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Exploring Students' Reading Comprehension through Cooperative Learning-based Digital Interactive Media

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ABSTRACT

This study explores students' reading comprehension before and after implementing a cooperative learning model supported by digital interactive media. Conducted at SDN 1 Jamblang with 35 third-grade students, the research applied a one-group pretest-posttest design. The Student Teams Achievement Division (STAD) model was integrated with interactive media such as images, videos, and quizzes, adjusted to the school's limited technology. Data were collected through reading comprehension tests, observations, and documentation. The average pretest score was 59.14, rising to 82.60 in the posttest, with a normalized gain score of 0.6094 (moderate improvement). Observational results showed strong engagement, with teacher implementation at 81.25% and student activity at 90.63%. These findings indicate that cooperative learning, when enhanced with digital interactive tools, can effectively improve students' reading comprehension. Theoretically, this study supports Vygotsky's and Piaget's views by demonstrating how digital media and cooperative learning promote cognitive growth through social interaction and developmentally appropriate strategies. Practically, it offers a replicable model for educators aiming to improve literacy, especially in technology-limited schools. This approach offers a promising alternative for enhancing reading instruction and deserves further development to support digital-era literacy learning.

Keywords: Reading Comprehension, Cooperative learning, Digital Interaktif Media

INTRODUCTION

Tolerance is a value that must be taught to students from an early age to form a character Language is the primary tool humans use to convey thoughts, reasoning, attitudes, and feelings[1]. Indonesian as the National Identity of the Indonesian Nation has two positions, namely as the national language and the state language and functions as a means of communication between people. Language can also be used as a tool to identify a person's identity [2]. In addition to functioning as a symbol of identity and unifying the nation, Indonesian is also the main tool of communication in various fields of life such as government, economy, law, culture, and especially education. In the context of education, Indonesian is the main medium in the learning process, both as a separate subject and as a medium for understanding other subjects.

According to various sources including [3], Indonesian has an important role in national development and daily life, along with the development of the era and the rapid progress of information and communication technology. Technology has become an inseparable part of modern society, from communication activities, work, to learning. Various digital devices such as smartphones, laptops, and online learning platforms are now widely used by students in their daily activities. [4] stated that the widespread use of digital technology among students encourages the world of education to immediately

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transform and adjust learning strategies to suit the characteristics of the current generation.

This development has a major impact on the world of education, including the learning process in schools. Therefore, it is necessary to adjust the learning approach and strategy to be relevant to the needs of 21st century students. One important adjustment is the effective integration of digital technology in teaching and learning activities. This integration aims to create more interesting, interactive, and meaningful learning, as well as foster essential skills such as critical thinking, creativity, collaboration, and digital literacy. As stated by [4] the use of interactive digital media in learning has been shown to significantly increase student engagement and motivation to learn[5]. One of the important aspects of digital literacy and 21st century education is reading ability. A strong interest in reading is key to national progress because through reading, people can broaden their horizons, improve their thinking, and build a more advanced civilization[6] This basic skill is not only the foundation of all learning processes, but also the main gateway for students to access, understand, and manage information critically. Improving reading comprehension skills cannot only rely on conventional methods, but requires a structured, collaborative, and adaptive learning strategy to technological developments. An approach that integrates collaboration between students and interactive digital media is believed to be able to answer these challenges in a more contextual and meaningful way.

In the context of today's education, reading is no longer just a technical skill, but a process of understanding, evaluating, and managing information critically. This is supported by [7] who found a strong correlation between reading literacy of mathematical story problems and students' problem-solving skills along with the development of technology, this skill is also strengthened by the use of various digital media as learning resources. Reading comprehension skills need to be a primary concern in the learning process, especially at the elementary school level. Reading comprehension is the process of understanding the meaning of a text. [8] stated that reading comprehension aims to obtain in-depth information and understand the content of what is read. This ability is very important in supporting students' learning success in various subjects, because it determines the extent to which information can be absorbed and applied.

