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# The Effect of Using the MARBEL Indonesian Culture Educational Game in Flipped Classroom Learning on the Science and Science Learning Outcomes

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**Abstract:** The purpose of this study is to ascertain how the Marbel Indonesian Culture Educational Game, when used in a flipped classroom, affects the scientific learning outcomes and science curriculum of fourth-grade students at SDN Kajen. This study employs quasi-experimental quantitative methodologies. Thirty-two grade 4 respondents from SDN Kajen participated in this study. Both test and non-test methods are used in data collection. The findings of this study demonstrate that student learning outcomes are impacted when the Indonesian Cultural Marbel educational game is used in Flipped Classroom instruction. The significance values for pair 1 (0.001 < 0.05) and pair 2 (0.001 < 0.005) demonstrate this. Additionally, the use of the instructional game Indonesian Cultural Marbel in Flipped Classroom Learning improves student learning results by 41.5%. The Marbel Budaya Indonesia educational game is therefore considered less effective in boosting the efficacy of Flipped Classroom learning because its N-Gain value of 0.415 places it in the less effective group.

Keywords: Educational games; Flipped classroom; Learning outcomes

# Introduction

The basic education level plays a very important role where students are not only taught basic academic skills such as reading, writing and arithmetic, but are also equipped with important values, including respecting cultural diversity amidst increasingly rapid technological developments (Rozi et al., 2024). The rapid development of technology can bring convenience as well as challenges in the learning process, especially at the elementary school level (Taherdoost & Madanchian, 2022).

Based on data from the Indonesian Internet Service Providers Association (APJII), internet use by Indonesian children continues to increase, especially via mobile devices (Putra & Dewi, 2020). This shows good adaptability to technology (Sakti, 2023). It also provides opportunities to make learning more interesting, interactive and relevant to students' current needs (Arikarani & Amirudin, 2021). So that children's cellphone use can be monitored and can help them understand various learning materials (Suyadi & Selvi, 2022).

The increasingly rapid development of technology also requires teachers to always adapt to technology in order to create effective, interesting, interactive learning and adapt to developments (Fernanda & Ahmadi, 2023). One learning method that can be elaborated with technological developments is the flipped classroom learning method (Fauzan et al., 2021). With the help of digital resources such as instructional videos, online courses, and educational apps, this learning paradigm allows students to learn content outside the classroom (Apriani et al., 2024). Learning by implementing a flipped classroom approach means class time can be focused on in-depth discussions, problem solving, and strengthening understanding (Latifah, 2023). The study by Masripah et al. (2019) shows how the flipped

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classroom, which allows students to learn at their own pace and according to their needs, can increase student engagement in the learning process.

One digital resource that can increase student involvement in learning is by using educational game application learning media (Nurhikmawati et al., 2024). Educational game applications such as Indonesian Cultural Marbel can also improve student learning outcomes (Erhel & Jamet, 2019). Through a variety of entertaining interactive tasks, this game combines visual and audio aspects to introduce the diversity of Indonesian culture (Kozlov et al., 2024). Research conducted by Podungge et al. (2022) shows how the use of educational games can improve learning outcomes by making content more interesting and easier for students to understand. Research conducted by Waryana (2021) with the title Application of the Flipped Classroom Learning Model Assisted by Google Sites to Increase Social Sciences Learning Activeness and Outcomes, also shows that the application of the Flipped Classroom learning model can increase students' active learning in social studies learning.

The challenges faced in utilizing technology optimally, amidst the phenomenon of increasing use of smartphones by elementary school students, are an important reason for this research. Without proper direction, the use of technology can actually have negative impacts, such as lack of concentration in studying or addiction to devices (Kurt et al., 2025). However, with the right approach, technology can be an effective learning tool (Børte & Lillejord, 2024). It is hoped that the combination of flipped classes and educational games such as Indonesian Cultural Marbel can overcome these challenges and improve student learning outcomes in understanding the diversity of Indonesian culture (Selasih et al., 2024).

This research was conducted on fourth grade students at SD Kajen with several considerations. First, at this age, students begin to develop critical thinking skills and respond well to technology-based learning (Ekaputra, 2023). Second, even though students are independent enough to use technological devices, they still need teacher guidance to maximize the use of technology in learning (Cipta et al., 2023). Third, this school represents the challenges many elementary schools in Indonesia face in integrating technology as an effective learning tool such as a lack of training in creating and using interactive learning media (Wahyu et al., 2020).

