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The Effect of Wayground Interactive Learning Media and Learning Motivation on IPAS Learning Achievement

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Abstract: Instruction in Integrated Science and Social Studies (IPAS) at the elementary level is often theoretical and teacher-centered, limiting student participation and learning outcomes. This study examined the effect of Wayground interactive learning media and learning motivation on the IPAS learning achievement of sixth-grade students at SDN Bulak Banteng I Surabaya. A quantitative approach with a 2×2 factorial experimental design was used. The independent variables were learning media (Wayground and PowerPoint) and learning motivation (high and low), while the dependent variable was learning achievement. The sample consisted of 60 students divided into four groups. Data were analyzed using two-way ANOVA with SPSS version 30, preceded by normality and homogeneity tests. Results showed: (1) a significant effect of learning media on achievement (Sig. = 0.000), with Wayground outperforming PowerPoint; (2) a significant effect of learning motivation on achievement (Sig. = 0.000); and (3) a significant interaction between learning media and motivation (Sig. = 0.001). Further analysis indicated that students using Wayground with high motivation achieved the highest scores, with large effect sizes for both the media effect and the interaction effect. Wayground interactive learning media is effective in improving IPAS learning achievement, particularly when combined with high learning motivation.

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Introduction

Elementary education plays an important role in developing students' cognitive knowledge, learning motivation, and active engagement in the learning process. At this level, learning is expected not only to transfer information but also to encourage students to understand concepts, participate actively, and apply knowledge in meaningful situations. These aspects are particularly important in learning Natural and Social Sciences (IPAS), which requires students to understand concepts related to both natural and social phenomena. However, IPAS learning in elementary schools may still be dominated by teacher-centered activities, verbal explanations, question-and-answer sessions, and written exercises. Such learning conditions may provide limited opportunities for students to explore concepts actively and may affect their interest and learning achievement.

Learning achievement is an important indicator of the extent to which students have understood the learning material. In achieving satisfactory learning outcomes, students need not only appropriate learning resources but also the willingness and motivation to engage in the learning process. Learning achievement is influenced by various factors, including learning

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activities, learning resources, learning environment, teacher quality, and students' motivation. Therefore, efforts to improve IPAS learning achievement need to consider both the learning media used by teachers and the internal factors that encourage students to participate actively in learning.

One approach that can support more active learning is the use of interactive learning media. The development of information and communication technology has expanded the possibilities for teachers to present learning materials through media that combine text, images, audio, animation, and interactive activities. Interactive learning media can provide students with opportunities to respond directly to learning stimuli and receive feedback during the learning process. Arsyad (2019), Munir (2012) and Sadiman et al. (2018) explain that learning media can support the delivery of information and facilitate students' understanding of learning materials. In this context, the use of interactive media is not merely intended to make learning more attractive, but also to create learning experiences that encourage students to become actively involved.

The potential of interactive media becomes more relevant when it is connected to students' learning motivation. Students who are motivated to learn tend to demonstrate greater attention, persistence, and involvement in completing learning activities. Sardiman (2012) and Uno (2012) describe motivation as an important driving force that encourages students to engage in learning activities and achieve learning goals. Thus, the effectiveness of learning media cannot be separated from students' willingness to use and respond to the learning opportunities provided by the media. Interactive media that provides immediate responses, challenges, and opportunities for participation can create learning conditions that encourage students to remain involved in the learning process.

One platform that provides these characteristics is Wayground, formerly known as Quizizz. According to the official Wayground platform, Wayground is an instructional platform that supports interactive teaching, practice, and assessment through various resources and learning modes. It allows teachers to provide interactive activities in live or student-paced formats and provides feedback and performance reports that can support the learning process. The platform also incorporates game-based elements into learning activities, enabling students to participate in learning through interactive questions, challenges, and feedback. These features make Wayground relevant to elementary learning environments in which students require learning activities that provide both instructional content and opportunities for active participation.

The use of Wayground can therefore be understood not simply as the use of digital technology, but as an interactive learning approach that connects student participation, feedback, and learning experiences. When students interact with questions and learning activities, they receive feedback that helps them identify their understanding of the material. This process provides opportunities for students to correct errors, reinforce concepts, and develop a better understanding of the subject matter. From a constructivist perspective, learning occurs through students' active involvement in constructing knowledge based on their experiences. Accordingly, interactive media can facilitate engagement, engagement can increase opportunities for active learning and feedback, feedback can support conceptual understanding, and improved conceptual understanding can contribute to learning achievement.

The relationship between interactive media, motivation, and learning achievement is also supported by previous studies. Research on interactive learning media has generally shown that the use of digital and multimedia-based learning resources can increase student

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engagement and provide learning experiences that are more varied than conventional instructional activities. Studies by Li & Xue (2023) and Wang & Wu (2022) discuss the role of digital and interactive learning environments in supporting student participation and learning processes. These findings indicate that interactive learning media can provide opportunities for students to become more actively involved in learning rather than simply receiving information from the teacher.

