



Addressing the Challenge of Mathematical Misconceptions: Development of Interactive Multimedia Based on Cognitive Conflict Strategy

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ABSTRAK

Miskonsepsi matematika menghambat pembelajaran dan pemahaman konsep matematika pada siswa. Penelitian ini bertujuan untuk menganalisis masalah miskonsepsi matematika dengan mengembangkan multimedia interaktif berbasis strategi konflik kognitif. Desain penelitian yang digunakan adalah penelitian dan pengembangan dengan pendekatan Design-Based Research (DBR), yang menggabungkan teknik pengumpulan data kualitatif dan kuantitatif. Terdapat empat belas partisipan dalam penelitian ini, termasuk siswa, guru, dan validator ahli, dan prosedur penelitian melibatkan implementasi intervensi multimedia interaktif. Teknik pengumpulan data meliputi penilaian pretest dan posttest setelah intervensi, observasi, dan wawancara. Data penelitian dianalisis menggunakan uji Paired Sample t-test. Temuan penelitian menunjukkan bahwa intervensi multimedia interaktif berbasis strategi konflik kognitif secara efektif mengurangi miskonsepsi matematika pada siswa. Hasil penelitian juga menunjukkan peningkatan pemahaman konseptual dan keterlibatan dalam proses pembelajaran. Penelitian ini memberikan kontribusi bagi bidang pendidikan matematika dengan menyajikan solusi inovatif dan praktis dalam mengatasi miskonsepsi siswa. Implikasi penelitian menunjukkan bahwa multimedia interaktif berbasis strategi konflik kognitif dapat digunakan sebagai pendekatan pedagogis untuk meningkatkan pemahaman konseptual dan mengurangi miskonsepsi matematika.

ABSTRACT

Mathematical misconceptions hinder students' learning and understanding of mathematical concepts. This study aims to analyze the issue of mathematical misconceptions by developing interactive multimedia based on the cognitive conflict strategy. The research design used was research and development with Design-Based Research (DBR), combining qualitative and quantitative data collection techniques. There were fourteen participants in this study including students, teachers, and expert validators, and the research procedure involved the implementation of interactive multimedia interventions. Data collection techniques had pretest and posttest assessments after the intervention, observations, and interviews. The research data were analyzed using the Paired Sample t-Test. The study's findings indicated that the interactive multimedia intervention based on the cognitive conflict strategy effectively reduced students' mathematical misconceptions. The results also demonstrated improved conceptual understanding and increased engagement in the learning process. This research contributes to the field of mathematics education by presenting innovative and practical solutions to address students' misconceptions. The research implications suggest that interactive multimedia based on the cognitive conflict strategy can be used as a pedagogical approach to promote conceptual understanding and reduce mathematical misconceptions.

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1. INTRODUCTION

Expected ideal conditions in addressing mathematical misconceptions involve developing practical, interactive multimedia tools. Mathematical misconceptions pose a frequent challenge in mathematics education. Students often develop incorrect or inaccurate understandings of mathematical concepts (Minarni et al., 2016; Roselizawati Hj Sarwadi & Shahrill, 2014), which hinder the learning process and create difficulties in comprehending more complex concepts in the future. High levels of mathematical misconceptions negatively impact the learning context and students' psychological well-being (Núñez-Peña et al., 2015; Steuer et al., 2013). Students with mathematical misconceptions tend to make repeated errors in solving mathematical problems due to their flawed understanding of the actual concepts. Moreover, high misconceptions can lead to lower academic achievement in mathematics (Malambo, 2021; Schnepfer & McCoy, 2013). Students with misconceptions struggle to comprehend more advanced material and solve more challenging mathematical problems. Another consequence is a lack of self-confidence (Lester et al., 1989; Wijaya et al., 2014). Students who experience misconceptions often feel less confident when faced with mathematical tasks and may lose interest in the subject. Addressing

students' mathematical misconceptions by developing practical, interactive multimedia tools is crucial. These tools are expected to assist students in overcoming their mathematical misconceptions more effectively and interactively. By utilizing interactive multimedia, students can actively engage in learning, explore concepts, and receive adequate feedback to correct their understanding. The availability of practical, interactive multimedia tools aims to enhance students' understanding of mathematical concepts and reduce the level of misconceptions present.

