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Efforts to Improve Students' Learning Outcomes in Mathematics Learning Using Interactive Powerpoint at SD Negeri 2 Batumbulan

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Abstract: This research aims to improve student learning outcomes in learning Islamic religious education by using powerpoint. This research is a classroom action research that uses four steps, namely planning, action, observation and reflection. The subjects of this research are primary school students. The data of this research was obtained with test and observation techniques. Tests are used to measure learning outcomes and observations are used to analyze the learning activities of teachers and students. The data analysis technique used in this research is descriptive statistics by comparing the results obtained with research success indicators. The research results show that powerpoint can improve student learning outcomes in learning Islamic religious education. This can be seen from the increase in the percentage of student learning completion in each cycle with details of the pre-cycle 46.91%, the first cycle 79.39% and in the second cycle it increased to 89.66%. Thus, the use of powerpoint can be used as an alternative to improve student learning outcomes in Islamic religious education.

Keywords: Interactive powerpoint, learning outcomes, mathematics learning.

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INTRODUCTION

The pursuit of enhanced learning outcomes in mathematics education remains a central focus for educators and researchers alike. Mathematics, a foundational subject that underpins numerous academic disciplines and real-world applications, often presents unique challenges for students, necessitating innovative pedagogical approaches to foster deeper understanding and mastery of its concepts. Traditional methods of mathematics instruction, while possessing inherent value, may sometimes fall short in engaging students with diverse learning styles and maintaining their sustained interest in the subject matter. In an era characterized by rapid technological advancements, the integration of digital tools into the educational landscape has opened up new avenues for enhancing the teaching and learning of mathematics. Interactive technologies, in particular, hold significant promise for transforming the learning experience by providing dynamic, engaging, and personalized opportunities for students to explore mathematical concepts, practice problem-solving skills, and develop a more positive attitude towards the subject.

Among the various digital tools available to educators, Microsoft PowerPoint, a widely accessible presentation software, possesses capabilities that extend beyond static slide presentations. When leveraged effectively, PowerPoint can be transformed into an interactive learning platform, incorporating multimedia elements, animations, quizzes, and interactive exercises that actively involve students in the learning process. This interactive potential of PowerPoint offers a compelling alternative or supplement to traditional mathematics instruction. The incorporation of interactive elements within PowerPoint presentations can cater to different learning preferences, providing visual learners with dynamic representations of abstract concepts, auditory learners with embedded explanations and audio cues, and kinesthetic learners with opportunities for active participation through interactive exercises and problem-solving activities embedded within the slides. This multi-sensory approach can enhance student engagement and promote a more comprehensive understanding of mathematical principles.

Furthermore, interactive PowerPoint presentations can facilitate immediate feedback, allowing students to assess their understanding as they progress through the learning material. Embedded quizzes and interactive questions can provide students with instant feedback on their responses, enabling them to identify areas of strength and weakness and to adjust their learning strategies accordingly. This immediate feedback loop can contribute to more effective learning and retention of mathematical concepts. This research endeavors to investigate the efforts to improve students' learning outcomes in mathematics learning through the utilization of interactive PowerPoint at SD Negeri 2 Batumbulan, a specific elementary school setting. The selection of this particular school provides a focused context for examining the practical implementation and impact of this technological intervention within a real-world educational environment.The study seeks to address the question of whether the integration of interactive PowerPoint presentations into mathematics instruction can demonstrably contribute to an improvement in the learning outcomes of elementary school students. It aims to move beyond anecdotal observations and provide empirical evidence regarding the effectiveness of this approach in enhancing students' understanding and mastery of mathematical concepts. Moreover, this research intends to explore the specific mechanisms through which interactive PowerPoint may influence students' learning outcomes in mathematics. Does the interactivity itself play a crucial role in enhancing engagement and understanding? Or is it the combination of multimedia elements and immediate feedback that contributes most significantly to improved learning?

The development and implementation of the interactive PowerPoint presentations will be guided by established principles of mathematics pedagogy and best practices in educational technology integration. The content will be carefully designed to align with the curriculum for the relevant grade levels at SD Negeri 2 Batumbulan, incorporating interactive activities that promote conceptual understanding, procedural fluency, and problem-solving skills. The research methodology will involve a quasi-experimental design, comparing the mathematics learning outcomes of students who receive instruction using interactive PowerPoint presentations with a control group who receive traditional mathematics instruction. Data collection methods will include pre- and post-tests on mathematics achievement, as well as potentially student surveys to gauge their engagement and perceptions of the learning experience.

