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Implementation of Napkin AI Technology in Cooperative Learning and Its Effect on Students' PAI Learning Outcomes

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Abstract

This study aims to examine the effect of applying a cooperative learning model assisted by Napkin AI media on the learning outcomes of fifth-grade Islamic Religious Education students at SDN 08 Watampone. Using a quantitative experimental approach, this study involved 25 fifth-grade students in the 2025/2026 academic year as subjects. Data were collected through multiple-choice learning outcome tests in the form of pretests and posttests, then analyzed using the Paired Sample t-Test. The results of the study showed a significant increase, where the average student score before treatment was 50.96, which is considered low, rising to 81.80 after treatment and categorized as high. The statistical test results with a significance value of 0.000 < 0.05 also confirmed the presence of a significant influence. The implementation of a cooperative learning model assisted by Napkin AI has been proven effective in improving students' PAI learning outcomes, as indicated by the change from a low to a high category and the significant influence between before and after the implementation.

Keywords: Cooperative learning model; Media Napkin AI; learning outcomes of Islamic Education

Abstrak

Penelitian ini bertujuan menguji pengaruh penerapan model pembelajaran kooperatif berbantuan media Napkin AI terhadap hasil belajar PAI siswa kelas V SDN 08 watampone. Dengan pendekatan kuantitatif jenis eksperimen, penelitian ini melibatkan 25 siswa kelas V tahun ajaran 2025/2026 sebagai subjek. Data dikumpulkan melalui tes hasil belajar berbentuk pilihan ganda pada saat pretest dan posttest, lalu dianalisis menggunakan uji Paired Sample t-Test. Hasil penelitian menunjukkan peningkatan yang signifikan, di mana nilai rata-rata siswa sebelum perlakuan sebesar 50,96 yang tergolong rendah, naik menjadi 81,80 setelah perlakuan dan masuk kategori tinggi. Hasil uji statistik dengan nilai signifikansi 0,000 < 0,05 juga menegaskan adanya pengaruh yang signifikan. Dengan demikian, penerapan model pembelajaran kooperatif berbantuan Napkin AI terbukti efektif meningkatkan hasil belajar PAI siswa, ditunjukkan oleh perubahan dari kategori rendah menjadi tinggi serta adanya pengaruh yang signifikan antara sebelum dan sesudah penerapan.

Kata Kunci: Model Pembelajaran Kooperatif; Media Napkin AI; Hasil Belajar PAI

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1. Introduction

The development of artificial intelligence technology has brought significant changes to the education sector, especially in creating more interactive, personalized, and student-focused learning methods. With a deductive approach, the integration of AI technology in education is believed to improve the effectiveness of the learning process by delivering material in a more relevant and collaborative manner. In the realm of Islamic Religious Education (PAI), which is not only oriented towards cognitive aspects but also emotional and spiritual ones, creative methods are needed to meet those needs. One innovation worth noting is the use of Napkin AI as an aid in cooperative learning, which facilitates students to actively collaborate, organize ideas, and deepen conceptual understanding in a visual and structured way. Thus, the application of Napkin AI technology in cooperative teaching is very important to study, especially in evaluating its impact on the overall improvement of students' PAI learning outcomes.

Education as an investment in human capital is a fundamental pillar in the development of human resources, playing a crucial role in improving individual quality of life and national progress. Through education, learners are guided to develop their potential optimally so that they can adapt to and compete in the era of globalization and digitalization (Sitorus et al., 2025). Furthermore, Government Regulation Number 4 of 2022 concerning amendments to Government Regulation Number 57 of 2021 on National Education Standards defines education as a deliberate and structured effort to create learning environments and processes that enable students to actively develop their potential in terms of spirituality, personality, intelligence, noble character, and the skills they need.

Technological advancements have brought significant impacts on various aspects of human life. The rapid pace of innovation requires society to adapt quickly in order to keep up with ongoing changes (Akbar & Noviani, 2019). The education sector is one of the fields that has greatly benefited from these developments (Khotimah et al., 2019).