Based on observations made in class IV at SDN Kajen, it shows that students are starting to develop critical thinking skills and respond well to technologybased learning (Priante & Tsekouras, 2025). Apart from that, students are also quite independent in using technological devices (Wardani et al., 2024). Based on the results of interviews with class IV teachers, he explained that there were challenges in implementing learning using technological devices. Such as the lack of knowledge to utilize educational game learning media to increase learning interest and learning outcomes, so that the integration of technology as an effective learning tool has not been optimal (Handayani et al., 2024).

The aim of this research is to examine how integrating the flipped classroom and educational games can improve student learning outcomes in understanding Indonesia's cultural diversity (Roman et al., 2025). By utilizing technology that is already familiar to students, it is hoped that it can increase their motivation and interest in learning (Afifa & Astuti, 2024). In addition, this learning model provides teachers with the opportunity to manage teaching more effectively through data generated from educational games, which can be used to identify areas that need more attention (Usman et al., 2024).

With this background, it is hoped that this research can provide new insights into the use of innovative learning approaches to improve student learning outcomes, as well as strengthen the role of technology in education so that it can create a dynamic, interactive and meaningful learning environment through the integration of flipped classes and educational games (Huang, 2025). Apart from that, with a good understanding of cultural diversity, students will not only better appreciate the richness of Indonesian culture, but will also be better prepared to face global challenges (Kwangmuang et al., 2024).

# Method

This research uses а quasi-experimental methodology. This research approach was chosen because although researchers cannot completely control the random selection of research subjects, they can use two different groups to carry out learning (Khairunnisak et al., 2023). An experimental group that uses Flipped Classroom learning with the Indonesian Marbel Culture educational game, and a control group that uses conventional methods without technology integration. Quasi-experimental research makes it possible to see differences in learning outcomes between the two groups in a controlled learning context, although there are limitations in fully controlling external variables (Abraham & Supriyati, 2022).

Test and non-test procedures were used in this research data collection methodology. There is a pre-test and post-test used in the test technique (Adam & Mulyani, 2023). The test instrument used consisted of multiple choice questions and essays designed to measure student understanding before and after treatment (Siregar & Siregar, 2024). The validity of the 708 instrument was tested by involving material experts and methodology experts to evaluate the suitability of the instrument in measuring learning outcomes of Indonesian cultural diversity as well as the suitability of the instrument to the research objectives (Dewi et al., 2024). While the reliability is tested using the Cronbach's Alpha coefficient to ensure that the question items used in the test actually measure the same aspect of the variable (Rosidin et al., 2023). For example, if the questions in a learning outcomes test regarding Indonesian cultural diversity provide similar answers for participants who have similar understanding, then the instrument can be considered consistent and valid (Ramadhan et al., 2023).

Then the test scores are analyzed by comparing the pre-test and post-test results to assess the increase in student understanding after implementing the learning method (Prastyo & Wulandari, 2023). The test used to determine the magnitude of improvement and effectiveness uses the following formula:

$$N_{gain} = \frac{Posttest \ score - Pretest \ score}{Maximum \ score - Pretest \ score}$$
(1)

The N-gain results obtained are then interpreted to determine the category of N-gain percentage (Annisa et al., 2022). The following is a table of percentages for the N-gain category.

Table 1. Percentage of N-gain category

0 0	
Percentage	Category
N-gain $\geq 0.70$	Tall
0.30 < N-gain < 0.70	Currently
N-gain $\leq 0.3$	Low

The N-gain results obtained are then converted into percent to find out the interpretation of the N-gain percentage (Aziziyah et al., 2022). The following table shows the percentage of N-gain effectiveness.

