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The Effect of Smartboard Media on the Outcomes of Science Learning at Grade III Students of State Elementary School 124386 Pematangsiantar

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Abstract

This study aimed to determine the effect of Smartboard media on the science and social studies (IPAS) learning outcomes of third-grade students at UPTD SD Negeri 124286 Pematangsiantar. The study employed a quantitative approach using a quasi-experimental design with two groups, namely an experimental class and a control class. The population of this study consisted of all third-grade students at the school. The research sample included 20 students in the experimental class and 20 students in the control class. Data were collected through tests administered in the form of pretests and posttests. Prior to implementation, the research instruments were tested for validity, discrimination index, and item difficulty level. The validity test results indicated that all 20 test items were valid. The findings revealed that the average student learning outcome score in the experimental class was 87.00, while the control class obtained an average score of 76.25. Based on the hypothesis testing using the Independent Sample t-Test, the significance value (Sig. 2-tailed) was 0.002 < 0.05, indicating that Ha was accepted and H0 was rejected. Therefore, it can be concluded that the use of Smartboard media had a significant effect on the IPAS learning outcomes of third-grade students at UPTD SD Negeri 124286 Pematangsiantar.

Keywords: **Smartboard Media, Learning Outcomes, IPAS, Quasi-Experimental Study**

INTRODUCTION

The rapid development of Information and Communication Technology (ICT) in today's

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digital era has significantly influenced various aspects of human life, particularly the field of education. Technology is no longer viewed merely as a supporting tool; rather, it has become an integral component of the teaching and learning process. Consequently, the integration of technology into classroom instruction has become an unavoidable demand in 21st-century education. Advances in ICT have transformed educational practices by enabling more innovative, effective, and student-centered learning environments. In the educational context, technological advancement is reflected in the increasing use of digital and interactive learning media. Technology facilitates the presentation of learning materials through visual and audio elements, multimedia integration, and two-way interaction between teachers and students. Such conditions encourage the creation of learning experiences that are more engaging, flexible, and aligned with the characteristics of learners in the digital age, particularly elementary school students who require concrete and contextual learning experiences. Furthermore, the rapid growth of educational technology also requires teachers to improve their competencies in utilizing technology-based instructional media. Teachers are expected to integrate technology effectively into classroom instruction so that learning objectives can be achieved optimally.

At the elementary school level, various subjects are designed to develop students' knowledge and 21st-century skills. One of the subjects implemented in the *Merdeka Curriculum* is Integrated Science and Social Studies (IPAS). According to official documents from the Ministry of Education, Culture, Research, and Technology, IPAS represents an innovation in which Natural Sciences (IPA) and Social Sciences (IPS), previously taught separately, are integrated into a single subject (Sutinah et al., 2025). IPAS emphasizes an integrated understanding of the interactions among humans, nature, and the environment, while simultaneously fostering students' critical and analytical thinking skills in solving contextual problems, including global issues such as climate change (Sutinah et al., 2025). Moreover, the Learning Outcomes for IPAS in Phase B (Grades 3–4) emphasize basic scientific processes, such as observing and questioning phenomena, as a foundation for understanding the surrounding environment (Kemendikdasmen, n.d.).

Based on observations conducted at UPTD SD Negeri 124386 Pematangsiantar, the learning process has generally been implemented in accordance with the applicable curriculum, with classroom instruction conducted face-to-face and teachers acting as the primary facilitators. However, several challenges were identified in the implementation of IPAS learning. Students experienced difficulties in understanding abstract concepts, relating learning materials to everyday life, and actively participating during classroom activities. In addition, students' learning motivation tended to be low because the instructional process was still dominated by

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lecture-based methods and limited learning media. The use of instructional media remained largely conventional, relying primarily on textbooks and verbal explanations, resulting in insufficient visualization of concepts and limited opportunities for interactive student engagement. These conditions contributed to relatively low student learning outcomes in IPAS.