Reading comprehension is one of the main indicators of the quality of education and literacy of a nation. However, various international and national surveys show that the reading comprehension of students in Indonesia is still very low. The results of a UNESCO survey revealed that the reading interest of the Indonesian people was only 0.001 percent, placing Indonesia in 60th place out of 61 countries surveyed. This data is reinforced by the results of the Programme for International Student Assessment (PISA) 2022, where Indonesia's reading literacy score only reached 359, far below the OECD average of 476[9]. Although Indonesia's ranking in PISA 2022 rose 5-6 positions compared to 2018, in absolute terms Indonesia's reading literacy score still does not meet international and national standards.

The problem of low reading comprehension skills in Indonesia cannot be separated from various interrelated factors. One of the main root problems is the low interest in reading among students, which is exacerbated by the lack of literacy culture both in the family and school environment. A learning environment that does not fully support literacy development causes students to be less accustomed to reading actively and critically[6]. In addition, the learning methods used in many schools are still conventional. so that students tend to be passive and not optimally involved in the learning process without involving students in discussions or group activities that can stimulate in-depth

reading comprehension.

In today's digital era, the use of technology in learning has great potential to increase students' interest and reading comprehension skills. However, the implementation of interactive digital media in Indonesian schools still faces various challenges. Not all educators have adequate access or training to design and integrate technology optimally in the learning process[10] This condition causes some learning processes to still take place conventionally, which may not be fully in accordance with the characteristics of today's students who are accustomed to technology. In addition, there is also a gap in access to digital learning resources between schools in urban and rural areas, which has the potential to affect the distribution of education quality nationally[11]. This condition is exacerbated by the lack of evaluation and monitoring of the effectiveness of the learning that has been carried out. All of these problems contribute to the low achievement of reading literacy of Indonesian students, as reflected in various national and international studies.

In the current digital era, the use of technology in education holds great potential to improve students' interest and reading skills. However, the implementation of interactive digital media in Indonesian schools still faces several challenges. Not all educators have adequate access or training to effectively design and integrate technology into the learning process. This condition highlights the need for innovation and systematic evaluation of effective learning strategies to improve students' reading ability.

In an ideal context, students are able to access, understand, and use information from written texts effectively. If the reading learning process is carried out effectively, students will have adequate literacy skills to equip them for other subjects or in their daily lives. If the reading learning process is carried out effectively, students will have adequate literacy skills to equip them for other subjects or in their daily lives. Teachers are able to guide students to actively read and understand texts using varied and engaging strategies. However, this condition is not fully reflected in reality. Learning does not only focus on comprehension outcomes but also emphasizes an active, meaningful learning process oriented toward developing students' critical thinking skills [12]. This can be achieved through the use of appropriate learning models, the use of relevant learning media, and the support of a conducive learning environment. Good reading comprehension skills extend beyond simply understanding text content; they also encompass the ability to analyze, evaluate, and apply the information gained from reading to everyday life. This aligns with global literacy standards, as measured by the PISA and UNESCO indicators, which emphasize the importance of basic literacy, critical thinking skills, and character development.

To address the problem of low reading comprehension skills, a comprehensive solution is needed. One way to achieve this is by integrating the STAD cooperative learning model, supported by interactive digital media, into the school learning process. Teachers need training to effectively design and implement technology-based learning. Furthermore, efforts are needed to improve the culture of literacy in schools and families, as well as ensure equitable access to digital learning resources throughout Indonesia. Regular monitoring and evaluation are also crucial to ensure the effectiveness of the learning model. The structured implementation of the STAD cooperative model, supported by interactive digital media, is expected to significantly improve students' reading comprehension and support the improvement of the quality of national education.

The Student Teams Achievement Divisions (STAD) cooperative learning model has been widely studied and proven effective in improving students' reading comprehension

skills. [13] shows that the application of the STAD model can significantly improve students' reading comprehension skills. Another study [14] also strengthens this finding, where the use of the STAD model assisted by interactive digital media can increase student motivation and learning outcomes. The Student Teams Achievement Division (STAD) cooperative learning model has been extensively researched and proven effective in improving students' reading comprehension and motivation. Previous research has shown that implementing STAD can increase student engagement and comprehension of reading material.