Many studies have been conducted in developing interactive multimedia for mathematics education, focusing on three main aspects. Firstly, some studies connect instructional models with the use of interactive multimedia, such as integrating blended learning models with the assistance of interactive multimedia (Attard & Holmes, 2022; Borba et al., 2016). Additionally, online mathematics learning using interactive multimedia is widely employed to enhance learning outcomes (Trenholm, 2023; Trenholm & Peschke, 2020). Secondly, the utilization of interactive multimedia also impacts students' psychological aspects, including motivation (Aristika & Juandi, 2021; Nasir & Nurfayanti, 2020), and student's interest in mathematics (Amelia & Harahap, 2021; Anwar et al., 2019). These studies measure student engagement, willingness to learn, and interest in mathematics as the primary focus. Thirdly, interactive multimedia development has been carried out across various platforms (Alim et al., 2020; Nugroho et al., 2022). These studies focus on the design, content, and interactive features that support understanding mathematical concepts (Arifin et al., 2021; Deb et al., 2014). However, there is a lack of research specifically exploring the use of interactive multimedia in addressing students' mathematical misconceptions. Furthermore, the development of multimedia that targets students' cognitive development, particularly in information processing, has been limited. In previous research, it has been found that cognitive conflict strategies can stimulate the thinking process and challenge misconceptions in learners. However, research examining interactive multimedia development specifically designed to apply cognitive conflict strategies in addressing mathematical misconceptions is still limited. Therefore, this study offers novelty by developing innovative interactive multimedia that integrates cognitive conflict strategies to target and reduce mathematical misconceptions among students.

The urgency of this research lies in the pressing need to address mathematical misconceptions and enhance students' conceptual understanding of mathematics. By developing interactive multimedia based on the cognitive conflict strategy, educators and researchers can provide effective tools to support students in overcoming misconceptions, promoting deeper learning, and improving their mathematical abilities. The specific objectives of this research are as follows: (1) to develop interactive multimedia materials that integrate the cognitive conflict strategy, (2) to investigate the effectiveness of the developed multimedia in addressing mathematical misconceptions among students, (3) to explore the perceptions and experiences of both students and teachers regarding the use of interactive multimedia in addressing mathematical misconceptions. This study is expected to significantly contribute to developing interactive multimedia based on the cognitive conflict strategy as an effective solution for addressing students' mathematical misconceptions. The findings of this research are expected to provide practical recommendations and implications for enhancing the quality of mathematics education and improve students' understanding of mathematical concepts.

The development of Interactive multimedia based on the cognitive conflict strategy addresses the challenge of mathematical misconceptions among students. Misconceptions, which are commonly encountered in mathematics education, involve incorrect understanding of mathematical concepts. Therefore, it is crucial to explain why this study is highly relevant. Firstly, the use of interactive multimedia with the cognitive conflict strategy provides an effective solution for addressing mathematical misconceptions. Secondly, interactive multimedia as a learning medium offers advantages in presenting information visually, audibly, and interactively. Thirdly, this study also focuses on the validity and practicality of interactive multimedia, providing a solid foundation for its use in mathematics education. This study aims to analyze the issue of mathematical misconceptions by developing interactive multimedia based on the cognitive conflict strategy.