Research specifically related to Quizizz, which is now known as Wayground, has also examined the use of game-based digital activities in education. The use of Quizizz has been associated with interactive assessment, immediate feedback, and game-based learning activities that can encourage student participation. These characteristics are relevant to Wayground because the platform continues the core functionality of Quizizz while expanding its instructional resources and learning modes. However, the reviewed studies have generally examined digital assessment, gamification, or student engagement as separate aspects. This leaves an opportunity to examine Wayground in relation to learning motivation and learning achievement within a specific elementary IPAS learning context.

Learning motivation represents another important factor in explaining students' learning achievement. Motivated students are more likely to pay attention to learning activities, participate in classroom tasks, and persist when facing difficulties. Previous research has examined the relationship between motivation and learning achievement, showing that students' motivation can support their involvement and persistence in learning. In the context of technology-supported learning, motivation may become particularly important because interactive media provides learning opportunities, while students' motivation influences how actively they respond to those opportunities. Therefore, examining interactive learning media without considering learning motivation may provide an incomplete understanding of factors associated with students' learning achievement.

The importance of this relationship is particularly relevant in IPAS learning at the elementary school level. IPAS combines knowledge about natural and social phenomena and therefore requires students to understand concepts while relating them to situations encountered in everyday life. Learning activities that provide opportunities for exploration, interaction, and feedback can help students connect learning materials with their experiences. Previous studies in elementary education have examined digital learning media, student motivation, and learning achievement, but the combination of these variables within IPAS learning remains relatively limited in the literature reviewed.

Based on the reviewed literature, the state of the art of this study can be viewed through five connected areas. First, studies on interactive learning media emphasize the role of digital media in increasing student participation and providing varied learning experiences. Second, studies related to Wayground or Quizizz highlight the use of interactive and game-based activities in teaching and assessment. Third, studies on learning motivation demonstrate its importance in encouraging students' attention, persistence, and participation. Fourth, studies in elementary education and IPAS emphasize the need for learning approaches that facilitate students' understanding of natural and social phenomena. Fifth, although these areas have been examined individually, studies that simultaneously examine Wayground interactive learning media, learning motivation, and IPAS learning achievement in elementary education remain limited.

To clarify the position of the present study, the research gap can be summarized as follows.

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Table 1. Research Gap and Position of the Present Study

Research Focus	Previous Studies	Research Gap	Position of the Present Study
Interactive learning media	Studies have examined digital and multimedia-based media in supporting student engagement and learning processes.	The application of interactive media specifically in IPAS learning at the elementary level remains limited.	Examines Wayground as an interactive learning medium in elementary IPAS learning.
Wayground/Quizizz	Previous studies have examined Quizizz as a digital assessment and game-based learning platform.	Limited studies connect Wayground/Quizizz with both learning motivation and learning achievement in IPAS.	Examines Wayground in relation to learning motivation and IPAS learning achievement.
Learning motivation	Previous studies have identified motivation as an important factor in student participation and learning achievement.	Motivation is often examined separately from specific interactive learning media.	Examines learning motivation together with Wayground interactive learning media.
IPAS/elementary education	Previous studies have examined digital learning and learning outcomes in elementary education.	The combination of Wayground, motivation, and IPAS achievement has received limited attention.	Focuses specifically on elementary students' IPAS learning achievement.
Interaction between learning media and motivation	Previous research has discussed media and motivation as factors that can support learning.	The combined contribution of interactive media and motivation to IPAS learning achievement requires further examination.	Tests the effect of Wayground interactive learning media and learning motivation on IPAS learning achievement.

The research gap demonstrates that the present study does not merely repeat previous research on digital learning media or learning motivation. Previous studies have generally examined digital or interactive learning media and learning motivation as factors related to student learning outcomes, but these factors have often been examined separately. Limited attention has been given to examining an interactive learning medium and learning motivation together within the context of elementary IPAS learning, particularly through the use of Wayground. Therefore, the present study brings these variables together by focusing on

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Wayground as an interactive learning medium and learning motivation as an internal learning factor, with learning achievement as the outcome. The theoretical relationship proposed is that interactive media can provide opportunities for active engagement and immediate feedback, while learning motivation can encourage students to utilize these opportunities consistently. Through these processes, students may obtain greater opportunities to understand learning concepts and demonstrate their learning achievement.

This research is also supported by the preliminary condition observed at SDN Bulak Banteng I Surabaya. Based on preliminary observations, interactive digital learning media were rarely used in IPAS learning, while learning activities were predominantly conducted through lectures, question-and-answer sessions, and written exercises. This condition indicates the need for learning activities that provide greater opportunities for interaction and student participation. The use of Wayground may provide an alternative learning environment in which students can interact with learning materials, answer questions, receive feedback, and participate more actively in learning activities.