Theoretically, according to [15] this research is based on Vygotsky's sociocultural development theory, which emphasizes the importance of interaction in learning through the Zone of Proximal Development (ZPD), and Piaget's cognitive development theory, which states that elementary school students are in the concrete operational stage and learn most effectively through contextual visual experiences. These two theories provide a strong foundation for implementing digital media-assisted cooperative learning at the elementary level [16]

By combining a model that aligns with students' cognitive development and real classroom challenges, this study aims to offer relevant and effective solutions to improve students' reading comprehension skills in the digital era.

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MATERIAL AND METHODS

Methods

This study employed a quantitative one-group pretest-posttest design to explore students' reading comprehension before and after cooperative learning with digital interactive media. The research was conducted at SDN 1 Jamblang, located in a rural area of Cirebon, West Java, involving 35 third-grade students selected through saturated sampling. The school has limited technological infrastructure, including basic multimedia equipment such as a projector. The Student Teams Achievement Division (STAD) model was implemented with support from digital media such as videos, images, and interactive quizzes. Data were collected through reading comprehension tests consisting of 10 multiple-choice questions based on three texts, targeting indicators such as identifying explicit information, understanding main ideas, making inferences, and interpreting words in context, as suggested by Anderson[17]. Observation sheets were also used to assess teaching implementation and student engagement. The data were analyzed descriptively using normalized gain (N-Gain) to determine improvement levels. This research received ethical approval from the Research Ethics Committee of Universitas Muhammadiyah Cirebon, and informed consent was obtained from the school and the students' guardians prior to data collection.

Instrument

The instruments used in this study consisted of a reading comprehension test and observation sheets. The test included 10 multiple-choice questions based on three reading texts, developed according to reading comprehension indicators such as identifying explicit information, understanding main ideas, making inferences, and interpreting word meanings in context, as stated by Anderson . These test items were validated by experts and showed good content validity, with r-values ranging from 0.535 to 0.798, exceeding

the minimum requirement of r-table = 0.344, and were therefore considered valid. The reliability of the instrument was confirmed with a Cronbach's Alpha value of 0.769, indicating that the test was moderately reliable. Additionally, structured observation sheets were used to evaluate the implementation of learning activities by the teacher and the students' engagement during the lessons.

Procedures

The research procedure was divided into three main stages: preparation, implementation, and evaluation. The preparation stage included developing learning instruments, validating the reading comprehension test items, and coordinating with the teacher. In the implementation stage, the pretest was administered to assess students' initial reading comprehension, followed by two learning sessions using the STAD model integrated with digital interactive media such as videos, images, and quizzes. The media were displayed via projector due to limited technological facilities. During the learning activities, observations were conducted to assess the implementation and student engagement. In the final stage, the posttest was given, and all data collected from tests and observations were analyzed descriptively, including the calculation of normalized gain (N-Gain) to determine students' improvement.

Data Analysis

The data in this study were analyzed using quantitative descriptive techniques to present a comprehensive picture of students' reading comprehension outcomes before and after the learning intervention. Descriptive statistics, including mean pretest and posttest scores, were used to compare student performance. To assess learning outcomes, normalized gain (N-Gain) was calculated, indicating the relative improvement achieved by students. N-Gain is a well-established metric in educational research for evaluating learning effectiveness in pre-experimental designs. Additionally, observation data from structured teacher and student activity sheets were analyzed using percentage calculations to evaluate the implementation of learning activities and student engagement. These observations were carried out directly by the researcher during the learning process to ensure accurate and consistent data collection, and during the learning process, the observations were assessed directly by the classroom teacher, who also served as an observer. This combined analysis provides a holistic understanding of how cooperative learning with digital interactive media affects students' reading comprehension.