2. METHOD

This study utilizes a research and development (R&D) approach to address mathematical misconceptions among students. Furthermore, the study aims to develop interactive multimedia based on the cognitive conflict strategy. The research design provides a systematic approach to developing and evaluating interactive multimedia interventions. The R&D framework consists of several sequential phases: analysis, design, development, implementation, and evaluation (Angouri, 2018). This study was conducted at one of the secondary schools in Indonesia, namely Madrasah Tsanawiyah (MTs) 5 Kuningan. The research subjects are three groups involved in this study: 1) Students who experience mathematical misconceptions. Through purposive sampling, eighth-grade students participated in implementing the interactive multimedia intervention and served as respondents in data collection. The selection of eighth-grade students as research subjects took several considerations into account (Kellett, 2008; Matthews, 1967; Pintrich, 2003). The selected student participants also exhibit relatively stable emotional maturity (Fröhlich, 2009). 2) Five mathematics teachers involved in the intervention implementation

guided students and provided feedback regarding using interactive multimedia. 3) Five expert validators in mathematics and education. They conducted assessments and provided feedback on the interactive multimedia development based on the cognitive conflict strategy, covering aspects of content validity, presentation, language, and graphics.

This study utilized data collection techniques, including the Three Tier Test, questionnaire, and interviews. The comprehensive data collection aimed to obtain research data on students' mathematical misconceptions, the effectiveness of interactive multimedia, and students' and teachers' perceptions regarding using interactive multimedia in addressing mathematical misconceptions. The Three Tier Test is one of the data collection techniques used to identify students' mathematical misconceptions before and after the interactive multimedia intervention. This test has three questions to measure students' understanding of mathematical concepts. The first level assesses basic conceptual understanding, the second assesses conceptual understanding, and the third sets conceptual understanding. Eight essay items using the Three Tier Test were used to identify students' misconceptions before and after the interactive multimedia intervention (Keeley & Tobey, 2017; Nicholls, 2007). The questionnaire consists of 30 items using a five-level Likert scale: Strongly agree, agree, neutral, disagree, and strongly disagree. Interviews are a data collection technique conducted through direct interaction between the researcher and the research subjects (Aberdeen, 2013), such as students and teachers. Interviews are performed after the implementation of the interactive multimedia intervention to gain a deeper understanding of students' experiences and teachers' perceptions regarding the use of interactive multimedia in addressing mathematical misconceptions.

This study employed a combination of qualitative and quantitative data analysis. The aim of using both analysis techniques was to obtain comprehensive research data on the validity and practicality of the interactive multimedia product, as well as its effectiveness in addressing students' mathematical misconceptions. Qualitative data analysis involves the assessment by expert validators in mathematics and education technology. The assessment focused on the developed interactive multimedia based on aspects such as alignment with mathematical concepts, clarity and consistency of content, the effectiveness of cognitive conflict strategies, clarity of instructions, and the connection between content and interactive activities (Bicen et al., 2014; Chiu & Churchill, 2016). The expert validators' assessment provided valuable input to improve the quality of the interactive multimedia in addressing mathematical misconceptions. Quantitative data analysis was conducted to measure the validity of the interactive multimedia product. Product validity can be measured using content analysis, content validity, and construct validity (Black & Babin, 2019; Molina et al., 2018). This analysis using the three-tier test, the Paired Sample t-test was employed to analyze the quantitative research data obtained from the pretest and post-test of the interactive multimedia intervention.

3. RESULT AND DISCUSSION

Result

In the analysis phase, there is a discrepancy between the ideal and the reality in the context of mathematics learning in schools. Ideally, students should be able to understand mathematical concepts well. However, many students still experience misconceptions, even when teachers use instructional media. The results of interviews with mathematics teachers at MTsN 5 Kuningan indicate that the development of mathematics instructional media is not optimal. Mathematics learning is still limited to conventional methods where teachers only provide explanations and materials that students must understand, followed by learning evaluations. Based on the analysis of the problems and the needs of mathematics learning in schools, it is found that students require instructional media that can encourage them to be active in their learning. One form of active learning is when students strive to construct their understanding of the learned material independently. To achieve this goal, effective instructional media is interactive multimedia that utilizes a teaching strategy that encourages students to construct their understanding. One suitable strategy is cognitive conflict, which prompts students to confront disputes within their understanding and strive to rectify existing misconceptions. Based on the analysis, this research aims to develop interactive multimedia with a cognitive conflict strategy using the Articulate Storyline 3 application.