The novelty of this study lies in examining the relationship between Wayground interactive learning media and learning motivation in relation to elementary students' IPAS learning achievement. Previous studies have generally examined the use of digital or interactive learning media and learning motivation as separate factors influencing student learning outcomes. However, limited attention has been given to how these two factors operate together in elementary IPAS learning, particularly through the use of Wayground as an interactive learning medium. Therefore, this study tests the effect of Wayground interactive learning media and learning motivation on IPAS learning achievement, both individually and simultaneously. The study is expected to contribute empirical evidence on the role of interactive digital learning media and students' learning motivation in supporting IPAS achievement at the elementary school level. In this way, the study extends existing research by bringing an interactive digital learning medium and an internal learning factor into a single empirical framework within the context of elementary IPAS learning.

Based on this background and the identified research gap, this study examines the effect of Wayground interactive learning media and learning motivation on IPAS learning achievement. The research questions are: (1) Does the use of Wayground interactive learning media affect students' IPAS learning achievement? (2) Does learning motivation affect students' IPAS learning achievement? and (3) Do Wayground interactive learning media and learning motivation simultaneously affect students' IPAS learning achievement? Accordingly, the objective of this study is to analyze the effect of Wayground interactive learning media and learning motivation, both partially and simultaneously, on IPAS learning achievement among elementary school students.

Research Method

This study used a quantitative approach with a quasi-experimental, pretest–posttest non-equivalent control-group design, applying a 2×2 factorial arrangement consisting of two learning-media conditions (Wayground and conventional PowerPoint) and two learning-motivation categories (high and low). This design was chosen because the study used intact, already-formed classes, which did not allow individual randomization of students to treatment conditions (Creswell & Creswell, 2021). Consequently, the absence of individual randomization may reduce internal validity because differences between groups may exist before the treatment. In particular, selection bias may occur if the two intact classes differ in characteristics that are related to students' IPAS learning achievement. To minimize this

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potential bias, pretest scores were administered to both groups to establish their baseline achievement before the treatment. The 2×2 factorial structure is presented in Table 2:

Table 2. 2×2 Factorial Research Design

Learning Media	High Learning Motivation	Low Learning Motivation
Wayground	A1B1	A1B2
Conventional PowerPoint	A2B1	A2B2

Note:
A1 = Wayground interactive learning media
A2 = Conventional PowerPoint learning media
B1 = High learning motivation
B2 = Low learning motivation

The 2×2 factorial design enables the study to examine three effects: the main effect of learning media, the main effect of learning motivation, and the interaction effect between learning media and learning motivation on IPAS learning achievement.

The independent variable was the use of Wayground interactive learning media, categorized into two groups: classes using Wayground and classes using conventional learning methods (PowerPoint). The moderator variable was learning motivation, defined as students' internal and external drive to participate in learning and achieve optimal academic results, and measured using a Likert-scale questionnaire (1–4) comprising favorable and unfavorable statements across four response options: strongly agree, agree, disagree, and strongly disagree. The questionnaire covered intrinsic motivation, extrinsic motivation, task value, and self-efficacy (Lin et al., 2021). Learning motivation was categorized into high and low groups for the 2×2 factorial analysis. The dependent variable was IPAS learning achievement, defined as students' ability to understand and apply IPAS concepts, measured using a multiple-choice test through pretest and posttest. The test covered knowledge, comprehension, and application and was developed based on the Grade VI IPAS learning-outcome indicators.

The population comprised Grade VI students of SDN Bulak Banteng I Surabaya in the 2025/2026 academic year, totaling 60 students (Class VI-C = 31 students; Class VI-D = 29 students). Because the size of the population allowed the entire group to be included, this study used a population-research approach rather than separate sampling, an approach recommended when the population size permits including the entire group as research subjects (Musa et al., 2016). Thus, all 60 students served as the research sample and were divided into two treatment groups: one group learning with Wayground media and one group learning using conventional PowerPoint-based instruction, consistent with the Nonequivalent Control Group Design.

Two main instruments were used for data collection: a learning-motivation scale and an IPAS achievement test. For the motivation questionnaire, item validity testing produced corrected item–total correlation coefficients (r) ranging from 0.799 to 0.905 for all 25 items, all of which exceeded the r-table value of 0.361 ($n = 30$, $\alpha = 0.05$), indicating that every item was valid. Reliability testing was conducted using SPSS version 30. According to the thesis's reliability results table, the achievement test's KR-20 reliability coefficient was 0.983, and the motivation questionnaire's Cronbach's Alpha was 0.988. Both values substantially exceeded the minimum acceptable threshold of 0.70, indicating very high instrument reliability.