RESULTS AND DISCUSSION

Results

This study was conducted on third-grade students at SD Negeri 1 Jamblang with a total of 35 participants. It employed an experimental design using the one-group pretest-posttest method, which involved a single treatment using the Student Teams Achievement Division (STAD) type of cooperative learning model and one measurement (pretest). The posttest was then used as the outcome of the experiment in this one-group pretest-posttest design. The data collected in this study consisted of pretest scores before the treatment and **posttest scores** after the treatment. The pretest and posttest data provided an overview of students' abilities in achieving indicators of reading comprehension skills in narrative text material in the third grade of SD Negeri 1 Jamblang.

Reading comprehension skills before and after applying the STAD type cooperative learning model

Students' reading comprehension skills were measured before and after the implementation of the STAD cooperative learning model assisted by interactive digital media. To obtain a general overview of students' reading comprehension skills, a pretest was conducted. To calculate the pretest results, descriptive statistical tests were conducted using the IBM SPSS 27 application. The pre-test and post-test results are presented in a table.

Table 1 Pretest Statistical Analysis

Descriptive Statistics								
	N	Range	Minimum	Maximum	Sum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Datapretest	35	70	30	100	59.14	3.132	18.530	343.361
Valid N (listwise)	35							

Table 1, it is known that the number of students who took the pre-test was 35 people. The average score (mean) obtained during the pre-test was 59.14. The minimum score obtained by students was 30 and the maximum score was 100. The standard deviation of 18.530 indicates a fairly high variation in scores among students when the initial measurement was carried out before the learning treatment. Next, after implementing the cooperative learning model, students were given a post-test to measure their improvement. The results of the post-test are summarized in Table 2.

Table 2 Posttest Statistical Analysis on IBM SPSS 27 application

Descriptive Statistics								
	N	Range	Minimum	Maximum	Sum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
Dataposttest	35	50	50	100	2890	82.57	2.183	12.912
Valid N (listwise)	35							

Based on the results of descriptive statistical analysis of the post-test data on students' reading comprehension, a sample size of 35 students was obtained. The minimum score obtained by participants was 50, while the maximum score was 100, resulting in a range of 50. The total cumulative score for all participants was 2890, with an average score of 82.57. This average indicates that students generally achieved high results after participating in the learning process. Overall, these data indicate that students' post-test scores were spread across a fairly wide range, but the average score tended to be in the high category.

Table 3 Description of Pre-test and Post-test Statistics

Statistik	Pre-test	Post-test
N	35	35
Range	70	50
Minimum	30	50
Maximum	100	100
Sum	2070	2890
Mean	59.14	82.57
Std. Error Mean	3.132	2.183
Std. Deviation	18.530	12.912

Table 3 shows differences in the mean, minimum, maximum, and standard deviation scores between the pre-test and post-test results. Based on the descriptive analysis, 35 students took the pre-test and post-test. The minimum pre-test score was 30 and the maximum 100, with a mean of 59.14 and a standard deviation of 18.530. In the post-test, the minimum score was 50 and the maximum score remained 100, with a mean of 82.57 and a standard deviation of 12.912. The score range for the pre-test was 70, while for the post-test it was 50. The standard error for the pre-test was 3.132, and for the post-test it was 2.813.

Observation of Learning Implementation

Observation was carried out to assess the implementation of learning activities during the use of the STAD cooperative learning model assisted by digital interactive media. Two aspects were observed: teacher activities and student participation. The observations were conducted across three meetings using structured observation sheets, and the percentage of implementation was calculated based on the criteria in the observation instrument.

Table 4 of observation of model application

Meeting	Score Obtained	Maximum Score	Percentage (%)
1	26	32	81.25
2	28	32	87.50
3	30	32	93.75
Average	–	–	87.50

Learning effectiveness

To measure the effectiveness of the learning intervention, a normalized gain (N-Gain) analysis was conducted by comparing the pretest and posttest values. The calculation results showed that the average N-Gain score was 0.6094, which is included in the moderate category based on the Hake classification in. The interpretation of the N-Gain score is as follows:

Table 5 Interpretasi N-Gainc

Skor N-Gain (g)	Interpretasi
$g < 0,3$	Low
$0,3 \leq g < 0,7$	Currently
$g \geq 0,7$	Tall

Based on the classification in Table 5, the N-Gain scores obtained in this study can be interpreted to determine the level of effectiveness of learning interventions. The

descriptive results of the N-Gain scores of all students are presented in Table 7. The calculation of N-Gain uses the IBM SPSS 27 application.