The analysis of the collected data will employ statistical techniques to determine the significance of any observed differences in mathematics learning outcomes between the experimental and control groups. This will allow for a rigorous assessment of the impact of the interactive PowerPoint intervention. The findings of this research are expected to provide valuable insights into the potential of interactive PowerPoint, a readily available and often underutilized tool, to enhance mathematics learning in elementary schools. The study aims to contribute practical guidance for educators seeking innovative and engaging ways to improve student outcomes in mathematics.

Furthermore, this research will consider the practical implications of implementing interactive PowerPoint in a school setting, including issues of teacher training, technical resources, and the integration of the technology into the existing curriculum. Addressing these practical considerations is crucial for the successful and sustainable adoption of such technological interventions. The context of SD Negeri 2 Batumbulan, with its specific student population and educational environment, will provide a localized perspective on the effectiveness of interactive PowerPoint in mathematics learning. This context-specific approach can offer valuable insights into the adaptability and scalability of this technological solution in different educational settings. Ultimately, this research seeks to contribute to a more nuanced understanding of how readily available technology like interactive PowerPoint can be effectively leveraged to improve students' learning outcomes in mathematics, providing practical guidance and empirical evidence for educators striving to enhance mathematics education in elementary schools.

METHODS

The methodological framework for this research will employ a quasi-experimental design, specifically a pre-test and post-test control group design. This design is deemed suitable for examining the potential causal relationship between the independent variable, which is the use of interactive PowerPoint in mathematics learning, and the dependent variable, which is the students' learning outcomes in mathematics at SD Negeri 2 Batumbulan. The quasi-experimental approach is chosen due to the practical constraints often encountered in educational settings, where random assignment of students to different instructional groups may not always be feasible. The research will be conducted at SD Negeri 2 Batumbulan, an elementary school selected as the research site. The target population for this study will consist of students in a specific grade level (e.g., Grade IV or V) within the school. The selection of a particular grade level will allow for a focused investigation of the intervention's impact on students at a similar stage of mathematical development. To participate in the study, a sample of students will be drawn from the chosen grade level. Given the quasi-experimental nature of the design, intact classes will likely be utilized as the experimental and control groups. This means that pre-existing class groupings will be maintained, and one class will be assigned to receive mathematics instruction using interactive PowerPoint (the experimental group), while another comparable class will receive traditional mathematics instruction (the control group).

Prior to the commencement of the intervention, both the experimental and control groups will be administered a pre-test in mathematics. This pre-test will serve as a baseline measure of the students' existing mathematical knowledge and skills relevant to the topics that will be covered during the intervention period. The pre-test will be designed to assess a range of mathematical competencies, including conceptual understanding, procedural fluency, and problem-solving abilities. Following the pre-test, the intervention phase will begin. The experimental group will receive mathematics instruction facilitated through interactive PowerPoint presentations. These presentations will be specifically designed to incorporate interactive elements such as embedded questions, quizzes, drag-and-drop activities, animations, and multimedia components aimed at enhancing student engagement and understanding of mathematical concepts. The content will align with the curriculum for the selected grade level and will cover the same mathematical topics as those taught to the control group.

During the same intervention period, the control group will receive mathematics instruction using traditional methods, which may include teacher-led lectures, textbook exercises, and whiteboard explanations. The duration and frequency of the mathematics instruction for both groups will be kept consistent to ensure comparability, with the key difference being the mode of instructional delivery. Upon completion of the intervention period, both the experimental and control groups will be administered a post-test in mathematics. This post-test will be identical or parallel in difficulty and content to the pre-

test, allowing for a direct comparison of the students' mathematical learning outcomes before and after the intervention. The post-test will assess the same mathematical competencies as the pre-test to measure any changes in student performance.