Data were collected by administering a pretest to both groups to establish baseline achievement, followed by the assigned treatment. The experimental group received IPAS instruction using Wayground interactive learning media, whereas the control group received

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conventional PowerPoint-based instruction. After the treatment, a posttest was administered to measure students' learning achievement. The learning-motivation questionnaire was administered to identify students' motivation levels and classify them into high- and low-motivation categories for the factorial analysis.

Before hypothesis testing, prerequisite assumption tests were carried out. Normality was tested using the Shapiro–Wilk test at a significance level of $\alpha = 0.05$, given that each group's sample size was below 50. The test indicated normal distribution for both media-based groups (Wayground group Sig. = 0.067; PowerPoint group Sig. = 0.245) and motivation-based groups (high-motivation group Sig. = 0.092; low-motivation group Sig. = 0.068). Homogeneity of variance was tested using Levene's Test, which indicated homogeneous variance across groups (Levene statistic = 2.747, Sig. = 0.051). With both the normality and homogeneity assumptions satisfied, hypothesis testing proceeded using two-way analysis of variance (two-way ANOVA), conducted with SPSS version 30 at a significance level of $\alpha = 0.05$. The analysis examined the main effect of learning media, the main effect of learning motivation, and the interaction effect between learning media and learning motivation on IPAS learning achievement.

Result and Discussion

Research Design and Treatment Implementation

This study employed a 2 × 2 factorial quasi-experimental design with a pretest-posttest structure. The study examined the association of learning media and learning motivation with IPAS learning achievement. Learning media consisted of two levels, namely Wayground and PowerPoint, while learning motivation was categorized into high and low motivation. The participants consisted of 60 sixth-grade students from SDN Bulak Banteng I/263 Surabaya, with 30 students assigned to the Wayground group and 30 students to the PowerPoint group. Each combination of learning media and learning motivation consisted of 15 students, resulting in a balanced 2 × 2 factorial design.

The two groups received the same IPAS learning material and learning objectives. The difference between the groups concerned the learning media used during the instructional activities. The experimental group used Wayground as an interactive learning medium, while the control group used PowerPoint as a presentation-based learning medium.

Table 3. Treatment Implementation

Meeting	Learning Component	Wayground Group	PowerPoint Group
1	Introduction and concept presentation	The teacher introduced the learning objectives and material. Students explored the material through Wayground and responded to interactive questions.	The teacher introduced the learning objectives and presented the material using PowerPoint. Students listened to the explanation and responded to teacher questions.
2	Concept exploration and guided practice	Students completed interactive Wayground activities, answered questions, received immediate feedback, and	Students observed the PowerPoint presentation, participated in teacher-led discussion, and completed practice questions.

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Meeting	Learning Component	Wayground Group	PowerPoint Group
		discussed their answers with the teacher.	
3	Application and evaluation	Students completed application questions and interactive exercises through Wayground and discussed the results with the teacher.	Students completed application exercises based on the material presented through PowerPoint and discussed their answers with the teacher.
4	Review and assessment	Students reviewed the learning material and completed the posttest after the treatment.	Students reviewed the learning material and completed the posttest after the treatment.

Each meeting was conducted according to the classroom schedule and used the same learning objectives and IPAS content in both groups. The main distinction was the learning experience provided by the media. Wayground emphasized interactive participation, responses, and feedback, whereas PowerPoint emphasized visual presentation supported by teacher explanation and discussion.

Preliminary Analysis

A pretest was administered before the learning intervention to identify the students' initial IPAS learning achievement. The study employed a non-equivalent quasi-experimental design using intact classes; therefore, the pretest was used to provide descriptive information about the students' initial achievement in the Wayground and PowerPoint groups. The pretest results were also considered when interpreting the posttest findings because the students were not individually assigned to the treatment groups.

Table 4. Pretest and Posttest Scores of the Wayground and PowerPoint Groups

Learning Media	N	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Mean Improvement
Wayground	30	8.17	2.026	12.13	3.048	3.96
PowerPoint	30	7.93	1.978	9.07	2.487	1.14
Total	60	8.05	1.998	10.60	3.123	2.55

As shown in Table 4, the mean pretest scores of the Wayground group (M = 8.17, SD = 2.026) and the PowerPoint group (M = 7.93, SD = 1.978) were relatively similar before the intervention. After the intervention, the Wayground group achieved a higher mean posttest score (M = 12.13, SD = 3.048) than the PowerPoint group (M = 9.07, SD = 2.487). The mean improvement was 3.96 points for Wayground and 1.14 points for PowerPoint, indicating a greater descriptive improvement in the Wayground group. These results provide preliminary descriptive information before the subsequent two-way ANOVA analysis of learning media, learning motivation, and their interaction with students' IPAS learning achievement.