The researcher developed an interactive multimedia design with a cognitive conflict strategy focused on the topic of circles. The design consists of Android-based interactive multimedia intended to facilitate interactive and constructive learning for students. Three design stages are developed to ensure effectiveness and student engagement in the learning process. The storyboard plays a crucial role as a roadmap guiding the development process of interactive multimedia. It consists of three parts encompassing various essential elements of interactive multimedia. Storyboard 1 presents the initial display, including the title of the interactive multimedia, login menu, and user instructions. Storyboard 3 showcases the competency and learning menu with instructional and interactive multimedia menu buttons. Storyboard 3 displays the evaluation menu with instructional buttons, the interactive multimedia menu, and the back button. These three storyboards provide a clear overview of the structure and functionality of the developed interactive multimedia. The next stage in the design of this interactive multimedia

involves creating a flowchart that depicts the interaction pathways within the multimedia. The flowchart of the designed interactive multimedia is show in [Figure 1](#).

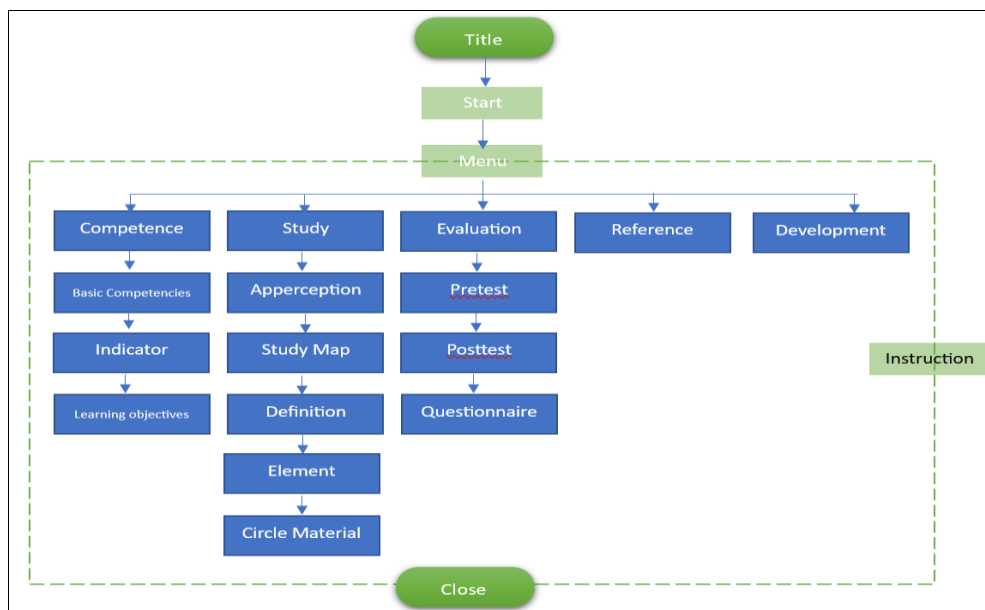


Figure 1. Interactive Multimedia Flowchart

Based on the previously created flowchart, the interactive multimedia design was developed by the researcher using the Articulate Storyline 3 application. The results of this interactive multimedia design development can be seen in [Figure 2](#).