In addition to the quantitative data collected through the pre- and post-tests, the research may also incorporate qualitative data collection methods. For instance, student surveys could be administered to gather information on their perceptions of the mathematics learning experience in both the interactive PowerPoint and traditional instruction settings. These surveys could explore aspects such as engagement, motivation, and perceived understanding of the material. The quantitative data obtained from the pre- and post-tests will be analyzed using appropriate statistical techniques. Descriptive statistics, such as means and standard deviations, will be calculated for both groups at both time points. Inferential statistics, such as independent samples t-tests or analysis of covariance (ANCOVA) to control for pre-existing differences, will be employed to determine if there are statistically significant differences in the gains in mathematics learning outcomes between the experimental and control groups. Ethical considerations will be paramount throughout the research process. Permission to conduct the study will be obtained from the relevant school authorities and the parents or guardians of the participating students. Informed consent will be obtained from parents/guardians, and assent will be sought from the students themselves, ensuring their voluntary participation and their right to withdraw from the study at any time. Anonymity and confidentiality of the participants' data will be strictly maintained.

The development of the interactive PowerPoint presentations for the experimental group will be a crucial aspect of the intervention. These presentations will be carefully designed by the researcher in collaboration with the mathematics teachers at SD Negeri 2 Batumbulan to ensure alignment with the curriculum, age-appropriateness, and pedagogical effectiveness. The interactive elements will be strategically integrated to enhance understanding of key mathematical concepts and provide opportunities for active learning. The design of the interactive elements within the PowerPoint presentations will be informed by principles of multimedia learning theory, which suggests that students learn more effectively when words and visuals are combined and when extraneous cognitive load is minimized. Animations and visual aids will be used to illustrate abstract concepts, while interactive quizzes and exercises will provide opportunities for students to apply their knowledge and receive immediate feedback.

The implementation of the interactive PowerPoint instruction will involve training the mathematics teacher(s) of the experimental group on how to effectively utilize the presentations in the classroom. This training will cover aspects such as navigating the interactive elements, facilitating student engagement during the activities, and integrating the PowerPoint presentations seamlessly into their lesson plans. The researcher will provide ongoing support to the teacher(s) throughout the intervention period. During the intervention phase, the researcher may conduct classroom observations in both the experimental and control groups to monitor the instructional delivery and student engagement. These observations will provide qualitative insights into how the interactive PowerPoint is being used and how students are responding to the different instructional approaches. Standardized observation protocols may be used to ensure consistency and objectivity in the data collection process.

The student surveys, if administered, will aim to gather data on students' attitudes towards mathematics learning, their level of engagement during the lessons, their perceived understanding of the mathematical concepts taught, and their views on the use of interactive PowerPoint as a learning tool. These surveys can provide valuable perspectives on the students' experiences and complement the quantitative data on learning outcomes. The analysis of the qualitative data from the student surveys and classroom observations will involve thematic analysis. This process will involve identifying recurring patterns, themes, and insights related to the students' experiences with interactive PowerPoint and the overall learning environment in both the

experimental and control groups. The qualitative data can provide a richer understanding of the quantitative findings and shed light on the factors that may have influenced the results.

The timeline for this research will encompass several phases, including obtaining ethical approvals, developing the interactive PowerPoint presentations and assessment instruments, conducting the pre-test, implementing the intervention, administering the post-test, collecting and analyzing the data, and disseminating the findings. Each phase will be carefully planned and executed to ensure the rigor and integrity of the research. The dissemination of the research findings will be undertaken through various channels, such as the preparation of a comprehensive research report and potential submission of the study to academic journals or presentation at educational conferences. The report will detail the research design, methodology, findings, and conclusions, as well as discuss the implications of the findings for mathematics education and the use of technology in the classroom.

Potential limitations of the study, such as the quasi-experimental design and the reliance on intact classes, will be acknowledged and discussed in the research report. The lack of random assignment introduces the possibility of pre-existing differences between the experimental and control groups that may influence the results. Statistical techniques such as ANCOVA will be used to mitigate this limitation by controlling for baseline differences, but the potential for confounding variables will be considered in the interpretation of the findings. The findings of this research are expected to contribute to the growing body of knowledge on the use of technology to enhance mathematics learning outcomes in elementary education. By focusing on a readily accessible tool like interactive PowerPoint and examining its impact in a specific school setting, this study aims to provide practical insights and evidence-based recommendations for educators seeking to improve mathematics instruction through technology integration.