Learning Motivation Categorization

Learning motivation was measured using a 25-item Likert-scale questionnaire. In the factorial analysis, learning motivation was treated as a categorical factor consisting of high and low motivation. Therefore, learning motivation was not treated as a covariate in the two-way ANOVA.

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The categorization produced 30 students in the high-motivation group and 30 students in the low-motivation group. The factorial distribution was balanced, with 15 students in each combination of learning media and motivation.

Table 5. Distribution of Students in the 2 × 2 Factorial Design

Learning Media	High Motivation	Low Motivation	Total
Wayground	15	15	30
PowerPoint	15	15	30
Total	30	30	60

The balanced distribution ensured that each experimental condition contained the same number of students. This structure allowed the study to examine differences associated with learning media, motivation level, and the interaction between the two factors.

Instrument Testing

The learning motivation questionnaire consisted of 25 Likert-scale items. The validity test involved 30 respondents, with a critical *r* value of 0.361 at α = .05. The corrected item-total correlation values ranged from 0.799 to 0.905.

Table 6. Validity and Reliability of the Learning Motivation Instrument

Component	Result
Number of items	25
Respondents	30
r table	0.361
Corrected item-total correlation	0.799–0.905
Valid items	25
Cronbach's alpha	0.988
Interpretation	Very high reliability
Component	Result
Number of items	25

All 25 items had corrected item-total correlation values above the critical value of 0.361 and were therefore considered valid. The Cronbach's alpha coefficient of 0.988 indicates very high internal consistency.

Nevertheless, the very high reliability coefficient and consistently high item-total correlations should be interpreted carefully. Such values may indicate that several items are highly similar in content and potentially redundant. Therefore, the instrument should be reviewed according to the theoretical dimensions and indicators of learning motivation to ensure that each item represents a meaningful aspect of the construct.

The questionnaire was developed based on the theoretical construct of learning motivation and covered indicators related to students' attention, interest, persistence, participation, and willingness to complete learning activities. The instrument blueprint should be retained as supporting documentation to demonstrate the relationship between the theoretical construct, indicators, and questionnaire items.

The IPAS achievement instrument was administered as a pretest and posttest. The test was intended to measure students' cognitive achievement, particularly conceptual understanding, scientific reasoning, and application of IPAS concepts. The reliability analysis reported a KR-20 coefficient in the range of 0.983–0.988 in the research materials. Because two values were recorded in the analysis documentation, the final value should follow the

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original statistical output. The instrument was used consistently for measuring achievement before and after the learning intervention.

Assumption Testing

Normality and homogeneity tests were conducted before the two-way ANOVA. The Shapiro-Wilk test was used because each comparison group consisted of fewer than 50 students.

Table 7. Results of Normality and Homogeneity Tests

Group/Test	N	Test	Sig.	Interpretation
Wayground	30	Shapiro-Wilk	0.067	Normal
PowerPoint	30	Shapiro-Wilk	0.245	Normal
High motivation	30	Shapiro-Wilk	0.092	Normal
Low motivation	30	Shapiro-Wilk	0.068	Normal
Homogeneity	60	Levene's test	0.051	Homogeneous

The Shapiro-Wilk significance values for the Wayground group (0.067), PowerPoint group (0.245), high-motivation group (0.092), and low-motivation group (0.068) were all greater than 0.05. Therefore, the achievement data met the normality assumption.

The Levene's test produced a statistic of 2.747 with a significance value of 0.051. Because the significance value was greater than 0.05, the homogeneity assumption was considered satisfied. The degrees of freedom should follow the original SPSS output; the reported test statistic and significance value indicate that the group variances were sufficiently homogeneous for the subsequent analysis.

Effect of Learning Media on IPAS Achievement

Descriptive analysis showed differences in IPAS learning achievement between the Wayground and PowerPoint groups.

Table 8. Descriptive Statistics of IPAS Achievement by Learning Media

Learning Media	N	Mean	Std. Deviation
Wayground	30	12.13	3.048
PowerPoint	30	8.80	1.789

Students in the Wayground group obtained a mean achievement score of 12.13 (SD = 3.048), whereas students in the PowerPoint group obtained a mean score of 8.80 (SD = 1.789). The absolute mean difference was 3.33 points. When expressed relative to the PowerPoint mean, the difference was approximately 37.84%.

The two-way ANOVA showed a significant main effect of learning media on IPAS learning achievement, $F(1, 56) = 45.714$, $p < .001$, partial $\eta^2 = .449$. The partial eta squared was calculated using the following formula:

$$\eta p^2 = 110.700 / (110.700 + 135.600) = 0.449.$$

The value indicates a large effect. The Cohen's *d* calculated from the two group means and standard deviations was approximately 1.32, which also represents a large standardized difference.