Basic education holds a strategic position as the foundation for developing students' competencies and character (Dwintari, 2017). At this level, the learning process is not only aimed at mastering knowledge but also at shaping attitudes and values that serve as a foundation for further education (Pradana, 2021). The integration of technology in learning is also encouraged to create active, creative, and innovative learning environments aligned with the national curriculum. However, in reality, learning in elementary schools is still largely conventional and teacher-centered, with limited use of instructional media. This condition results in low student engagement and motivation, which ultimately leads to suboptimal learning outcomes (Daniyati et al., 2023).

Therefore, the goal of education is not merely focused on knowledge acquisition and academic achievement, but also on the development of character, attitudes, and skills to prepare students for global challenges (Urfa et al., 2024). To achieve quality education, classroom learning should encourage students to be active, creative, and engaged in meaningful learning experiences so that their potential can develop optimally (Syafa & Mukhrij Sidqy, 2024). Consequently, innovation in learning, particularly through digital technology, has become an essential requirement in improving the quality of education (Rahmawati & Nurachadija, 2023).

Islamic Religious Education (PAI) is one of the key subjects in shaping students' character (Firmansyah et al., 2023). The objective of PAI at the elementary level is to instill faith, piety, and noble character from an early age. Elementary school age is considered a sensitive period, as children tend to imitate values and behaviors from their surroundings (Putri, 2023). Therefore, PAI learning needs to be designed in an engaging and contextual manner so that it can effectively influence students' understanding and foster their religious character. However, in practice, PAI is often delivered through lecture-based methods with limited variation in instructional media, resulting in passive learning and difficulties in understanding abstract concepts.

PAI plays a significant role in shaping students' character. Learning PAI at the elementary level aims to instill values of faith, piety, and moral conduct from an early age. At this developmental stage, students are highly sensitive to values and behaviors acquired from their environment (Dzofir, 2020).

To address these challenges, teachers need to implement innovative learning approaches that actively engage students (Susanty, 2020). One key aspect lies in selecting appropriate learning models and utilizing interactive media. One suitable approach is cooperative learning, where students work together in small groups to achieve shared learning goals (Hasanah & Himami, 2021). This approach has been proven to enhance interaction, participation, and students' sense of responsibility, both individually and collectively. Numerous studies have demonstrated that cooperative learning can significantly improve motivation and learning outcomes among elementary school students (Sukses, 2020).

In addition to learning models, instructional media also play an important role in supporting the success of the learning process. The utilization of digital technology, particularly Artificial Intelligence (AI)-based media, represents an innovative approach to improving learning quality (Hakeu et al., 2023). Napkin AI is an AI-based learning medium capable of presenting material in visual forms such as graphs, concept maps, and mind maps, thereby facilitating students' understanding of complex and abstract content. This type of interactive visual media is considered effective in enhancing student participation, conceptual understanding, and information retention.

The presence of technology enables educators to design digital learning media, which refers to any tools used to deliver instructional content in a way that supports students in understanding the material (Nurjannah et al., 2021).

Although previous research has shown that cooperative learning models are effective in improving student learning outcomes and that the use of technology-based and artificial intelligence media can enhance conceptual understanding and learning motivation, there are still research gaps that have not been thoroughly examined. Previous studies generally examined these two aspects separately, namely the effectiveness of cooperative learning models without specific integration of AI technology, or the use of digital/AI media without being combined with a cooperative learning approach. In addition, previous research tended to focus on improving learning outcomes in general, and has not specifically highlighted Islamic Religious Education (PAI) learning at the elementary school level, which has unique characteristics, particularly in strengthening cognitive, affective, and spiritual aspects simultaneously. Therefore, this study has novelty by directly integrating cooperative learning model with Napkin AI media in the context of Islamic Religious Education learning for elementary school students, as well as empirically testing its effect on learning outcomes. Thus, this research not only expands the study on the effectiveness of cooperative learning and AI technology, but also provides a specific contribution to the innovation of Islamic Religious Education learning that is more contextual and adaptive to technological developments.

