Lectura: Jurnal Pendidikan
Volume 16, Nomor 2, Agustus 2025, Halaman 502-512
ISSN: 2086-4876
ISSN: 2549-063X
DOI: https://doi.org/10.31849/cjwsdf89
Link: https://journal.unilak.ac.id/index.php/lectura/article/view/27431

The Effect of STAD Learning Model Using Bingo Card Media on Grade IV Students Mathematics Outcomes

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Submitted: 10-06-2025 Accepted: 16-06-2025 Published: 09-08-2025

Abstract
This research is based on the problem of mathematics learning which is often considered difficult and boring, so it has an impact on low student learning outcomes. This study aims to see data on student learning outcomes using the Student Teams-Achievement Divisions (STAD) learning model and students who do not use the STAD learning model, and to analyze the influence of the STAD learning model based on bingo card media on the mathematics learning outcomes in grade IV of elementary school. This study used a quasi-experimental method with a pretest-posttest design. A control group of 64 students. The experimental class applied the STAD model with bingo card media, while the control class used conventional methods. Data collection was carried out through essay tests that had been tested for validity and reliability. Data analysis used normality, homogeneity, and independent tests. Sample T-test. The average post-test result of the experimental class was 87.31, higher than the control class which was 76.72. The results of the T-test showed a significance of 0.000 <0.05, which means there is a significant difference between the two classes. Therefore, the STAD learning model assisted by bingo card media is effective in improving the mathematics learning outcomes of fourth-grade students. In conclusion, STAD Learning Model using bingo card media is also able to create a more interactive, enjoyable learning atmosphere and increase students' active involvement in learning.

Keywords: STAD learning model, bingo card media, learning outcomes

INTRODUCTION

Mathematics is one of the compulsory subjects implemented in the education curriculum in Indonesia which is taught from early childhood to high school. Mathematics learning is instilled from an early age, starting from the introduction of numbers and symbols. According to Saidah et al. (2019), Mathematics subjects at the elementary school level include several main aspects, namely numbers, geometry, measurement, and data processing, all of which aim to develop students' logical, systematic, critical, and creative thinking skills. This goal is in line with the view of Rahmalia & Safari (2024) which emphasizes that mathematics learning at the elementary school level must be able to form cooperation skills and problem-solving abilities. Thus, in its implementation, mathematics learning in the classroom must be presented with appropriate and interesting learning methods, so that students can follow the learning optimally and obtain maximum learning outcomes. This is reinforced by the opinion put forward by Aryati & Mulyawati (2024) that in the learning process, teachers are required to have the skills to package learning using interesting methods, models, and media.

However, in reality, mathematics learning for elementary school students is considered difficult learning, because in the learning process, they are often faced with complex questions that require high concentration and long processing time (Aisyah et al., 2024). Based on these facts, the obstacles in mathematics learning in elementary schools are the low ability of students to understand concepts, the way the material is delivered is less interesting, fear of failure, and pressure in working on exam questions which then results in a decrease in student learning outcomes.

This problem was also found at SDN (*Sekolah Dasar Negeri*) Ciracas 15 Pagi, especially in grade IV students. Based on the results of observations from the Odd Semester Mid-Term Assessment data for the 2024/2025 academic year conducted on November 7, 2024, it was found that most students had not achieved the Minimum Completion Criteria (*Kriteria Ketuntasan Minimum*/KKM), with a completion rate of only 62%. Learning is said to be successful if at least 75% of students have achieved the KKM (Fauzi et al., 2023). This condition shows that students' mathematics learning outcomes are still low and innovative learning solutions are needed so that the learning process becomes more interesting and effective.