These findings indicate that students in the Wayground group obtained higher posttest achievement scores than students in the PowerPoint group. The interactive characteristics of Wayground may provide students with more opportunities to participate in learning activities, respond to questions, receive feedback, and monitor their understanding. However, because

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this study used a non-equivalent quasi-experimental design, the observed difference should be interpreted cautiously and should not be regarded as definitive evidence of causality.

Effect of Learning Motivation on IPAS Achievement. Learning achievement was also examined based on students' learning motivation.

Table 9. Descriptive Statistics of IPAS Achievement by Learning Motivation

Learning Motivation	N	Mean	Std. Deviation
High motivation	30	12.27	2.959
Low motivation	30	8.67	1.668

Students with high learning motivation obtained a mean achievement score of 12.27 (SD = 2.959), whereas students with low learning motivation obtained a mean score of 8.67 (SD = 1.668). The absolute mean difference was 3.60 points. Relative to the low-motivation group mean, the difference was approximately 41.52%.

The two-way ANOVA showed a significant main effect of learning motivation on IPAS learning achievement, $F(1, 56) = 57.488$, $p < .001$, partial $\eta^2 = .506$.
The partial eta squared was calculated as:

$$\eta p^2 = 139.200 / (139.200 + 135.600) = 0.506.$$

The result indicates a large effect. Cohen's *d*, calculated from the group summary statistics, was approximately 1.49, also indicating a large standardized difference.

The findings indicate that students classified as having high learning motivation obtained higher achievement scores than students classified as having low motivation. Higher motivation may encourage students to maintain attention, participate in learning activities, persist when completing tasks, and make greater effort to understand the learning material.

Two-Way ANOVA of Learning Media, Learning Motivation, and Their Interaction

Because the research used a 2 × 2 factorial design, the main effects of learning media and learning motivation and their interaction were analyzed simultaneously using two-way ANOVA.

Table 10. Two-Way ANOVA of Learning Media, Learning Motivation, and Their Interaction

Source	Sum of Squares	df	Mean Square	F	Sig.	Partial η^2
Learning Media	110.700	1	110.700	45.714	< .001	.449
Learning Motivation	139.200	1	139.200	57.488	< .001	.506
Media × Motivation	131.111	1	131.111	54.146	< .001	.495
Error	135.600	56	2.421	—	—	—
Total	516.611	59	—	—	—	—

The two-way ANOVA demonstrated a significant main effect of learning media, $F(1, 56) = 45.714$, $p < .001$, partial $\eta^2 = .449$. Learning motivation also had a significant main effect, $F(1, 56) = 57.488$, $p < .001$, partial $\eta^2 = .506$.

The interaction between learning media and learning motivation was also statistically significant, $F(1, 56) = 54.146$, $p < .001$, partial $\eta^2 = .495$. The interaction effect was therefore large based on the partial eta squared value.

The significant interaction indicates that the observed difference associated with learning media varied according to students' level of learning motivation. Therefore, the main

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effect of learning media should be interpreted together with the motivation factor rather than as an effect that occurs uniformly across all students.

Interaction between Learning Media and Learning Motivation

The descriptive statistics for the four combinations of learning media and learning motivation are presented below.

Table 11. Descriptive Statistics of IPAS Achievement by Learning Media × Motivation

Learning Media	Learning Motivation	N	Mean	Std. Deviation
Wayground	High	15	14.67	2.059
Wayground	Low	15	9.60	1.121
PowerPoint	High	15	9.87	1.246
PowerPoint	Low	15	7.73	1.624

The Wayground–high motivation group obtained the highest mean achievement score (M = 14.67, SD = 2.059), while the PowerPoint–low motivation group obtained the lowest mean score (M = 7.73, SD = 1.624).

Among students with high motivation, the Wayground group obtained a mean score of 14.67 compared with 9.87 for the PowerPoint group. The mean difference was 4.80 points. Based on the available group means and standard deviations, Cohen's *d* was approximately 2.89.

Among students with low motivation, the Wayground group obtained a mean score of 9.60, compared with 7.73 for the PowerPoint group. The mean difference was 1.87 points, with a Cohen's *d* of approximately 1.31.

Table 12. Simple Group Differences Based on Learning Motivation

Motivation Level	Wayground Mean	PowerPoint Mean	Mean Difference	Cohen's *d*
High	14.67	9.87	4.80	2.89
Low	9.60	7.73	1.87	1.31

Both standardized differences were large based on conventional Cohen's *d* criteria. The difference between Wayground and PowerPoint was considerably larger among students with high motivation than among students with low motivation.

The simple comparisons provide a descriptive interpretation of the significant interaction. However, the p-values for formal simple-effects testing should be obtained from the estimated marginal means or simple-effects procedure in the original SPSS output. The Cohen's *d* values reported above are calculated from the available descriptive statistics and do not replace the model-based simple-effects significance test.