2. Methods

This study employed an experimental research design using a quantitative approach. The quantitative approach was selected because the study aims to test hypotheses through numerical data processing and statistical analysis. This research is categorized as field research, conducted directly in a real classroom setting to examine the effect of implementing a learning model on students' learning outcomes. Experimental research allows researchers to apply a specific treatment and systematically measure its impact under controlled conditions (Salsabila et al., 2024).

The variables in this study consisted of two types: the independent variable (X) and the dependent variable (Y). The independent variable was the cooperative learning model assisted by Napkin AI media, while the dependent variable was students' learning outcomes. The cooperative learning model assisted by Napkin AI refers to a learning approach that emphasizes student collaboration in small groups, supported by digital media (Napkin AI) to visualize learning materials in a more interactive and structured manner. Students' learning outcomes were measured through cognitive test scores obtained before and after the implementation of Napkin AI (Ritonga, 2024).

The population of this study consisted of all fifth-grade students of SDN 08 Watampone in the 2025/2026 academic year, totaling 25 students. All members of the population were included as research subjects.

Data were collected using a learning achievement test administered twice: before (pretest) and after (posttest) the implementation of the cooperative learning model assisted by Napkin AI. This was intended to identify changes in students' Islamic Religious Education (PAI) learning outcomes. The research instrument consisted of 15 multiple-choice questions developed based on the

instructional material. The multiple-choice format was chosen due to its objectivity, ease of scoring, and ability to cover a wide range of content. The collected data were then analyzed quantitatively to determine whether the cooperative learning model assisted by Napkin AI had a significant effect on students' PAI learning outcomes.

3. Result and Discussion

3.1 Result

The results of this study indicate a significant improvement in the Islamic Religious Education (PAI) learning outcomes of fifth-grade students at SDN 08 Watampone after the implementation of a cooperative learning model assisted by Napkin AI media. The research data were obtained through two stages of measurement, namely the pretest (before treatment) and the posttest (after treatment).

At the initial stage, prior to the implementation of the learning model, students were given a pretest to determine their baseline abilities. Based on the data analysis, the mean score obtained was 50.96. This result indicates that, in general, students' initial abilities were still categorized as low and had not yet met the Minimum Mastery Criterion (KKM), which was set at 75. This suggests that most students experienced difficulties in understanding the PAI material.

In addition to the mean score, the median score of 47 and the mode of 44 further confirm that the distribution of students' scores tended to fall within the low category. This indicates that the most frequently occurring scores were low, meaning that the majority of students had not yet mastered the material optimally. The score range was quite wide, from a minimum of 32 to a maximum of 79, indicating a considerable disparity in students' abilities.

The standard deviation of the pretest scores was 13.545, reflecting a high level of variability among students. This suggests the presence of a significant gap between students with higher understanding and those who still struggled. This condition indicates that the previous learning process had not been able to address students' needs evenly.

After the implementation of the cooperative learning model assisted by Napkin AI, a posttest was administered. The results showed a highly significant improvement. The mean score increased to 81.80, which exceeded the KKM and fell into the high category.

The median and mode, both at 80, indicate a more even distribution of student scores. This suggests that most students achieved a relatively similar level of understanding and were categorized as having good performance. Furthermore, the score range also improved, with the minimum score increasing to 73 and the maximum reaching 97.

The standard deviation in the posttest decreased to 6.014, indicating a reduction in score variability. This shows that students' abilities became more homogeneous after participating in the cooperative learning model assisted by Napkin AI. Moreover, no students were found in the low achievement category, indicating the effectiveness of the learning model in improving overall student understanding.

Overall, the results of this descriptive analysis demonstrate a significant improvement not only in the mean scores but also in the distribution and equity of students' learning outcomes after the implementation of the cooperative learning model assisted by Napkin AI.