In overcoming low learning outcomes, innovation is needed in implementing learning by applying appropriate learning models and media. The use of the STAD-type cooperative learning model collaborated with bingo card media is a solution used by researchers. Student learning model Teams-Achievement Divisions (STAD) is a cooperative learning approach that places students in small groups of 4 to 5 members with diverse achievement backgrounds. In one group, there is a combination of students with low, medium, and high academic achievement, and diversity in gender, ethnicity, and social status Ridwan et al. (2022). The STAD learning model is included in the cooperative model. Suryana & Somadi (2018) state that learning is designed to achieve three main goals, namely improving academic achievement, strengthening appreciation for diversity, and developing students' social skills. The main idea of the STAD approach is to encourage students' learning motivation through group interaction, where each group member will help each other understand the material and complete tasks together (Sitio et al., 2021).

To strengthen the effectiveness of the STAD learning model, there are various types of learning media, one of which is the bingo card media which is applied as a fun learning aid. Bingo card media is a familiar game concept with slight modifications for educational

purposes. Bingo card game is a game in the form of cards and numbered tables, if students collect three vertical, horizontal, or diagonal dots in a row in answering questions correctly then they shout "Bingo!" and get points (Saputri et al., 2024). Related to the STAD learning model, bingo card media is used to support student activity in learning. In line with what is expressed by the Chahyadi (2024), bingo card media is a learning media that can involve students directly in a learning experience obtained from direct contact with objects or objects being studied.

Several previous studies have examined the application of the STAD learning model and interactive learning media separately. Sitio et al. (2021) proved in their research that STAD can improve students' activeness, collaboration, and academic achievement. In addition, another study conducted concluded that understanding of mathematical concepts increased by 8.57% after the implementation of the STAD learning model. Another study that examined the application of Septian et al. (2020) bingo card media, namely, research by Mareta & Julianto (2017) shows that there is an influence of the use of bingo card game media on science learning outcomes. However, these studies have not integrated the STAD learning model with bingo card media simultaneously.

Based on the results of previous research studies, it can be concluded that most studies only test the effectiveness of the STAD learning model or game media such as bingo cards separately. These studies have not integrated both approaches simultaneously in one complete learning process. In addition, most studies were conducted on subjects outside of mathematics or at different levels, such as junior high and high school. The context of application to fourth-grade elementary school students, especially on shape material, is still very limited in empirical studies. This gap shows the importance of conducting research that combines the STAD model with bingo card media to improve mathematics learning outcomes at the elementary level, which requires a more concrete, fun, and interactive learning approach.

The novelty of this research lies in the integration of the STAD-type cooperative learning model with bingo card media as a learning strategy combined in one learning activity. This combination is expected to create a learning atmosphere that is more collaborative, active, fun, and effective in improving student mathematics learning outcomes. This approach has not been studied empirically, so this research provides innovation in developing more innovative learning models at the elementary school level.

Thus, the purpose of this study was to measure and analyze the effect of the application of the STAD learning model assisted by bingo card media on the mathematics learning outcomes of fourth-grade students of SDN Ciracas 15 Pagi. In addition, this study was also used to determine significant differences between the learning outcomes of students who use the STAD learning model based on bingo card media and those who use conventional learning methods. It is hoped that the results of this study can enrich insights into the field of mathematics learning and provide alternative learning models that are more interesting and effective to be applied in elementary schools.

METHOD

This study was conducted using a quantitative approach that aims to measure and analyze the effect of implementing learning models on students' mathematics learning outcomes. The quantitative approach was chosen because it is appropriate for studying the relationship between variables systematically and measurably through numerical data that are analyzed statistically. The method used in this study is the experimental method,

which specifically applies the type of quasi-experimental with pretest-posttest design control group design.

The experimental method in this study aims to identify and analyze the effect of a treatment on changes in conditions or variables observed in the experimental group compared to the control group. This study involved two groups, each of which was given different treatments, namely the experimental class and the control class. The experimental class received treatment in the form of implementing the Student-type cooperative learning model. Teams-Achievement Divisions (STAD) combined with the use of bingo card media, while the control class follows the learning process with conventional methods that are usually applied in schools.