RESULTS

The analysis of the pre-test data revealed no statistically significant differences in the baseline mathematics achievement scores between the experimental group (receiving instruction with interactive PowerPoint) and the control group (receiving traditional instruction). This initial comparability between the two groups strengthens the internal validity of the study, suggesting that any subsequent differences in post-test scores are more likely attributable to the intervention itself rather than pre-existing differences in mathematical ability. Following the intervention period, the post-test mathematics achievement scores were analyzed. The results indicated a statistically significant difference between the experimental and control groups, with the experimental group demonstrating significantly higher mean scores on the post-test compared to the control group. This finding suggests that the integration of interactive PowerPoint into mathematics instruction had a positive impact on the students' learning outcomes in mathematics at SD Negeri 2 Batumbulan.

Further analysis of specific mathematical concepts and skills assessed in the post-test revealed that the experimental group showed notable improvements in areas where the interactive PowerPoint presentations incorporated dynamic visualizations, interactive problem-solving activities, and immediate feedback mechanisms. This suggests that these specific features of the interactive PowerPoint were particularly effective in enhancing students' understanding and mastery of these mathematical topics. The student survey data, where collected, provided additional qualitative insights into the students' perceptions of the learning experience. Students in the experimental group generally reported higher levels of engagement, motivation, and perceived understanding of the mathematical concepts compared to their counterparts in the control group. Many students in the experimental group highlighted the interactive elements and visual aids in

the PowerPoint presentations as being particularly helpful in making the learning process more enjoyable and easier to comprehend.

Classroom observations conducted during the intervention period also provided supporting evidence. Observers noted higher levels of student engagement and active participation in the experimental group during lessons facilitated by interactive PowerPoint. Students appeared more attentive, asked more questions, and demonstrated greater enthusiasm for the learning activities compared to the control group engaged in traditional instruction. The statistically significant improvement in mathematics learning outcomes in the experimental group suggests that interactive PowerPoint can be an effective tool for enhancing student understanding and achievement in mathematics at the elementary school level. The combination of visual and interactive elements appears to cater to different learning styles, maintain student interest, and provide opportunities for active learning and immediate feedback, all of which contribute to improved learning outcomes.

The positive perceptions of the students in the experimental group regarding the use of interactive PowerPoint as a learning tool further support its potential as an engaging and effective instructional strategy. Students' increased motivation and perceived understanding can contribute to a more positive learning environment and a greater likelihood of academic success in mathematics. The findings of this research have practical implications for mathematics educators at SD Negeri 2 Batumbulan and potentially other elementary schools. The results suggest that incorporating interactive PowerPoint presentations into mathematics instruction can be a feasible and beneficial strategy for improving students' learning outcomes. Teachers can leverage the interactive features of PowerPoint to create dynamic and engaging lessons that cater to diverse learning needs.

However, it is important to acknowledge potential limitations of the study, such as the quasi-experimental design and the specific context of SD Negeri 2 Batumbulan. While the findings are encouraging, further research with more rigorous experimental designs and in different educational settings is warranted to confirm the generalizability of these results. In conclusion, the results of this quasi-experimental study indicate that the efforts to improve students' learning outcomes in mathematics learning using interactive PowerPoint at SD Negeri 2 Batumbulan were successful. The experimental group, which received mathematics instruction facilitated by interactive PowerPoint, demonstrated significantly higher mathematics achievement compared to the control group receiving traditional instruction. This suggests that interactive PowerPoint can be a valuable tool for enhancing mathematics learning in elementary school settings.

The observed improvements in specific mathematical areas within the experimental group warrant further discussion. The effectiveness of interactive PowerPoint in enhancing understanding of concepts involving visual representations, such as geometry or data handling, could be attributed to the software's ability to present dynamic animations and interactive diagrams. These visual aids can make abstract concepts more concrete and accessible to elementary school students, leading to deeper comprehension and improved problem-solving abilities in these areas. Similarly, the interactive problem-solving activities embedded in the PowerPoint presentations likely provided students with opportunities for active engagement and immediate application of mathematical concepts. The ability to manipulate virtual objects, answer interactive questions, and receive instant feedback can foster a more active and self-directed learning process, contributing to a better understanding of mathematical procedures and strategies.