Table 2. Percentage of N-gain effectiveness

0 0	
Percentage (%)	Category
< 40	Ineffective
40 - 55	Less effective
56 – 75	Quite effective
> 76	Effective

Furthermore, non-test techniques are carried out using observation, interviews and questionnaires (Mukaromah et al., 2024). Observations focused on students' active involvement and participation during the learning process and students' responses to the use of technology in learning. Interviews were conducted with 4th grade teachers to dig deeper into their experiences with the learning methods applied, including their effectiveness and the obstacles they faced. Questions in the interview covered their experiences in implementing Flipped Classroom and the use of educational games, their perceptions of the influence of this method on student learning outcomes, challenges and successes they experienced during the implementation of the method. The questionnaire used is in the form of a Likert scale and is designed to measure students' learning motivation and attitudes towards the learning methods applied (Ulfah et al., 2024).

Data obtained from observations and interviews were analyzed descriptively to understand in depth students' perceptions, attitudes and experiences in participating in Flipped Classroom learning using the educational game Marbel Budaya Indonesia. Qualitative data will be analyzed using thematic analysis techniques, namely identifying the main themes that emerge from interviews and observations, which are then used to enrich the results of quantitative analysis and provide further context regarding student learning outcomes (Putra et al., 2024). Meanwhile, data from the questionnaire was analyzed quantitatively to determine the level of student motivation and attitudes (Nabilah & Jumadi, 2022).

This research was conducted involving 32 respondents located in Kajen Village, Margoyoso, Pati. Then the respondent criteria consist of inclusion and exclusion criteria (Prayudi, 2023). Inclusion criteria include students aged around 9-10 years who are currently studying at elementary school, students who are able to adapt to technology and actively participate in the learning process and students who give permission to participate. Meanwhile, the exclusion criteria are students who are less than 9-10 years old and more than 9-10 years old, students who are not active in the learning process and students who are not given permission to participate so they cannot take part in the entire research series. Sample selection was carried out using a purposive sampling technique to ensure suitability for the research objectives. Ethical considerations in this research include obtaining permission from the school and parents, as well as ensuring the confidentiality of respondent data.

Before the instrument was used in research at SDN Kajen, a trial was first carried out. The research instrument test was carried out at MI Darun Najah Ngemplak Kidul. to ensure its validity and reliability. The selection of this school was based on similar characteristics to the school where the main research was conducted, so that the results of the trial could be expected to be relevant. The results of validity and reliability tests are used to revise the instrument so that it conforms to established standards, ensuring that the instrument is able to measure the variables studied accurately and consistently (Mukholifah et al., 2020).

## **Result and Discussion**

Researchers will talk about the following topics in light of studies on how using the MARBEL Indonesian Culture Educational Game in flipped classroom instruction affects the scientific learning outcomes of SDN Kajen class 4 students.

### Data Analysis

The following findings were drawn from the experimental class's and control class's pre-test and post-test data processing outcomes, which involved 32 respondents.

**Table 3.** Pretest and posttest results for the experimental class and control class

	Ν	Min	Max	Mean	Std. Dev
Pretest of experiment	16	35	75	48.69	10.371
Posttest of experiment	16	50	90	66.56	11.650
Pretest of control	16	30	60	39.69	8.056
Posttest of control	16	40	80	58.13	13.022
Valid N	16				

The table above illustrates how student learning outcomes are calculated from the pretest to the posttest. The experimental class's average scores on the pretest

Table 5. Results of the paired sample t test

and posttest were 48.69 and 66.56, respectively. The control pretest had an average score of 39.69, whereas the control posttest had an average score of 58.13.

#### Normality Test

The study data distribution's normalcy is assessed using the normality test. The following are the results of the normality test for the experimental and control groups.

#### Table 4. Results of the normality test

	Statistic	df	Sig.	Statistic	df	Sig.
Pretest of experiment	.200	16	.088	.905	16	.097
Posttest of experiment	.178	16	.185	.940	16	.349
Pretest of control	.172	16	.200	.907	16	.105
Posttest of control	.152	16	.200	.932	16	.261

Both the experimental class's and the control class's pretest and posttest significance scores are over 0.05. indicating that the study's data is normally distributed, as shown in the accompanying table.

#### T Test for Paired Samples

A paired sample t test was employed to ascertain whether including the Indonesian Cultural Marbel educational game into Flipped Classroom instruction had an impact on student learning outcomes. The outcomes of the paired sample t test are as follows.