Population is defined as a generalization area in a study, which includes objects or subjects that have certain characteristics and from which conclusions can be drawn (Amin et al., 2023). The population in this study were all fourth-grade students at SDN Ciracas 15 Pagi in the 2024/2025 academic year, consisting of two classes, namely class IV-A and IV-B with a total of 64 students. In determining the sample, a nonprobability sampling technique was used, namely a sampling technique that was not carried out randomly. With details of the experimental class sample totaling 32 students and the control class sample totaling 32 students. In this study, class IV-A was designated as the control group, while class IV-B acted as the experimental group.

Data collection in this study was carried out using a test instrument in the form of 10 essay questions designed to measure students' mathematics learning outcomes before and after treatment. The instrument validation process was carried out through the assessment stage of expert mathematics lecturers. The experts assessed the suitability of the question indicators with the basic competencies taught, the level of difficulty of the questions, and the relevance of the questions with the use of bingo card media. After receiving input, several questions were revised to clarify the sentences and adjust the level of difficulty to the characteristics of grade IV students. The trial test was conducted on grade V students at the same school to be used as validation data. With this step, it is hoped that the instruments used in the study are truly valid and able to measure learning outcomes accurately.

After the test instrument is tested by experts and has gone through a trial, the test questions will be tested with statistical tests, namely validity and reliability tests. Validity tests are carried out using the product correlation coefficient formula. Moment. Based on the calculation results, 10 essay questions used as test instruments were declared valid because they met the criteria. $r_{hitung} < r_{tabel}$. In the reliability test using the Cronbach's Alpha formula. The calculation produces $Cronbac$ h's Alpha > 0.06 = 0.851 > 0.06 test instrument is declared reliable for measuring student learning outcomes.

Pretest-posttest research design control group design requires both groups, both experimental and control, to take a pre-test before the treatment is given. The pre-test aims to determine the initial ability of students to understand the material being taught. After that, the experimental group received treatment in the form of the application of the STAD learning model assisted by bingo card media, while the control group continued to follow learning with conventional methods without using the STAD model. After the treatment was completed, both groups were given a post-test to measure student learning outcomes after the intervention was carried out. Comparison of the results of the pre-test and post-test in the two groups is the basis for determining the effectiveness of the application of the learning model used.

In this study, data processing was carried out using descriptive statistical analysis and inferential statistical analysis. Descriptive statistical analysis is used to describe the data that has been produced so that it makes it easier for readers to interpret the existing data (Martias, 2021). Furthermore, the data is analyzed inferentially which leads to the conclusion of the formulated hypothesis. The tests contained in the inferential analysis are the normality test, the homogeneity test and the independent sample T- Test.

FINDINGS AND DISCUSSION

Findings

Data Description

In this study, the data before the treatment was in the form of pre-test results from both classes. The following table describes the data before the treatment through statistical tests using the IBM SPSS Version 26 Program.

Table 1. Results before Treatment

Class	Minimum Value	Maximum Value	Average	Standard Deviation	Variance
Experimental Class	38	80	64.88	12,710	161,325
Control Class	30	80	61.5	13.107	171,847

Based on table 1. The data results before treatment from both classes have the same maximum value, namely 80. The two classes have differences in average values, namely 64.88 and 61.5.

Next, is the result data obtained after treatment using the learning model. The experimental class applies the STAD learning model with the help of bingo card media while the control class uses the conventional learning model. The following is a table of data descriptions through statistical tests using the IBM SPSS Version 26 Program.

Table 2. Results after Treatment

Class	Minimum Value	Maximum Value	Average	Standard Deviation	Variance
Experimental Class	78	100	87.31	6.682	44.648
Control Class	68	87	76.72	5.532	30.599

Based on Table 2, it was obtained that there was an increase in the average score of learning outcomes in the experimental class with the control class. In the experimental class, the average post-test score reached 87.31 with a standard deviation of 6.682. While in the control class, the average post-test score was 76.72 with a standard deviation of 5.532. In general, there was an increase in the average score of 10.59 points in the experimental group compared to the control group.