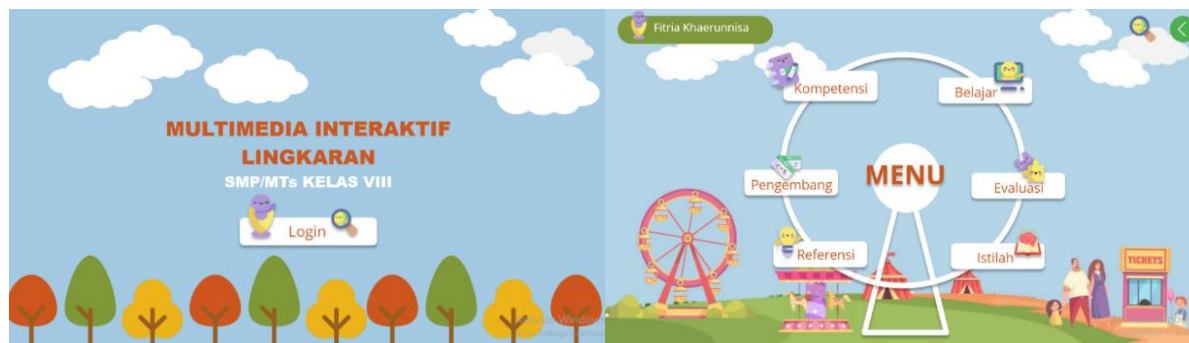


Figure 2. Interactive Multimedia Design Development

The Identity Menu is crucial in collecting student identity information when using interactive multimedia. Its function goes beyond merely identifying students; it enables personalized learning, evaluation, analysis, and effective tracking of student progress. The interactive multimedia menu is a vital component of an application/platform that provides easy navigation and access to various multimedia content. Its functions include intuitive navigation settings, responsive user controls, interactive features that enhance user engagement, and effective content organization. With a well-designed interactive multimedia menu, users can easily explore and use all the features offered within the interactive multimedia. User Instructions are an essential component of interactive multimedia that provides step-by-step guidance to users on practical usage. These instructions include detailed explanations of navigation, available features, and functions and the steps to follow instructions, answer questions, and complete assigned tasks. With clear and comprehensive user instructions, users can easily understand and optimize the use of interactive multimedia according to their desired learning objectives.

This competency description outlines the various skills expected from users to operate interactive multimedia effectively. The competencies include the ability to master menu and navigation, interact effectively with provided interactive elements and comprehend and apply taught mathematical concepts through interactive multimedia. They can identify potential misconceptions and utilize the available cognitive conflict strategies. This

visual representation is a map illustrating the relationships between related concepts in circle learning. The map plays a crucial role in assisting students in organizing information, enhancing their understanding of the interconnections between concepts, and strengthening their comprehension of circles. With this map, students can have a more comprehensive overview of the topic of processes and gain a deeper understanding of the involved concepts.

The approach adopted in this interactive multimedia aims to activate students' initial understanding of correct and incorrect circle concepts. Using questions and scenarios presented in the multimedia, students can test and refine their accurate understanding while identifying and addressing any misconceptions. This approach gives students an active and engaged learning experience, allowing them to gain a deeper and more precise understanding of circle concepts. The strategy implemented in this interactive multimedia aims to create situations or questions that trigger tension or conflict in students' understanding of mathematical concepts. The interactive multimedia encourages students to reflect, question, and revise their understanding by leveraging cognitive conflict. Through this process, students are prompted to delve deeper into the mathematical concepts taught, strengthen their understanding, and overcome misconceptions. This strategy encourages active student engagement in the learning process and fosters critical thinking and problem-solving skills.

With an approach that engages students, they are invited to discover and understand the concepts and relationships associated with circles. Through interaction with interactive multimedia, students can explore, formulate hypotheses, and connect different concepts. This approach enables students to actively engage in learning, deepen their understanding, and see the connections between mathematical concepts related to circles. In Reflection Syntax, students are expected to reflect on their experience using interactive multimedia. They are encouraged to consider, analyze, and reflect on their understanding before and after using the multimedia. Students can identify gaps in their understanding, compare concepts they have grasped before and after using the multimedia, and clarify concepts that may confuse them. This Assessment menu presents various types of tests and questions specifically designed to assess students' understanding of circle concepts and their ability to apply that knowledge. Through this menu, students can test themselves with various exercises and challenges relevant to the learning material. This References menu provides students access to various sources of information relevant to circle learning, including textbooks, journals, and online sources such as YouTube. Students can expand their knowledge of circle concepts through this menu by accessing more in-depth and diverse materials.