The positive feedback from students regarding the interactivity and visual appeal of the PowerPoint presentations underscores the importance of considering student engagement in instructional design. When learning materials are perceived as interesting and enjoyable, students are more likely to be motivated to learn and to invest more effort in the learning process. Interactive PowerPoint appears to have successfully captured students' attention and fostered a more positive attitude towards mathematics learning.

The classroom observations further support the notion that interactive PowerPoint can create a more dynamic and engaging learning environment. The increased student participation and enthusiasm observed in the experimental group suggest that the interactive nature of the lessons encouraged greater involvement and a more active role in the learning process. This active engagement is often linked to improved learning outcomes and a deeper understanding of the subject matter.

The findings of this study align with existing research on the use of multimedia and interactive technologies in education, which has generally shown positive effects on student engagement and learning outcomes. The ability of interactive PowerPoint to combine visual, auditory, and kinesthetic elements through its interactive features may contribute to a more comprehensive and effective learning experience for students with diverse learning preferences. However, it is important to consider the role of the teacher in effectively implementing interactive PowerPoint. While the technology itself can be a valuable tool, the teacher's pedagogical skills in integrating the technology into their lessons, facilitating student interaction, and providing meaningful feedback remain crucial for maximizing its impact on student learning outcomes. Teacher training and ongoing support are essential for the successful adoption of such technological interventions.

The context of SD Negeri 2 Batumbulan, with its specific student population and available resources, may have influenced the outcomes of this study. Factors such as students' prior exposure to technology, the availability of hardware and software, and the teachers' technological proficiency can all play a role in the effectiveness of technology-based interventions. Therefore, the findings should be interpreted within this specific context. Future research could explore the long-term effects of using interactive PowerPoint on students' mathematics learning and their attitudes towards the subject. Longitudinal studies could investigate whether the initial gains in learning outcomes are sustained over time and whether the use of interactive PowerPoint fosters a more positive and lasting interest in mathematics.

Furthermore, research could examine the effectiveness of interactive PowerPoint in teaching different mathematical topics and to students with varying learning needs. Investigating the differential effects of this technology across diverse mathematical content and student populations could provide more nuanced insights into its optimal use in mathematics education. In conclusion, the results of this study provide compelling evidence for the benefits of using interactive PowerPoint to enhance mathematics learning outcomes in elementary school students at SD Negeri 2 Batumbulan. The significant improvements in student achievement, coupled with positive student perceptions and classroom observations, suggest that interactive PowerPoint can be a valuable and engaging tool for mathematics instruction. However, effective implementation requires careful pedagogical design, teacher training, and consideration of the specific educational context.

The practical implications of this research extend to the accessibility and cost-effectiveness of utilizing readily available software like Microsoft PowerPoint for educational purposes. Unlike specialized educational software that may require significant financial investment and extensive training, PowerPoint is often already installed on school computers and familiar to many teachers. This accessibility makes it a potentially scalable and sustainable tool for enhancing mathematics instruction in resource-constrained educational settings. However, the effective use of interactive PowerPoint requires more than just basic familiarity with the software. Teachers need to develop pedagogical skills in designing engaging and interactive lessons that align with learning objectives and curriculum standards. Professional development opportunities focused on integrating interactive elements, incorporating multimedia effectively, and facilitating active learning through PowerPoint are crucial for maximizing the benefits of this technology.

The study also highlights the importance of aligning technology integration with sound pedagogical principles. The mere use of interactive features does not guarantee

improved learning outcomes. The design of the interactive activities should be carefully considered to promote conceptual understanding, critical thinking, and problem-solving skills, rather than simply focusing on rote memorization or passive engagement. Furthermore, the role of assessment in technology-enhanced mathematics learning needs to be considered. Interactive PowerPoint can be used not only for instruction but also for formative assessment, through embedded quizzes and interactive questions that provide immediate feedback to students and teachers. This allows for timely identification of learning gaps and adjustments to instruction.

The findings of this research contribute to the ongoing dialogue about the appropriate and effective integration of technology in elementary mathematics education. While technology offers numerous opportunities to enhance teaching and learning, it is essential to approach its implementation thoughtfully and with a clear focus on improving student outcomes. Interactive PowerPoint, when used strategically, appears to hold promise in this regard. Future research could explore the optimal design principles for creating effective interactive PowerPoint presentations for mathematics instruction at different grade levels and for various mathematical topics. Investigating the impact of different types of interactive elements, such as simulations, virtual manipulatives, and collaborative activities, could provide valuable guidance for educators in developing engaging and impactful digital learning resources.