Table 1. Students' IPAS Formative Test Results

Aspect	Results
Number of students	20 students
Minimum Mastery Criterion (KKM)	70
Students achieving mastery (≥ KKM)	6 students (30%)
Students not achieving mastery (< KKM)	14 students (70%)

Based on documentation of formative IPAS test scores in Grade III at UPTD SD Negeri 124386 Pematangsiantar, 14 out of 20 students (70%) did not achieve the Minimum Mastery Criterion (KKM) score of 70. These findings indicate the need for more innovative and interactive instructional media to improve students' learning outcomes. One potential solution to address these low learning outcomes is the implementation of innovative learning media, such as Smartboard integrated with Wordwall. A Smartboard, also known as an Interactive Whiteboard (IWB), is an interactive display board used to present and control digital learning materials during instruction. The British Council defines an Interactive Whiteboard as "a large interactive display attached to a computer and a projector," meaning that both teachers and students can control the computer directly through the interactive display (English, 2026). This definition highlights that Smartboards function not merely as projection tools but as interactive media that enable direct interaction, such as touching, dragging objects, and annotating learning materials.

Smartboards are capable of presenting instructional materials visually, auditorily, and interactively through images, videos, animations, and multimedia content. Furthermore, Smartboards are designed as user-friendly digital media integrated with other instructional technologies, making them particularly helpful for teachers who are still adapting to digital learning tools. Their practical and interactive features allow teachers to deliver lessons in a more systematic, engaging, and efficient manner without requiring advanced technological skills.

Wordwall, on the other hand, is a digital learning platform that enables teachers to create various interactive activities, including quizzes, educational games, and practice exercises that can be accessed both online and offline. According to Sari Dewi (2021), Wordwall is a web-

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based interactive learning medium that allows teachers to design educational games aimed at increasing students' engagement and comprehension. In practice, the effectiveness of Wordwall can be enhanced when integrated with Smartboards as interactive classroom display media. Smartboards allow Wordwall activities to be projected onto large screens and operated through touch interaction, enabling students to interact directly with the exercises or games presented. This integration creates a more engaging, collaborative, and less monotonous learning environment. In addition, the use of Wordwall through Smartboards has been shown to improve students' learning motivation because it combines visual, auditory, and kinesthetic learning elements (Rahmawati, 2022).

Previous studies have also demonstrated the effectiveness of Smartboard-based learning media. Research conducted by Amira and Wijayanti (2025) revealed that the percentage of students achieving learning mastery increased progressively from the first cycle to the second cycle and further improved in the third cycle, reaching a very high level of mastery. Similarly, a study by Sholihah and Hamidaturrohmah (2025) found significant differences in learning outcomes between students taught using Smartboard media and those taught without it. These findings indicate that the use of Smartboard media has a positive effect on improving students' learning outcomes.

Based on the problems identified and supported by previous studies, this research aims to examine the effect of Smartboard media integrated with Wordwall on the IPAS learning outcomes of third-grade students at UPTD SD Negeri 124386 Pematangsiantar. It is expected that the findings of this study will contribute to the development of innovative, interactive, and technology-based learning practices in elementary education.

METHODOLOGY

1. Research Type and Design

This study employed a quantitative research approach with an experimental method. Quantitative research emphasizes the objective measurement of variables using numerical data and statistical analysis to answer the formulated research problems (Creswell & Creswell, 2023, p. 157). An experimental approach was chosen because this study aimed to determine the effect of Smartboard media on the IPAS learning outcomes of third-grade students at UPTD SD Negeri 124386 Pematangsiantar.

The type of research used was a quasi-experimental design, specifically the Nonequivalent Control Group Design (Creswell & Creswell, 2023, p. 178). In this design, two intact groups that were not randomly assigned were involved: an experimental group and a

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control group. Both groups were administered a pretest prior to the treatment. The experimental group received instruction using Smartboard media, while the control group received conventional instruction without the use of Smartboard media. After the treatment, both groups were given a posttest to measure students' learning outcomes.

Table 2. Quasi-Experimental Research Design

Group	Pretest	Treatment	Posttest
Experimental	O_1	X	O_2
Control	O_3	—	O_4

Description:
O_1 = Pretest for the experimental group
O_2 = Posttest for the experimental group
O_3 = Pretest for the control group
O_4 = Posttest for the control group
X = Learning treatment using Smartboard media
— = Learning without Smartboard media

2. Research Location and Time

This study was conducted at UPTD SD Negeri 124386 Pematangsiantar, located on Jl. Jambu, Pematangsiantar. The research subjects were third-grade students enrolled during the 2025/2026 academic year, in accordance with the school's IPAS learning schedule. The selection of the research location was based on preliminary observations indicating that students' IPAS learning outcomes, particularly on the topic of weather and its effects on daily life, were still relatively low. In addition, there was a clear need for more interactive learning media to assist students in understanding the subject matter more effectively. This research was conducted during the second semester of the 2025/2026 academic year.