3.2 Discussion

The results of the Paired Sample t-Test revealed that the significance value was 0.000, which is lower than the threshold of 0.05. Therefore, the null hypothesis (H_0) was rejected, while the alternative hypothesis (H_1) was accepted. In addition, the calculated t-value of 25.814 exceeded the t-table value of 2.064. These findings indicate a statistically significant difference between students' learning outcomes before and after the implementation of the cooperative learning model assisted by Napkin AI. Thus, it can be concluded that the application of this learning model has a significant effect on improving students' Islamic Religious Education (PAI) learning outcomes.

The improvement in learning outcomes suggests that the integration of cooperative learning with interactive digital media is effective in enhancing students' understanding. This finding is in line with Slavin (2015), who argues that cooperative learning improves academic achievement by promoting active interaction among students, enabling them to support one another in understanding the material. Through group discussions and collaborative activities, students function not only as passive recipients of information but also as active participants in the construction of knowledge.

Furthermore, Johnson and Johnson (2017) emphasize that the effectiveness of cooperative learning is determined by several key elements, including positive interdependence, individual accountability, face-to-face interaction, and the development of social skills. In this study, students' active participation in group discussions and collaborative task completion contributed to a deeper understanding of the concepts. This reflects a shift from teacher-centered instruction toward a more student-centered learning approach.

From the perspective of instructional media, the use of Napkin AI plays a crucial role in facilitating students' understanding of abstract PAI concepts. The presentation of learning materials in visual forms, such as concept maps, diagrams, and interactive illustrations, helps students grasp the relationships between concepts more effectively. This finding aligns with Mayer's (2014) Multimedia Learning theory, which suggests that combining verbal and visual information enhances the processing capacity of working memory, thereby improving learning outcomes.

In addition, Arsyad (2019) states that appropriate instructional media can increase students' attention, interest, and motivation. In this study, the use of Napkin AI was found to enhance student engagement during the learning process, which ultimately contributed to improved learning outcomes. This indicates that technology-based media play a strategic role in supporting effective instruction.

The integration of Artificial Intelligence (AI) in education is also supported by Luckin et al. (2016), who argue that AI can enhance learning quality by

providing interactive and adaptive learning experiences. In this study, Napkin AI served as a tool that facilitated students' understanding through structured visualization, making the learning process more meaningful.

The findings of this study are consistent with those of Wulandari et al. (2025), who reported that cooperative learning models improve learning outcomes among elementary school students. Similarly, Muin et al. (2025) found that the use of technology- and AI-based learning media enhances conceptual understanding and student motivation. These findings reinforce the idea that the integration of appropriate learning models with technology-based media can positively influence student achievement.

From a constructivist perspective, the results of this study also support Piaget's (1972) theory, which posits that knowledge is actively constructed by learners through experience. In the cooperative learning process assisted by Napkin AI, students were actively involved in exploration, discussion, and concept visualization, enabling processes of assimilation and accommodation that strengthen their cognitive structures.

In conclusion, the implementation of a cooperative learning model assisted by Napkin AI is effective in improving students' PAI learning outcomes. Beyond enhancing cognitive achievement, this approach also fosters active, collaborative, and meaningful learning experiences. Therefore, the development and application of innovative, technology-based learning models should be continuously promoted to improve the quality of education at the elementary level.

4. Conclusion

Based on the findings and discussion of this study, it can be concluded that the implementation of a cooperative learning model assisted by Napkin AI has a positive effect on the Islamic Religious Education (PAI) learning outcomes of fifth-grade students at SDN 08 Watampone. Prior to the implementation of the cooperative learning model assisted by Napkin AI, students' PAI learning outcomes were categorized as low. However, after the implementation of the model with the support of Napkin AI, students' learning outcomes improved and reached a high category.

The results of statistical analysis also confirmed a significant difference between students' learning outcomes before and after the implementation of the cooperative learning model assisted by Napkin AI. Therefore, it can be concluded that this learning model is effective in improving PAI learning outcomes of fifth-grade students in elementary school.

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