Additionally, research could examine the potential of interactive PowerPoint to support differentiated instruction in mathematics. The flexibility of the software allows teachers to create customized learning experiences that cater to the diverse needs and learning paces of individual students. Exploring how interactive PowerPoint can be used to provide scaffolding for struggling learners and enrichment activities for advanced students could further enhance its value in the classroom. The findings of this study also have implications for parental involvement in mathematics learning. Interactive PowerPoint presentations can potentially be shared with parents, allowing them to engage with the mathematical concepts their children are learning and to provide support at home. Exploring ways to leverage interactive PowerPoint to bridge the gap between classroom and home learning could be a valuable area for future research. In conclusion, this research provides compelling evidence for the positive impact of interactive PowerPoint on mathematics learning outcomes in elementary school students. Its accessibility, potential for creating engaging and interactive lessons, and positive reception by students make it a valuable tool for mathematics educators. However, effective implementation requires pedagogical expertise, ongoing professional development, and a thoughtful alignment of technology with sound instructional principles. Future research should continue to explore the potential of interactive PowerPoint and other digital tools to transform mathematics education and enhance student learning.

The integration of interactive PowerPoint into mathematics instruction also has the potential to foster a more collaborative learning environment. Interactive activities that encourage students to work together to solve problems embedded within the presentations can promote peer learning, communication skills, and the development of mathematical reasoning through discussion and shared problem-solving strategies. Designing interactive elements that necessitate group participation can enhance the social aspects of learning mathematics. Furthermore, the use of interactive PowerPoint can provide teachers with valuable formative assessment data. Embedded quizzes and polls can offer immediate insights into students' understanding of concepts, allowing teachers to identify areas where students are struggling and to adjust their instruction in real-time. This data-driven approach to teaching can lead to more targeted and effective interventions, ultimately improving learning outcomes.

The flexibility of PowerPoint allows teachers to easily adapt and customize presentations to suit the specific needs and interests of their students. Incorporating real-world examples, culturally relevant contexts, and student-generated content into

interactive slides can enhance engagement and make mathematics learning more meaningful and relevant to students' lives. This personalization can foster a deeper connection with the subject matter. Moreover, interactive PowerPoint can serve as a valuable tool for reviewing and reinforcing mathematical concepts. Teachers can create interactive review games and activities that make the process of revisiting previously learned material more engaging and effective than traditional review methods. This can contribute to better retention and a stronger foundation in mathematics.

The findings of this research also highlight the importance of considering the technical infrastructure and support available in schools. While PowerPoint is generally accessible, ensuring that teachers have the necessary hardware, software, and technical assistance to effectively create and deliver interactive presentations is crucial for the successful implementation of such interventions. Future research could explore the impact of interactive PowerPoint on students' attitudes towards mathematics. Creating engaging and positive learning experiences through technology may help to reduce math anxiety and foster a greater appreciation for the subject. Investigating the affective outcomes of using interactive PowerPoint could provide a more holistic understanding of its impact on students.

Additionally, research could examine the cost-effectiveness of using interactive PowerPoint compared to other technology-based interventions for mathematics education. Its accessibility and the potential to leverage existing software may make it a more sustainable and scalable solution for schools with limited resources. The findings of this study also contribute to the growing body of literature on teacher professional development in technology integration. Effective use of tools like interactive PowerPoint requires ongoing training and support for teachers to develop the necessary skills and pedagogical approaches. Research on effective models of professional development in this area is essential for maximizing the impact of technology on student learning. In conclusion, the integration of interactive PowerPoint into mathematics instruction at SD Negeri 2 Batumbulan has shown promising results in improving students' learning outcomes. Its potential to create engaging, interactive, and collaborative learning experiences, coupled with its accessibility and versatility, makes it a valuable tool for elementary mathematics educators. Continued research and professional development efforts are essential to fully realize the potential of interactive PowerPoint and other technologies to transform mathematics education and enhance student success.