The interactive multimedia product that has been developed undergoes a validation process by an expert team. In this validation phase, qualitative data in the form of comments and suggestions from the validators are collected, which will be used as input to make revisions to the developed product. Additionally, quantitative data in the form of product validity assessments are also collected. Based on the feedback provided by the validators, the researchers made revisions to the product, resulting in an improved version. In the next stage, the results of the validity assessment by the five validators and the validity test calculations using Aiken's formula can be see in [Table 1](#).

Table 1. Interactive Multimedia Validity

Aspect	Indicator	V
Content	Suitability of the material to the curriculum	0.96
Feasibility	Accuracy of the material	0.87
	Recency of material	1.00
Presentation	Presentation technique	1.00
	Learning presentation	0.87
Feasibility	Presentation support	1.00
	Language suitability with students	0.80
Language	Ethical and aesthetic	0.94
	Communicative and informative	0.93
Feasibility	Direct	0.73
	Language precision	0.87
Graphic	Language conformity with PEUBI	0.87
	Media view	1.00
Feasibility	Readability of fonts	0.91
	Accuracy of color and design arrangement	0.93
Mean (\bar{x})		0.91

Based on [Table 1](#), Aiken's V validity coefficient is 0.91. This indicates that the multimedia interactive based on the cognitive conflict strategy that has been developed has a very high category of validity. With this validity value, multimedia interactive can be considered valid in reducing misconceptions in mathematics learning.

Regarding validity criteria, the V value 0.91 is more significant than 0.4. Therefore, the multimedia interactive that utilizes the cognitive conflict strategy meets the requirements as a valid tool in addressing misconceptions in mathematics learning.

After the validation process, the interactive multimedia developed by the researcher was tested on the respondents. The respondents were five mathematics teachers and 33 8th-grade students who experienced misconceptions. This testing aimed to gather responses and feedback from the teachers and students regarding the interactive multimedia. Response of interactive multimedia is show in Table 2.

Table 2. Responses to Interactive Multimedia

Respondents	Score	P-Percentage (%)	Criteria
Teacher	385	96	Highly Practical
Students	2278	86	Highly Practical
Mean (\bar{x})		91	Highly Practical

Based on Table 2 show practicality assessment by the teachers, the P value of the developed interactive multimedia with cognitive conflict strategy reached 96%. This indicates that interactive multimedia falls into the highly practical category. Furthermore, the responses from the 33 students and their calculations can be found in the following table. In addition, the practicality assessment results from the students showed a P value of 86%. This indicates that the developed interactive multimedia with cognitive conflict strategy is categorized as highly practical. Moreover, based on the average percentage of responses from teachers and students, the practicality percentage of the interactive multimedia developed by the researcher is 91%. The interactive multimedia with cognitive conflict strategy can be considered highly practical with this P value. Furthermore, according to the practicality criteria that set a P value $\geq 61\%$, interactive multimedia with cognitive conflict strategy has proven practical in reducing misconceptions in mathematics learning. To develop interactive multimedia with a cognitive conflict strategy to reduce misconceptions among students, an analysis was conducted on the level of misconceptions among students before and after the trial of interactive multimedia. Data on the level of misconceptions were obtained through pretest and posttest. The result of analyzing students' level of mathematical misconceptions is show in Figure 3.