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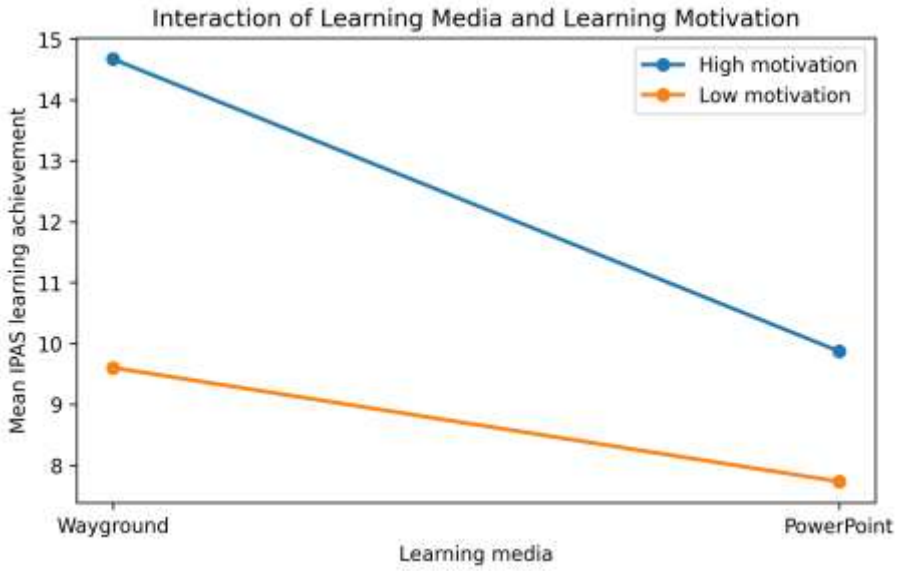


Figure 1. Interaction Plot of Learning Media and Learning Motivation on IPAS Achievement

The interaction plot was constructed using the mean achievement scores for each combination of learning media and learning motivation, as presented in Table 13:

Table 13. Mean Scores of IPAS Achievement by Learning Media and Learning Motivation

Learning Media	High Motivation	Low Motivation
Wayground	14.67	9.60
PowerPoint	9.87	7.73

The plot shows that the difference between Wayground and PowerPoint was larger among students with high motivation than among students with low motivation. This descriptive pattern corresponds to the significant interaction obtained from the two-way ANOVA.

Effect Size Summary

Table 14. Effect Sizes of Learning Media, Learning Motivation, and Their Interaction

Effect	Effect Size	Interpretation
Learning Media	Partial $\eta^2 = .449$	Large
Learning Motivation	Partial $\eta^2 = .506$	Large
Media × Motivation	Partial $\eta^2 = .495$	Large
Wayground vs PowerPoint	Cohen's $d = 1.32$	Large
High motivation: Wayground vs PowerPoint	Cohen's $d = 2.89$	Large
Low motivation: Wayground vs PowerPoint	Cohen's $d = 1.31$	Large
High vs Low motivation	Cohen's $d = 1.49$	Large

The effect-size analysis indicates that the learning media, learning motivation, and their interaction were associated with substantial differences in IPAS achievement within the study sample. The partial eta squared values were .449 for learning media, .506 for learning

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motivation, and .495 for the interaction. The corresponding Cohen's d values also indicated large standardized differences between the relevant groups.

Discussion of the Learning Media Effect

The significant main effect of learning media indicates that IPAS learning achievement differed between students who learned using Wayground and those who learned using PowerPoint. Students in the Wayground group obtained a higher mean achievement score (M = 12.13, SD = 3.048) than students in the PowerPoint group (M = 8.80, SD = 1.789). The two-way ANOVA confirmed a statistically significant difference, $F(1, 56) = 45.714$, $p < .001$, partial $\eta^2 = .449$.

The higher achievement observed in the Wayground group can be interpreted in relation to the interactive characteristics of the medium. During the treatment, students using Wayground were involved in interactive questions, immediate feedback, application activities, and interactive exercises. These features provided students with more opportunities to respond and participate directly in the learning process, whereas the PowerPoint group primarily received material through visual presentation supported by teacher explanation and discussion.

From a constructivist perspective, active participation can provide opportunities for students to process information, connect new information with prior knowledge, and construct understanding through learning experiences. The finding is also consistent with previous research indicating that interactive digital media and gamified learning activities can support student engagement and learning outcomes, although the magnitude of the observed effect may depend on instructional design and implementation (Minzi Li et al., 2023); (Jian Li & Xue, 2023).

Therefore, the difference observed in this study should not be interpreted simply as an effect of using digital technology. Rather, the learning experience provided by Wayground, particularly opportunities for active response, immediate feedback, and interactive practice, may have contributed to the different achievement levels observed between the two groups. Because the study employed a non-equivalent quasi-experimental design without adjustment for pretest scores in the final ANOVA, the finding is interpreted as an observed post-intervention difference rather than definitive evidence of causality.