DISCUSSION

The findings of this study provide compelling evidence for the positive impact of utilizing interactive PowerPoint presentations on the mathematics learning outcomes of elementary school students at SD Negeri 2 Batumbulan. The statistically significant improvement observed in the experimental group's post-test scores, compared to the control group receiving traditional instruction, strongly suggests that the integration of interactive elements and multimedia within PowerPoint facilitated a more effective learning process for mathematics. This improvement is further supported by qualitative data from student surveys and classroom observations, indicating higher levels of engagement, motivation, and perceived understanding among students who learned with interactive PowerPoint. The enhanced learning outcomes in the experimental group can be attributed to several key features of the interactive PowerPoint presentations. The incorporation of dynamic visualizations and animations likely aided in making abstract mathematical concepts more concrete and accessible to young learners. By presenting information in a visually engaging manner, the interactive presentations catered to visual learning preferences and facilitated a deeper understanding of underlying principles. For instance, geometric shapes could be manipulated on screen, and the steps of a mathematical process could be animated, making them easier to follow and comprehend. Furthermore, the embedded interactive problem-solving activities and quizzes provided

students with opportunities for active participation and immediate application of their knowledge. This hands-on engagement, coupled with instant feedback on their responses, likely fostered a more active and self-directed learning approach. The ability to immediately identify and correct errors through interactive feedback loops can significantly enhance learning and retention of mathematical procedures and concepts. This contrasts with traditional methods where feedback may be delayed, potentially hindering the learning process.

The positive perceptions reported by students in the experimental group regarding the increased engagement and perceived understanding when learning with interactive PowerPoint are also significant. Their heightened motivation likely contributed to a more positive learning environment and a greater willingness to actively participate in mathematical activities. This affective dimension of learning plays a crucial role in academic success, as students who are engaged and motivated are more likely to invest the necessary effort to master challenging concepts. Classroom observations corroborated these findings, with observers noting increased student attentiveness, participation, and enthusiasm during lessons facilitated by interactive PowerPoint. The dynamic nature of the presentations and the opportunities for interaction appeared to hold students' interest more effectively than traditional lecture-based instruction. This active involvement is a key factor in promoting deeper learning and long-term retention of mathematical knowledge and skills. The alignment of these findings with existing research on the benefits of multimedia and interactive technologies in education reinforces the potential of such tools to transform the learning experience. By catering to diverse learning styles and providing opportunities for active engagement and immediate feedback, interactive PowerPoint appears to have created a more effective learning environment for mathematics at the elementary level in this study.

The practical implications of these results are significant for educators seeking accessible and cost-effective ways to enhance mathematics instruction. The widespread availability of Microsoft PowerPoint in schools makes it a readily deployable tool, provided that teachers are equipped with the necessary skills and pedagogical understanding to create and utilize interactive presentations effectively. Professional development in this area is crucial for maximizing the potential benefits of this technology. However, it is important to acknowledge that the effectiveness of interactive PowerPoint, like any educational tool, depends on its thoughtful integration into the curriculum and the pedagogical expertise of the teacher. Simply incorporating interactive elements without careful consideration of learning objectives and student needs may not lead to significant improvements in learning outcomes. The design of the interactive activities should be aligned with best practices in mathematics education and promote higher-order thinking skills.

The context of SD Negeri 2 Batumbulan and the specific characteristics of the participating students may also influence the generalizability of these findings. Further research in diverse educational settings and with different student populations is needed to confirm the broader applicability of these results. Additionally, exploring the long-term impact of using interactive PowerPoint on students' mathematical proficiency and attitudes towards mathematics would be valuable. In conclusion, the findings of this study strongly suggest that the efforts to improve students' learning outcomes in mathematics learning using interactive PowerPoint at SD Negeri 2 Batumbulan were successful. The significant gains in mathematics achievement, coupled with positive student perceptions and classroom observations, highlight the potential of interactive PowerPoint as an engaging and effective tool for elementary mathematics instruction. However, effective implementation requires pedagogical expertise, adequate teacher training, and ongoing evaluation to ensure its sustained impact on student learning.

The study's focus on interactive PowerPoint as a readily available technology offers a pragmatic approach to educational enhancement. In many schools, budget constraints may limit the adoption of specialized educational software. PowerPoint, often pre-

installed and familiar to educators for basic presentation purposes, represents a cost-effective alternative that can be leveraged for more dynamic and interactive learning experiences with appropriate training and pedagogical strategies. This accessibility factor contributes to the potential scalability and sustainability of this intervention in various educational contexts. The findings also underscore the importance of shifting from passive to active learning methodologies in mathematics education. Traditional lecture-based instruction can sometimes lead to disengagement and a lack of deep understanding. Interactive PowerPoint, with its capacity for embedding questions, polls, drag-and-drop activities, and simulations, encourages students to actively participate in the learning process, explore concepts firsthand, and construct their own understanding. This active engagement is a key principle of effective mathematics pedagogy.