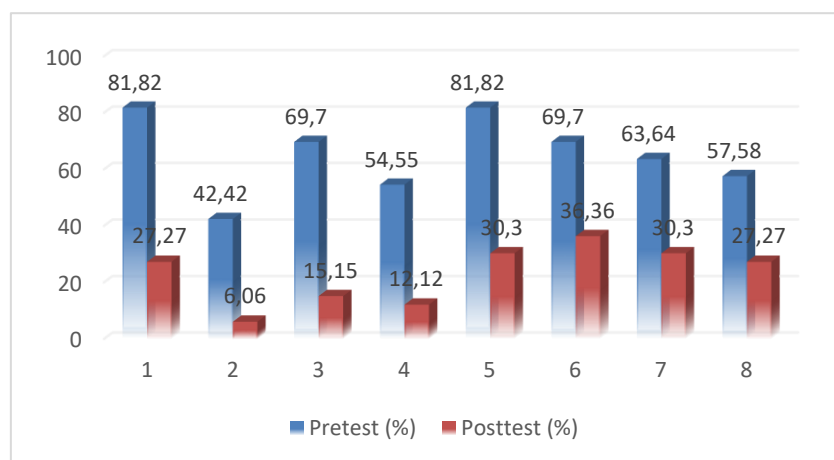


Figure 3. Students Misconception Level

Based on Figure 3, there is a descriptive decrease in students' misconceptions about each test item. Entirety average, there was a decrease in the level of mathematical misconceptions from 65.15 to 23.10. This indicates an improvement in students' understanding of the mathematical material after using interactive multimedia with cognitive conflict strategy. Furthermore, to analyze the significant impact of interactive multimedia with cognitive conflict strategy in reducing misconceptions in mathematics learning, the obtained data were analyzed using the Paired t-test. This analysis began by testing the assumptions of normality and homogeneity. The significance values for the pretest and posttest results were 0.700 and 0.336, respectively. According to the normality test criteria mentioned in section 3.9.2, if the Sig. The value is more significant than 0.05, and it can be concluded that the pretest and posttest data have a normal distribution. Therefore, the data can be further tested for homogeneity. The obtained significance value for homogeneity was 0.604. According to the homogeneity test criteria, if this value (0.604) is more significant than 0.05, it can be concluded that the pretest and posttest data are homogenous. Therefore, the data can be further subjected to the paired t-test.

Based on Paired t-test mathematical misconceptions data, the significance values for the pretest, and post-test results are 0.00. Referring to the criteria for the paired t-test, with a significance value of 0.00, which is smaller than 0.05, it can be interpreted that there is a significant difference between the pretest and posttest results of misconceptions. Furthermore, the average N-Gain score for each student is 76.41%. This N-Gain value indicates that the developed interactive multimedia with cognitive conflict strategy falls under the effective category in reducing students' mathematical misconceptions. According to the effectiveness criteria, with an N-Gain score of 76.41%, which is greater than 56%, it can be interpreted that interactive multimedia with cognitive conflict strategy effectively reduces mathematical misconceptions.

Discussion

The study findings indicate that developing interactive multimedia based on cognitive conflict strategy is effective in helping students improve their understanding and build more accurate concepts. Interactive multimedia also offers advantages in presenting information visually, audibly, and interactively, facilitating students' understanding more engagingly and enjoyably (Santagata & Bray, 2016; Uhl et al., 2021). Through images, graphs, animations, and videos, interactive multimedia can assist students in visualizing complex mathematical concepts (Fitriani, 2014; Santagata, 2009). The compelling visual representations enable students to understand the taught concepts better. Furthermore, interactive multimedia provides information through sounds, such as narration, dialogue, or verbal explanations. This diverse audio approach aids students with auditory learning preferences better comprehend mathematical material (Widianti & Hidayati, 2021; Yook et al., 2021). The interactive features in multimedia allow students to actively engage in learning, such as participating in simulations, answering questions, or performing interactive tasks. Students can directly test their understanding and apply mathematical concepts in relevant contexts through this interaction.