Comparison pre-test and post-test results from the second class can be seen in the following diagram. From the comparison diagram of the pre-test and post-test of both classes, it can be seen that there was a higher increase in the experimental class compared to the control class after the treatment was given. This shows that the STAD learning

model assisted by bingo card media has a positive influence on student learning outcomes.

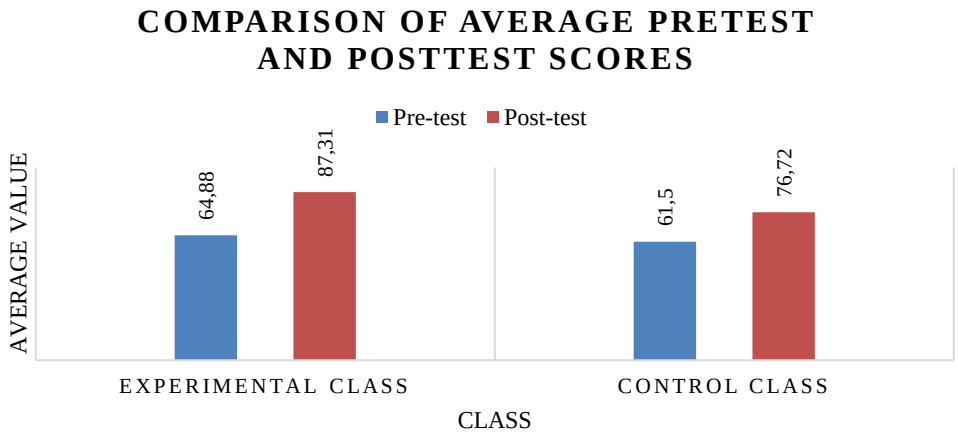

Diagram 1. Comparison of Pre-test and Post-test

Normality Test

Normality test was carried out using the Liliefors formula with the help of the IBM for Macroeconomics program. Windows SPPS version 26. The sample used in each class was 32 so the calculation was carried out with the Shapiro-Wilk provisions.

Table 3. Normality test before treatment

Class	Sig. (2-tailed)	Significance Level (α)	Criteria	Information
Control Class	0.214	0.05	Significance > (0.05)	Normal
Experimental Class	0.053			Normal

From the results of the normality test before the control class treatment, the sig value was obtained. Of 0.214 and the experimental class was 0.053. With the provisions of Shapiro-Wilk using n = 32, the significance level (α) = 0.05 with the criteria sig . > (0.05). So 0.214 > 0.05 and 0.053 > 0.05, which can be concluded that the samples taken are normally distributed.

Table 4. Normality test after treatment

Class	Sig. (2-tailed)	Significance Level (α)	Criteria	Information
Control Class	0.064	0.05	Significance > (0.05)	Normal
Experimental Class	0.234			Normal

Normality test of mathematics learning outcomes after treatment in the control class, it produces a sig. Value of 0.064 and the experimental class is 0.234. In the control class sig. > (0.05) = 0.064 > 0.05 and the experimental class sig. > (0.05) = 0.234 > 0.05. Thus, it can be concluded that the samples taken from both the control class and the experimental class are normally distributed.

Homogeneity Test

After the results of the normality test show that the research data is normally distributed, the data will be re-tested through the Homogeneity Test. The homogeneity

test is used to determine whether the variations in data are homogeneous or not. In this study, the homogeneity test was carried out through the IBM SPSS Version 26 program to test the homogeneity of variations for two sample groups. The results of the calculation of the homogeneity test can be seen in the table below:

Table 5. Homogeneity Test Criteria

Class	Sig. (2-tailed)	Significance Level (α)	Criteria	Information
Control Class Experimental Class	0.147	0.05	Significance > (0.05)	Homogeneous

From the results of the homogeneity test, the Sig. Value was obtained as much as 0.147 with a significance level of 0.05 and the criteria Sig. > (0.05). So it can be concluded that 0.147 > 0.05 = sig. >0.05 so that the variation of the two sample groups is declared homogeneous.