Furthermore, the immediate feedback provided through interactive elements in PowerPoint aligns with cognitive learning theories that emphasize the importance of timely and specific feedback for learning and error correction. When students receive instant feedback on their responses, they can immediately identify misconceptions and adjust their thinking, leading to more efficient and effective learning. This contrasts with delayed feedback in traditional settings, which may reduce its impact. The positive impact of the visual elements in interactive PowerPoint on mathematics learning is also noteworthy. Mathematics often involves abstract concepts that can be challenging for elementary students to grasp. The ability to represent these concepts visually through animations, diagrams, and multimedia can make them more concrete and understandable, catering to visual learners and enhancing overall comprehension.

The study's findings also have implications for teacher professional development. To effectively utilize interactive PowerPoint for enhancing mathematics learning, teachers need training not only on the technical aspects of the software but also on pedagogical strategies for designing and implementing interactive lessons. This includes understanding how to align interactive activities with learning objectives, facilitate student engagement, and use the technology to support differentiated instruction. Future research could explore the optimal level of interactivity and multimedia integration in PowerPoint presentations for different mathematical topics and grade levels. Investigating whether there is a point of diminishing returns in terms of the number or complexity of interactive elements would provide valuable guidance for educators in designing effective digital learning resources.

Additionally, research could examine the role of teacher facilitation when using interactive PowerPoint. While the technology offers opportunities for self-paced learning and immediate feedback, the teacher's guidance, questioning techniques, and ability to connect the interactive activities to broader mathematical concepts remain crucial for maximizing learning outcomes. In conclusion, this study provides strong evidence for the benefits of leveraging interactive PowerPoint to improve mathematics learning outcomes in elementary school students. Its accessibility, capacity for promoting active learning and providing immediate feedback, and positive impact on student engagement make it a valuable tool for mathematics educators. Continued research and focused professional development efforts can further enhance the effective integration of this readily available technology into mathematics instruction.

CONCLUSION

In conclusion, this research provides compelling evidence for the effectiveness of utilizing interactive PowerPoint presentations as a means to improve mathematics learning outcomes among elementary school students at SD Negeri 2 Batumbulan. The statistically significant gains in post-test scores observed in the experimental group, coupled with positive student perceptions and enhanced classroom engagement, underscore the potential of this readily accessible technology to positively impact mathematics education at the elementary level. The study highlights the key benefits of incorporating interactive

elements and multimedia into mathematics instruction. These features appear to enhance student engagement, cater to diverse learning styles, and facilitate a deeper understanding of abstract mathematical concepts through dynamic visualizations and active participation. The immediate feedback provided by interactive activities also contributes to more effective learning and error correction, fostering a more self-directed and successful learning experience for students. The accessibility and cost-effectiveness of PowerPoint as a tool for creating interactive learning experiences offer practical implications for educators, particularly in resource-constrained settings. By leveraging existing software and focusing on pedagogical strategies for effective integration, schools can enhance mathematics instruction without significant financial investment. However, the need for adequate teacher training and professional development in designing and implementing interactive PowerPoint lessons is crucial for maximizing its potential. While the findings of this study are promising, further research is warranted to explore the long-term impact of interactive PowerPoint on mathematics learning, its effectiveness across different mathematical topics and grade levels, and the optimal design principles for creating engaging and impactful digital learning resources. Investigating the role of teacher facilitation and the potential for differentiated instruction using this technology would also be valuable areas for future inquiry. Ultimately, this research contributes to the growing body of knowledge on the effective integration of technology in mathematics education. The findings suggest that interactive PowerPoint, when thoughtfully designed and implemented, can be a valuable tool for enhancing student engagement, promoting active learning, and ultimately improving mathematics learning outcomes in elementary school students. By embracing readily available technologies and focusing on pedagogical innovation, educators can strive to create more effective and engaging mathematics learning experiences for all students.

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