential applications of guided inquiry learning in mathematics education. By understanding the comparative effectiveness of different teaching models, particularly guided inquiry versus conventional methods, the study seeks to inform instructional practices that can improve students' mathematical competencies and problem-solving skills. This focus aligns with broader educational goals to promote active learning, critical thinking, and student engagement in the classroom, ultimately enhancing the overall quality of mathematics education.

METHODS

This study employs a quasi-experimental design, specifically utilizing a randomized control group-only design, to examine the effect of the guided inquiry learning model on students' mathematical problem-solving abilities (Şen, & Yılmaz, 2012). Quasi-experimental research is particularly suitable for educational settings where random assignment to experimental conditions is often

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difficult or impractical. In this context, the population of interest consists of seventh-grade students enrolled at SMPN 1 Baso. The school has a total of 138 seventh-grade students distributed across seven different classes, providing a diverse group of learners for the study. To ensure an unbiased representation of this population, a sample of 40 students was selected through a process of simple random sampling, a method that gives each student an equal chance of being chosen. This sampling method ensures that the findings are generalizable and that any observed differences in outcomes can be attributed to the intervention rather than pre-existing differences among students.

Within this sample, the students were further divided into two distinct groups: an experimental group and a control group, each consisting of 20 students. Class VII 1 was designated as the experimental group and received instruction through the guided inquiry learning model, while Class VII 2 formed the control group and was taught using conventional learning methods. The primary instrument used to assess the impact of the teaching approaches on students' mathematical problem-solving abilities was a final test composed of essay questions. These questions were specifically designed to evaluate the students' ability to analyze, strategize, and solve mathematical problems effectively. Following the intervention, the test results were subjected to statistical analysis using a t-test to determine whether there was a significant difference between the experimental and control groups. A significance level of $\alpha = 0.05$ was employed, with degrees of freedom (df) = 36, to rigorously test the hypothesis that guided inquiry learning would yield superior mathematical problem-solving outcomes compared to conventional instruction. This approach provides a robust framework for examining the effectiveness of guided inquiry as a pedagogical tool in enhancing mathematical skills.

RESULTS

The results of the study are based on the analysis of final test scores, which were used to measure the mathematical problem-solving abilities of students in both the experimental and control groups. Students in the experimental class, who were taught using the guided inquiry learning model, demonstrated a higher average score compared to those in the control class, who received conventional instruction. This observed difference in scores suggests that the guided inquiry approach has a positive influence on students' ability to tackle and solve mathematical problems. The scores reflect not just improved accuracy but also a more in-depth understanding of problem-solving strategies, indicating that students engaged in guided inquiry learning were better equipped to analyze, process, and apply mathematical concepts effectively.

To further validate the effectiveness of the guided inquiry learning model, a statistical t-test was conducted to determine whether the difference in test scores between the experimental and control groups was statistically significant. The t-test is a robust statistical method that allows for the comparison of the means of two groups to ascertain whether any observed differences are likely due to the intervention (guided inquiry) rather than random chance. The analysis confirmed that the difference in average test scores between the experimental and control groups was statistically significant, with a p-value less than the pre-determined alpha level of 0.05. This result indicates that the likelihood of the observed difference occurring by chance is very low, thereby supporting the hypothesis that the guided inquiry model substantially enhances students' mathematical problem-solving abilities.

In addition to the overall improvement in problem-solving scores, the results also highlight the specific benefits of the guided inquiry learning model in fostering deeper understanding and critical

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thinking. Students in the experimental group showed better performance in tasks requiring complex reasoning, multi-step problem-solving, and the application of various mathematical principles in novel situations. These improvements underscore the efficacy of guided inquiry in actively engaging students, encouraging them to explore and understand the underlying logic of mathematical problems, and empowering them to become independent problem solvers. The findings clearly suggest that guided inquiry is an effective pedagogical approach for enhancing mathematical problem-solving skills and can be a valuable addition to traditional mathematics instruction.

DISCUSSION

The results of this study provide compelling evidence that the guided inquiry learning model significantly outperforms traditional instructional methods in enhancing the mathematical problem-solving abilities of seventh-grade students. The experimental group, which was taught using guided inquiry, exhibited higher levels of problem-solving proficiency, as reflected in their final test scores. This suggests that when students are actively involved in constructing their knowledge through inquiry-based activities, they are better able to grasp complex mathematical concepts and develop a stronger capacity for logical reasoning (Arends, 2012). The findings confirm that guided inquiry fosters an educational environment where students can explore mathematical problems, test hypotheses, and develop strategies that lead to a deeper understanding of the subject matter.