Table 6. N-Gain calculation score

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
NGain_Score	34	.17	1.00	.6094	.24780
NGain_Persent	34	16.67	100.00	60.9384	24.78049
Valid N (listwise)	34				

The normalized gain (N-Gain) analysis was conducted on data from 34 students. The descriptive statistics show that the minimum N-Gain score was 0.17, and the maximum was 1.00, with an average (mean) score of 0.6094 and a standard deviation of 0.24780. In percentage form, the average N-Gain percentage was 60.94%, with a range from 16.67% to 100.00%. This indicates that the learning intervention had a moderate level of effectiveness in improving students' reading comprehension, based on Hake's criteria. The variation in scores, as reflected by the standard deviation, suggests that while some students achieved high gains, others showed lower levels of improvement. Nonetheless, the average gain falls within the moderate category, confirming that the implementation of the STAD model supported by digital interactive media contributed positively to students' learning outcomes. The improvement in students' reading comprehension after implementing the STAD learning model with interactive digital media is reflected in the results of the N-Gain analysis. The average N-Gain score was 0.6094, indicating a difference in learning outcomes before and after the treatment. The relatively wide range of scores, from 0.17 to 1.00, with a standard deviation of 0.24780, reflects that most students experienced significant improvement, although some students still experienced modest improvement.

Discussion

Reading comprehension skills before and after applying the STAD type cooperative learning model

Based on the results of the descriptive statistical tests conducted, a difference was found in the average scores between the pre-test and post-test results for students' reading comprehension. The average pre-test score of 59.14 and the post-test score of 82.67 indicate a significant difference in achievement. While no conclusions regarding effectiveness can be drawn without further testing, this difference indicates a change in student scores after participating in the STAD cooperative learning model with the assistance of interactive digital media. Furthermore, the minimum and maximum scores on the post-test also shifted to a higher range. In the pre-test, the minimum and maximum scores were 50 and 75, respectively, while in the post-test, they were 70 and 95. This shift indicates that all students achieved scores in the higher category than before participating in the learning. Based on the descriptive analysis, the average pre-test score was 59.14 with a standard deviation of 18.530. Meanwhile, the average posttest score increased to 82.57 with a standard deviation of 12.912. This increase in the average score indicates an improvement in students' reading comprehension after the treatment. Furthermore, the decrease in the standard deviation indicates that student learning outcomes are more evenly distributed and less spread out from the average score, demonstrating the effectiveness of the learning approach used. This data is also supported by interactive digital media-based learning.

Research by [18]. Shows that the use of interactive digital media can increase student engagement during the learning process, thus increasing their chances of understanding the material thoroughly. A recent study also supports these findings. [19] found that implementing the STAD model based on electronic learning tools (digital media) resulted in an increase in the average score and a decrease in the standard deviation in students' critical thinking skills. This aligns with the posttest data, which showed a tighter distribution of scores after the use of interactive media.

Furthermore, these results align with research on the application of STAD to improve seventh-grade students' reading comprehension conducted by [20]. The average score increased from 55.30 to 77.40 ($t = 19.55$; $p < 0.05$), indicating a statistically significant difference. Although the study used a t-test rather than a Wilcoxon test, the concept of score change remains relevant. Theoretically, cooperative learning theory suggests that through social interaction within groups, students complement each other and enrich their understanding of the material. This is consistent with the findings on diversity. This, these descriptive results support the implication that the use of the STAD model combined with interactive digital media explains statistical changes in student scores (average, distribution, and range), without the need to directly refer to "improvement" before inferential testing.