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		Mean	Std. Dev	Std. Error	Lower	Upper	t	df	Sig.		
Pair 1	Pretest-posttest of experiment	-17.875	7.274	1.819	-21.751	-13.999	-9.829	15	.001		
Pair 2	Pretest-posttest of control	-18.437	11.792	2.948	-24.721	-12.721	-6.254	15	.001		

Pairs 1 and 2 have a significance value of 0.001, as can be seen from the table above. It is possible to conclude that there is a difference in the influence of use because pair 1's significance value is 0.001 < 0.05 and pair 2's is 0.001 < 0.005. This implies that the average learning outcomes from the pretest to the posttest differed between the experimental class and the control class. In a flipped classroom, class 4 students at SDN Kajen are using the Marbel Indonesian Culture teaching game to acquire science and scientific learning objectives.

The degree of increase in student learning outcomes can then be determined by comparing the experimental class's and the control class's average pretest and posttest scores. The average scores that the students received are shown in Table 6. The experimental class's average posttest score was 66.56, as the accompanying table makes evident. On the other hand, the average posttest score for the control group was 58.13. This suggests that, in terms of learning outcomes, the Flipped Classroom approach utilizing the Marbel Indonesian Culture teaching game fared better than the control group, which did not get any therapy.

#### Table 6. Student average score results

	Ν	Min	Max	Mean	Std. Dev
Pretest of experiment	16	35	75	48.69	10.371
Posttest of experiment	16	50	90	66.56	11.650
Pretest of control	16	30	60	39.69	8.056
Posttest of control	16	40	80	58.13	13.022
Valid N	16				

#### The Test of Homogeneity

The Homogeneity Test was used to determine whether the posttest results for the experimental class and the control class were homogeneous. The outcomes of the homogeneity test are shown in Table 7. Based on the variance homogeneity test, p-value = 0.624. Because p > 0.05, it can be concluded that the variance of the posttest data between the experimental class and the control class is homogeneous.

Table 7. I	Results of the homog	eneity tes	st		
		Levene Statistic	df1	df2	Sig.
Student learning outcomes	Based on mean	.245	1	30	.624
	Based on median	.389	1	30	.537
	Based on median	.389	1	29.996	.537
	Based on trimmed	.280	1	30	.600
	mean				

To ascertain the efficacy of a medium and methodology, the N-gain test was utilized in both experimental and control group studies. The results of the N-gain test are shown in Table 8. The experimental class received a score of 0.415, falling into the modest improvement category, according to the N-Gain pretest and posttest data. Therefore, it can be said that using the Indonesian Cultural Marbel educational game in the Flipped Classroom learning approach has increased student learning results by 41.5%.

 Table 8. N-Gain test outcomes

Data	Experimental class	Control class
N-Gain	0.415	0.307
N-Gain (%)	41.5	30.7
Category	Currently	Currently
Interpretation of	Less Effective	Ineffective
effectiveness		

Therefore, it is believed that the Marbel Budaya Indonesia instructional game is less effective at bolstering the learning outcomes of Flipped Classrooms. In contrast, the control group that did not get any treatment had an N-Gain value of 0.307, meaning that it was deemed useless.

The following are the results of a comparison of the N-gain values in the control class and the experimental class to see whether there are significant differences. The following are the results of the N-gain comparison test.

Table 9. N-gain Comparison Test

		Mean	Std. Dev	Std. Error	Lower	Upper	t	df	Sig.
Pair 1	Pretest-posttest experiment	-17.875	7.274	1.819	-21.751	-13.999	-9.829	15	.001
Pair 2	Pretest-posttest control	-18.437	11.792	2.948	-24.721	-12.721	-6.254	15	.001

Based on the table above, a sig value of 0.01 < 0.05 is obtained, so it can be concluded that there is a significant difference between the learning outcomes of control class and experimental class students. So, it can be concluded that the treatment in the experimental class was more effective than the control class.

# Conclusion

The utilization of the Indonesian Cultural Marbel educational game in Flipped Classroom instruction has an impact on student learning outcomes, according to research done in class 4 at SDN Kajen. The significance values for pair 1 (0.001 < 0.05) and pair 2 (0.001 < 0.005) demonstrate this. Additionally, the use of the instructional game Indonesian Cultural Marbel in Flipped Classroom Learning improves student learning results by 41.5%.

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#### Author Contributions

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## **Conflicts of Interest**

The authors declare no conflict of interest.

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