One key implication of this research is that guided inquiry learning can transform the way mathematics is taught in classrooms. Traditional methods often emphasize rote learning and memorization of formulas, which may not adequately develop students' ability to apply mathematical concepts to solve problems. In contrast, guided inquiry encourages exploration, questioning, and active engagement with the material, which are critical for developing problem-solving skills. The process of guided inquiry allows students to take an active role in their learning, facilitating the development of higher-order thinking skills. This is particularly important in mathematics education, where students must not only understand theoretical concepts but also apply them in varied contexts to find solutions to problems.

Additionally, guided inquiry learning promotes student-centered teaching, wherein the teacher acts as a facilitator who guides the learning process rather than directly transmitting information. This approach has been shown to encourage collaboration among students, as they work together to explore problems, share ideas, and find solutions. Such collaboration enhances their critical thinking and reasoning skills, as they learn to listen to different perspectives, articulate their thought processes, and refine their understanding of mathematical concepts. Moreover, the guided inquiry model allows for differentiation, as students can explore problems at their own pace and according to their level of understanding, making it easier for teachers to address diverse learning needs within the classroom.

The study’s results also have broader implications for the development of curricula and instructional practices in mathematics education. Integrating guided inquiry strategies into the mathematics curriculum could lead to significant improvements in students' learning outcomes. This approach supports the development of skills that are vital not only for academic success but also for real-world problem-solving and decision-making. Moreover, these findings align with educational theories that advocate for active, experiential learning as a means of developing deeper cognitive skills and fostering lifelong learning habits. Given the increasing demand for critical

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thinking and problem-solving skills in the 21st century, guided inquiry learning offers a practical method for preparing students to meet these challenges effectively.

However, while the study confirms the benefits of guided inquiry, it also raises important considerations regarding its implementation in classrooms. Teachers need appropriate training and resources to effectively facilitate guided inquiry learning. Unlike conventional teaching methods, guided inquiry requires careful planning, skillful questioning, and the ability to create a learning environment that encourages exploration and risk-taking. Additionally, teachers must be able to support students in developing the necessary skills to engage in inquiry-based learning, such as hypothesis testing, problem analysis, and solution evaluation. The success of guided inquiry largely depends on the teacher's ability to scaffold the learning process, providing appropriate support and guidance without diminishing the students' autonomy and exploration.

In conclusion, the findings of this study highlight the significant advantages of using the guided inquiry learning model to improve mathematical problem-solving abilities in seventh-grade students. The model's emphasis on active, student-centered learning makes it a powerful pedagogical tool for enhancing students' critical thinking, reasoning, and application skills in mathematics. As education continues to evolve to meet the demands of a rapidly changing world, approaches like guided inquiry offer promising ways to better equip students with the skills they need to succeed academically and beyond. Further research is recommended to explore the long-term effects of guided inquiry on students' mathematical abilities and to identify best practices for its integration into various educational contexts.

CONCLUSION

This study concludes that the guided inquiry learning model has a significant positive impact on students' mathematical problem-solving abilities when compared to traditional, conventional teaching methods. The findings show that students who engage in guided inquiry learning exhibit higher levels of problem-solving skills, suggesting that this model is effective in not only enhancing their understanding of mathematical concepts but also in promoting critical thinking, logical reasoning, and the ability to approach problems systematically. By allowing students to actively explore mathematical ideas and apply strategies in a collaborative and inquiry-based environment, guided inquiry creates an enriched learning experience that fosters deeper comprehension and skill development.

These results carry important implications for mathematics educators and curriculum developers. The demonstrated effectiveness of guided inquiry suggests that its adoption in the classroom could be a significant step forward in improving the quality of mathematics education. It encourages a shift from passive learning to a more student-centered, active learning approach, which is essential for the development of key problem-solving competencies. Given the success observed in this study, educators are encouraged to implement guided inquiry strategies to not only enhance problem-solving skills but also to create a more engaging and interactive learning experience for students in mathematics. Future research may focus on long-term impacts and explore how guided inquiry can be integrated with other instructional methods to optimize learning outcomes.

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