3. Population and Sample

Population refers to a generalized area consisting of subjects with specific qualities and characteristics determined by the researcher to be studied and from which conclusions are drawn (Sugiyono, 2019, p. 126). The population in this study consisted of all third-grade students at UPTD SD Negeri 124386 Pematangsiantar.

A sample is a subset of the population selected for research purposes. The sampling

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technique used in this study was saturated sampling (total sampling), in which all students from the two available classes were included as research participants (Creswell & Creswell, 2023, p. 162).

The sample consisted of two classes:

a. Grade III-A as the control group, consisting of 20 students

b. Grade III-B as the experimental group, consisting of 20 students

The determination of the experimental and control groups was based on the existing classroom structure in the school; therefore, individual random assignment was not conducted. To minimize initial differences between groups, both groups were administered a pretest, and an equivalence test of initial abilities was conducted.

4. Data Collection Techniques

Data collection techniques refer to the procedures used by researchers to obtain data relevant to the research objectives. In this study, data collection was conducted through several stages as follows.

a) Preparation Stage

The researcher coordinated with the school administration and classroom teachers, while also preparing lesson plans and research instruments, including tests and observation sheets.

b) Pretest Administration (O_1 and O_3)

An initial test was administered to students in both groups to determine their prior knowledge regarding the topic of weather and its effects on life.

c) Treatment Implementation (X)

The experimental group received IPAS instruction using Smartboard media. During the learning process, materials were presented through Smartboard features such as images, videos, and simple simulations. Students were actively involved in interactive activities, including matching weather symbols, classifying weather types, and discussing the effects of weather on daily life. The treatment was applied only to the experimental group.

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d) Observations

During the treatment implementation, the researcher or observer completed observation sheets to ensure that the Smartboard media were used according to the planned instructional procedures.

e) Posttest Administration (O_2 and O_4)

A final test was administered after the treatment to measure students' learning outcomes following the implementation of Smartboard-based instruction.

f) Documentation

Supporting data were collected through documentation, including attendance lists, pretest and posttest scores, photographs of classroom activities, and instructional materials used during the research process.

5. Data Analysis Techniques

Data analysis techniques refer to the procedures used to process research data in order to answer the research questions. The data analyzed in this study consisted of pretest and posttest scores related to IPAS learning outcomes on the topic of weather and its effects on life. Data analysis procedures included: (1) instrument testing, (2) validity testing, (3) reliability testing, (4) item difficulty analysis, and (5) discrimination index analysis.

a) Validity Test

Validity testing was conducted to determine the extent to which each test item measured what it was intended to measure. In this study, validity testing was conducted using the Product Moment Correlation technique with the assistance of SPSS software. The decision criteria were as follows:

- If the calculated r value (r-count) > r-table at a significance level of 0.05, the item was considered valid.
- If the calculated r value (r-count) ≤ r-table, the item was considered invalid.

Based on the data analysis results, most test items had r-count values greater than r-table, indicating that the items were valid. However, several items had r-count values lower than r-table and were therefore categorized as invalid and excluded from the study.

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b) Reliability Test

After obtaining valid test items through validity testing, reliability testing was conducted to determine the consistency of the research instrument. Reliability testing in this study employed the Cronbach's Alpha method using SPSS software. The obtained value was then compared with the reliability criterion: if the Cronbach's Alpha coefficient was greater than 0.60, the instrument was considered reliable.

c) Item Difficulty Level

The item difficulty level refers to the degree of ease or difficulty of a test item, viewed from students' ability to answer the question correctly rather than from the perspective of the test developer. In test construction, it is important to identify whether items are categorized as difficult, moderate, or easy (Jakni, 2016). The formula used to determine the item difficulty level with the assistance of SPSS version 26 is as follows:

$$P = \frac{B}{Js}$$

(Source: Jakni, 2016, p. 168)

Description:
P = Difficulty index
B = Number of students answering correctly
Js = Total number of students taking the test
The classification criteria for item difficulty are presented in the following table.