Independent Sample T- Test

Based on the research results, the average value of students' mathematics learning outcomes in the experimental class was 87.31 with a standard deviation of 6.682, while the control class obtained an average of 76.72 with a standard deviation of 5.532. Before the hypothesis test was conducted, the data had met the requirements of normality and homogeneity.

Independent Sample T-Test was conducted using SPSS Version 26 with a significance level of 0.05. The test results showed a sig. Value (2-tailed) of 0.000 < 0.05, so H_0 was rejected.

Table 5. T-test

Class	Average	Sig. (2-tailed)	α	Criteria	Information
Control Class Experimental Class	76.72 87.31	0.00	0.05	significance < (0.05)	There is an influence

Therefore, the results that can be concluded from the calculation of the T- test are that there is a significant difference between the learning outcomes of students in the experimental class and the control class. The STAD model assisted by bingo cards is effective in improving the mathematics learning outcomes of fourth-grade students at SDN Ciracas 15 Pagi.

Discussion

This research was conducted at SDN Ciracas 15 Pagi and involved two groups of fourth-grade students, namely class IV-A as the control class and class IV-B as the experimental class. In this study, both class groups studied the same material, namely square and rectangular plane shapes. However, there is a significant difference in the learning approach used. In the control class, the learning process uses conventional learning methods, while the experimental class applies the Student-Based Cooperative Learning Model. Teams-Achievement Division (STAD) combined with bingo card media.

Based on the results obtained from this study, it can be seen that there is a significant influence on the learning outcomes of students who are included in the experimental class.

This finding is in line with the purpose of the study, namely to determine the effect of using the STAD learning model assisted by bingo card media on student learning outcomes. In addition, students who take part in learning with the STAD model and bingo card media show better conceptual understanding, high active involvement, and increased learning motivation compared to students in the control class. This also strengthens that the learning model and media applied contribute significantly to achieving learning objectives.

The success of the STAD learning model in improving student learning outcomes cannot be separated from the systematic stages applied in the learning process. The steps of the STAD model include conveying objectives and materials, forming heterogeneous groups, learning activities together in groups, using bingo cards as a fun learning tool, individual evaluations to measure personal mastery of the material, and awarding awards to the best groups. Each stage in the STAD model is designed to increase student engagement, strengthen conceptual understanding through group discussions, and create a competitive and fun learning atmosphere.

Slavin's theory (1995) states that the STAD-type cooperative learning model is a learning model that involves a process of cooperation in a heterogeneous group by improving the academic abilities of each (Isnaini & Kurniawan, 2020). Through the application of the STAD learning model, students have the opportunity to learn from their group mates, exchange ideas, and work together in completing tasks that directly impact the improvement of student mastery of the material and learning outcomes individually.

Bingo card media makes a major contribution to increasing students' active participation in the learning process. Bingo cards as a game-based educational media utilize the principle of joyful learning. This psychologically reduces students' anxiety towards mathematics learning which is considered difficult and increases the attraction to the teaching material. According to Setiyawan (2018), the media bingo cards can arouse competitive spirit, increase student involvement in learning, and build a dynamic, interactive, and non-boring learning atmosphere. This is proven by game-based learning is one of the effective strategies in building meaningful and enjoyable learning experiences for elementary school students. Thus, the application of interesting learning media such as bingo cards provides a concrete alternative for teachers to apply a structured game-based learning approach.

Bingo card media in this study shows a strong synergy in improving the quality of learning. When used simultaneously, the STAD model encourages collaboration and conceptual understanding through group discussions, while bingo creates a healthy competitive atmosphere and stimulates student focus and engagement during learning. The combination of the two effectively answers the challenges of learning mathematics which have been considered boring and difficult by most elementary school students. This is in line with the opinion of Rahmadina & Slamet (2024) that effective learning must be able to build positive interactions between students, create a challenging, fun learning atmosphere, and encourage student activity in the classroom.