Observation of Learning Implementation

Based on observations conducted over three learning sessions, the implementation of the Student Teams Achievement Division (STAD) cooperative learning model supported by digital interactive media showed a high level of effectiveness. The percentage of teacher implementation increased from 81.25% in the first session to 87.50% in the second session, and reached 93.75% in the third session. The overall average implementation rate was 87.50%, which falls into the excellent category. These results indicate that the teacher was able to systematically implement the STAD learning steps with continuous improvement in each meeting. This reflects the teacher's growing ability to integrate digital media and manage cooperative learning activities effectively. This finding is consistent with Vygotsky's theory, which emphasizes the role of the teacher as a more knowledgeable other who guides students within their Zone of Proximal Development (ZPD). As the teacher's implementation improved, students were increasingly supported in achieving their learning potential through collaboration and structured guidance[21]. Piaget's theory also supports this finding, as elementary students at the concrete operational stage benefit significantly from visual aids such as images, videos, and interactive quizzes. These results are also supported by the study of [22] in *Jurnal Dinamika*, which found that using interactive digital media like the Quizizz application in team-based quiz learning increased elementary students' learning motivation. This reinforces the idea that digital technology can foster engaging and participatory learning environments

These findings also align with previous studies by[23] and[24], which state that the application of STAD combined with digital media enhances the effectiveness of instruction and supports teachers in designing engaging and contextual learning experiences. Therefore, the observation results demonstrate that the implementation of the STAD model supported by digital interactive media was carried out effectively and progressively, contributing to a learning environment that is active, collaborative, and well-suited to the needs of 21st-century learners.

Learning effectiveness

Based on the results of the N-Gain analysis, which indicated a moderate category, it can be concluded that the implementation of the STAD model supported by interactive digital media had a positive impact on improving students' reading comprehension. The average score of 0.6094 reflects that the majority of students experienced a significant improvement in learning outcomes after the intervention. This effectiveness was not only reflected in the quantitative data but also evident in the learning process itself. The implemented approach was proven to be effective in creating learning experiences that encouraged active student engagement. The use of digital media such as videos, images, and interactive quizzes appeared to help students better understand the reading content. Visual support and group activities also facilitated meaningful social interactions during the learning process**.**

These findings indicate that the implemented approach successfully provided a learning experience that encouraged active student engagement. The use of digital media such as videos, images, and interactive quizzes appeared to help students better understand the reading content. Visual support and group activities also facilitated meaningful social interactions during the learning process. Furthermore, these findings reinforce previous research by [25], which stated that the STAD model can significantly improve learning outcomes and student engagement, especially when supported by learning media that are appropriate to student characteristics. This finding also aligns with research by [26] which showed that the use of gamification-based digital learning media, such as Wordwall, can significantly improve elementary school students' critical thinking skills. This confirms that interactive digital media can support active student engagement and overall learning effectiveness in the 21st-century context. Thus, the improvement in learning outcomes observed in most students indicates that the learning strategies implemented are able to create a supportive learning atmosphere, are responsive to student characteristics, and encourage the development of reading comprehension skills gradually and sustainably.

Thus, the observed improvement in learning outcomes for the majority of students indicates that the implemented learning strategies are able to create a supportive learning environment, are responsive to student characteristics, and encourage the gradual and continuous development of reading comprehension skills.

CONCLUSION

Based on the results of this study, it can be concluded that the implementation of the STAD (Student Teams Achievement Division) cooperative learning model assisted by digital interactive media contributed positively to improving students' reading comprehension skills. The increase in posttest scores and the average N-Gain score in the moderate category indicate that the learning intervention enhanced students' understanding of narrative texts. Furthermore, the high levels of student engagement and strong teacher involvement demonstrate that both parties participated actively in the learning process. These findings suggest that cooperative learning supported by interactive digital tools offers a practical and promising approach to strengthening literacy skills in primary education, particularly in schools with limited access to technology.

This study has certain research limitations, including the use of a one-group pretest-posttest design without a comparison group, and being conducted in a single school setting. These limitations may affect the extent to which the results can be generalized. Future research could involve multiple schools or use comparative experimental designs

to gain broader insights.

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