This study has provided a deeper understanding of the importance of developing interactive multimedia in addressing mathematical misconceptions. The cognitive conflict strategy approach in interactive multimedia can raise students' awareness of their misconceptions and encourage active engagement in learning (Gebreyohannes et al., 2016; Maag, 2004). Interactive multimedia with cognitive conflict strategy allows students to participate in learning actively. Through this active involvement, students can test their understanding, identify errors or misconceptions, and build more robust comprehension. Interactive activities, such as answering questions, solving problems, or engaging in independent exploration, serve as bridges for students to examine and improve their understanding. Furthermore, interactive multimedia with cognitive conflict strategy motivates students to think critically and reflectively, as they actively involve themselves in the process of justification and understanding improvement. By enhancing students' emotional and motivational engagement, interactive multimedia with cognitive conflict strategy can improve the effectiveness of mathematics learning.

The findings of this study have practical implications for the development of effective mathematics learning media. Teachers can adopt interactive multimedia based on cognitive conflict strategy as an alternative to addressing students' misconceptions and enhancing their understanding. Curriculum developers can also consider incorporating this interactive multimedia to design more engaging instructional materials. In comparison to previous research, the findings of this study support previous results that demonstrate the effectiveness of interactive multimedia in addressing mathematical misconceptions (Gebreyohannes et al., 2016; Parwati & Suharta, 2020). However, this study contributes further by using the cognitive conflict strategy approach as the foundation for developing interactive multimedia. Based on the research findings, an action plan can be formulated to implement interactive multimedia based on cognitive conflict strategy in school mathematics learning. Teachers can integrate this interactive multimedia into everyday teaching to assist students in addressing misconceptions and improving their mathematical understanding.

The research on addressing the challenge of mathematical misconceptions through developing interactive multimedia based on the cognitive conflict strategy has several limitations. Firstly, the sample size used in the research has been limited, potentially affecting the generalizability of the findings. To enhance the reliability and applicability of the results, future studies should consider more extensive and diverse samples that represent a wide range of students experiencing mathematical misconceptions. Secondly, the research may not have adequately accounted for contextual factors that can contribute to mathematical misconceptions. Socio-economic background, cultural differences, prior educational experiences, and individual learning styles can significantly influence the effectiveness of the developed interactive multimedia.

Therefore, further research should strive to incorporate these contextual factors to obtain a comprehensive understanding of their impact on addressing mathematical misconceptions. Additionally, the duration of the intervention or exposure to the interactive multimedia might have been insufficient to produce substantial and long-lasting effects. To fully evaluate the effectiveness and sustainability of the cognitive conflict strategy, future studies should consider longer-term interventions that allow for a thorough assessment of the intervention's impact over an extended period. Several recommendations can be made for further research in this area based on these limitations. Firstly, conducting large-scale studies with diverse student populations would enhance the

generalizability of the findings and provide a more comprehensive understanding of the effectiveness of the interactive multimedia and cognitive conflict strategy. Secondly, longitudinal studies with extended intervention periods should be implemented to assess the long-term impact and sustainability of the intervention. This would allow researchers to observe the effectiveness of the developed multimedia over time and identify potential factors that influence its efficacy. Future research should explore the influence of contextual factors, such as cultural differences and individual learning styles, on the effectiveness of the cognitive conflict strategy.

4. CONCLUSION

The finding of this study is that the development of interactive multimedia based on cognitive conflict strategy can effectively address students' mathematical misconceptions. Interactive multimedia also offers advantages in presenting information visually, audibly, and interactively, which can help students understand mathematical concepts more engagingly and enjoyably. The added value of this study is providing a new alternative to improving mathematics learning that still faces the challenge of students' mathematical misconceptions. This research provides a strong foundation for using interactive multimedia in mathematics education and offers profound insights into the effective utilization of interactive multimedia. However, this study has several limitations. It was conducted on a limited scale and with a limited sample of students. Additionally, the study did not examine the long-term impact of using interactive multimedia on students' mathematical understanding. Further research can expand the scale of the study and involve a larger sample, as well as examine the long-term effects of using interactive multimedia.

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