The results of this study are in line with previous studies that have been mentioned in the introduction. The findings of Sitio et al. (2021) showed that the application of the STAD model can increase students' academic activity and achievement. In addition, research conducted by Septian et al. (2020) proved that students' understanding of mathematical concepts increased significantly after implementing the STAD cooperative learning model. Furthermore, Mareta & Julianto (2017) found that the use of bingo game media was effective in improving science learning outcomes. Unlike previous studies that

only applied models or media separately, this study provides a new contribution by integrating both strategies into one complete learning model. These results are also supported by the findings of Chahyadi (2024) who proved that bingo media can increase students' learning motivation through competitive and fun games. Thus, this study strengthens empirical evidence that collaboration through cooperative learning models and the use of game media can create more effective, interesting, and enjoyable learning.

However, other factors can affect the success of implementing the STAD model based on bingo card media. First, the role of the teacher is very important in directing the course of group learning, regulating the dynamics of interaction between students, and ensuring that each student can contribute actively. Teachers must also be sensitive to the learning speed of each student so that the learning process continues to run optimally, even though it takes place in a collaborative and flexible atmosphere. Second, the level of student participation greatly determines the effectiveness of the cooperative learning model. The more enthusiastic and involved the students are, the greater the benefits obtained. Third, good time management is also an important factor in implementing the STAD model. Teachers must be able to manage time effectively so that all stages of learning, from group discussions, and utilization of bingo card media, to evaluation, can be carried out well in the time available.

In addition to these internal factors, there are external factors that also influence the success of the implementation of the STAD model based on bingo card media. A supportive school environment, such as the availability of adequate classrooms, adequate learning media, and support from the school. Parental involvement is also an equally important factor. The psychological and social conditions of students, such as self-confidence, and comfort in interacting with friends can affect students' active participation in groups. In addition, the availability of adequate learning resources, both in the form of books, digital media, and learning tools, are important supporters to make it easier for students to understand the material and carry out learning activities optimally.

The findings of this study provide a positive contribution to the development of learning strategies in elementary schools. The use of the STAD learning model combined with bingo card media not only focuses on academic achievement, but also forms the character and social skills of students. Teachers are advised to implement the STAD learning model which is collaborative, innovative, and fun as an effort to reduce boredom in traditional learning methods. The use of educational learning media such as bingo cards can strengthen interactions between students in the classroom and can create a more open and inclusive learning environment. Schools also have an important role in providing support, both teacher training, provision of adequate facilities and infrastructure, and development of a curriculum that is responsive to new methods such as the STAD model.

Therefore, the implementation of the STAD learning model based on bingo card media is recommended as an effective strategy to improve learning outcomes while developing elementary school students' skills. This approach is in line with the goals of 21st-century education which not only emphasize content mastery, but also collaboration, creativity, and communication as the main communication that elementary school students must have.

CONCLUSION

Based on the findings of this study, it can be concluded that the implementation of the Student Teams-Achievement Division (STAD) learning model integrated with bingo card media has a positive influence on the mathematics outcomes of Grade IV students. The

use of bingo cards, which offer a fun and engaging approach to learning, supported the STAD model in creating a collaborative and active learning environment. This combination encouraged students to participate more enthusiastically in the learning process, increased their concentration during mathematics lessons, and helped reduce anxiety when solving problems. The cooperative setting fostered peer learning, while the bingo card media provided an enjoyable way to reinforce mathematical concepts. Overall, this strategy proved effective in promoting both cognitive understanding and affective engagement among students.

However, the study has several limitations. The research focused solely on mathematics as a subject and was conducted only in one grade level within a particular school context. As such, the results may not be easily generalized to other subjects, educational levels, or broader school environments. Moreover, the study did not explore the long-term retention of mathematics concepts or assess how individual differences, such as learning styles or teacher facilitation techniques, might have affected the outcomes. For future researchers, it is recommended to investigate the implementation of the STAD model supported by various educational media across different subjects and grade levels. Expanding the research to include more diverse learning environments will provide a deeper understanding of its effectiveness. Additionally, studies that assess long-term impacts and student attitudes toward learning can offer valuable insights for developing more innovative and engaging teaching strategies in elementary education.

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