Table 3. Criteria for Item Difficulty Level

Criteria	Interpretation
0.00 ≤ 0.30	Difficult
0.31 ≤ 0.70	Moderate
0.71 ≤ 1.00	Easy

d) Discrimination Index

According to Nana Sudjana (2018), the discrimination index of a test item refers to its ability to distinguish between high-achieving students and low-achieving students. The discrimination

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index for each item was calculated using SPSS version 26 with the following formula:

$$DP = \frac{BA}{JA} - \frac{BB}{JB} = PA - PB$$

(Source: Nana Sudjana, 2018, p. 130)

Description:
DP = Discrimination index
BA = Number of upper-group students answering correctly
BB = Number of lower-group students answering correctly
JA = Total number of students in the upper group
JB = Total number of students in the lower group
PA = Proportion of upper-group students answering correctly
PB = Proportion of lower-group students answering correctly

Table 4. Classification of Discrimination Index

Discrimination Index	Interpretation
0.00–0.30	Poor
0.31–0.40	Fair
0.41–0.70	Good
0.71–1.00	Excellent

(Source: Nana Sudjana, 2018, p. 130)

RESULS AND DISCUSSION

Based on the research results, the use of Smartboard media significantly impacted the science learning outcomes of third-grade students on weather and its impact on life at the UPTD of SD Negeri 124386 Pematangsiantar. Before using the instrument, a validity test was conducted on 40 questions. Twenty questions were declared valid and 20 questions were declared invalid due to their calculated r-values being greater than the table r-value (0.444) and significance values being less than 0.05. Therefore, they were deemed valid and capable of measuring student learning outcomes effectively.

Furthermore, a discriminatory power test was conducted, which showed that six questions were classified as poor, one question as moderate, 11 questions as good, and two

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questions as very good, enabling the students to differentiate between their abilities. The difficulty level test yielded two difficult questions, three as moderate, and 15 as easy, thus deeming the instrument suitable for use in research. Based on the pretest results, the experimental class obtained a highest score of 70 and a lowest score of 50, while the control class obtained a highest score of 65 and a lowest score of 60. After being given treatment using Smartboard media in the experimental class, the posttest results showed an average score of 87.00 with a highest score of 100 and a lowest score of 70, while the control class obtained an average score of 76.25 with a highest score of 90 and a lowest score of 50. These results indicate that learning outcomes in the experimental class were higher than those in the control class. This is in line with the opinion of Azhar (2024) who stated that the use of learning media can clarify the presentation of material and thus significantly influence student learning outcomes.

The results of the hypothesis test using the Independent Sample t-Test with assistance obtained a significance value (Sig. 2-tailed) of 0.002, which is less than 0.05, so (H_0) is rejected and (H_a) is accepted. This indicates that there is a significant effect of the use of Smartboard media on student learning outcomes. These findings align with research conducted by Diansari and Prihastari (2025), which found that the use of Smartboards significantly improved student learning outcomes compared to learning without Smartboards.

The use of Smartboards in learning provided a more interactive learning experience than the in-focus media used in the control class. Smartboards allowed students to interact directly with the learning material through touch, object manipulation, and digital game-based activities such as Wordwall. This aligns with Syofiyanti et al. (2025), who stated that Smartboards are interactive learning media capable of increasing student engagement in the learning process. This reinforces the evidence that the use of technology in learning has a positive impact on the quality of learning in elementary schools. Conversely, in the control class using in-focus media, learning tended to be passive, as students simply viewed the material without any direct interaction. This is consistent with Hamalik (2022), who stated that teacher-centered learning tends to make students less active and contribute to low learning outcomes.

Thus, it can be concluded that the use of Smartboards in science learning has a significant impact on student learning outcomes. Therefore, the use of Smartboard can be used as an alternative learning media that is effective in influencing student learning outcomes in elementary schools.

CONCLUSION

The results of the study indicate that the use of Smartboard media has a significant

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influence on student learning outcomes. This is proven by the results of the hypothesis test using the Independent Sample t-Test which shows a significance value (Sig. 2-tailed) of 0.002 < 0.05, so that H_o is rejected and H_a is accepted. In addition, descriptively, the average student learning outcomes in the experimental class using Smartboard media are 87.00 higher than the control class using conventional learning with the help of an infocus, which is 76.25. This shows that the use of Smartboard media has an effect on student learning outcomes more optimally. Thus, it can be concluded that Smartboard media has a significant effect on the learning outcomes of third-grade students in science on weather material and its influence on life.

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