Discussion of the Learning Motivation Effect

The significant main effect of learning motivation indicates that IPAS learning achievement differed according to students' motivation level. Students classified as having high learning motivation obtained a higher mean achievement score (M = 12.27, SD = 2.959) than students with low learning motivation (M = 8.67, SD = 1.668). The two-way ANOVA showed a statistically significant main effect of learning motivation, $F(1, 56) = 57.488$, $p < .001$, partial $\eta^2 = .506$.

Learning motivation can support students' attention, participation, persistence, and willingness to complete learning tasks. Students with higher motivation may be more willing to maintain attention during instruction, respond to questions, engage in learning activities, and continue working when they encounter difficulties. These behaviors are relevant to IPAS learning because students are required not only to receive information but also to understand concepts and apply them in learning activities.

The finding is consistent with the view of motivation as a factor that initiates, directs, and sustains learning activity (Sardiman, 2012). The relatively higher achievement among

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highly motivated students suggests that students' motivational engagement was associated with their learning achievement in the present study.

However, learning motivation should not be interpreted independently from the learning environment. The significant interaction between learning media and learning motivation indicates that the relationship between motivation and achievement varied across the learning media conditions. Therefore, the main effect of motivation provides an overall description of the groups, while the interaction analysis offers a more specific explanation of how motivation and learning media were related to achievement together.

Discussion of the Interaction between Learning Media and Learning Motivation

The interaction between learning media and learning motivation represents an important finding of this study. The two-way ANOVA showed a statistically significant interaction, $F(1, 56) = 54.146$, $p < .001$, partial $\eta^2 = .495$. This indicates that the observed difference in IPAS learning achievement between the learning media conditions varied according to students' level of learning motivation.

The descriptive pattern provides further explanation of the interaction. Among students with high motivation, the mean achievement score was 14.67 for the Wayground group and 9.87 for the PowerPoint group, resulting in a mean difference of 4.80 points. Among students with low motivation, the corresponding means were 9.60 for Wayground and 7.73 for PowerPoint, resulting in a smaller mean difference of 1.87 points. Thus, the descriptive difference between the two media conditions was greater among students with high motivation.

This pattern may be related to the way students engaged with the interactive features provided during the Wayground treatment. Immediate feedback allowed students to recognize whether their responses were correct and to adjust their understanding during learning activities. Interactive questions and application exercises also required students to participate actively rather than only observe the presentation. Students with higher motivation may have been more willing to sustain attention, respond to questions, use feedback, and complete the interactive activities. This interpretation is consistent with evidence that gamified learning environments can promote student motivation, engagement, and learning outcomes, although their effects may vary according to instructional design and learning environment (Jian Li & Xue, 2023).

For students with low motivation, the availability of interactive features did not correspond to the same magnitude of difference in achievement. Although Wayground provided opportunities for interaction and feedback, students still needed to attend to the learning tasks and participate actively in order to engage with these features. The smaller difference between Wayground and PowerPoint among students with low motivation therefore suggests that the observed relationship between learning media and achievement was not uniform across motivation levels. Previous research has also reported positive relationships among academic motivation, student engagement, and academic achievement, indicating that students' motivational characteristics may be relevant to their engagement in learning activities (Zhang et al., 2022).

The highest mean achievement was observed in the Wayground–high motivation group ($M = 14.67$, $SD = 2.059$), whereas the lowest mean was observed in the PowerPoint–low motivation group ($M = 7.73$, $SD = 1.624$). This pattern illustrates that interactive learning media and higher learning motivation occurred together with higher observed achievement in the present sample. However, the result should be interpreted as an observed interaction rather than evidence that motivation alone causes students to benefit more from Wayground. The

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study used a non-equivalent quasi-experimental design, and learning motivation was measured through a self-report questionnaire. In addition, the final two-way ANOVA did not adjust posttest scores using pretest achievement as a covariate.

Overall, the interaction finding suggests that learning media and learning motivation should be considered together when interpreting differences in IPAS achievement. The result does not indicate that Wayground produces the same level of difference for all students; rather, the descriptive pattern shows a larger difference between media conditions among highly motivated students than among students with low motivation. Further research using randomized designs, larger samples, and covariate-adjusted analyses could provide stronger evidence regarding the relationship between interactive learning media, learning motivation, and IPAS achievement.

Limitations

Several limitations should be considered when interpreting the findings. First, learning motivation was measured using a self-report questionnaire, so the results may be influenced by students' perceptions, response accuracy, or social-desirability tendencies. Second, the study used intact classes rather than fully randomized individual assignment. Third, students remained in their usual out-of-school environments during the treatment period, meaning that factors such as supplementary lessons, exposure to other learning media, and family support could not be fully controlled. Therefore, the findings should be interpreted within the context of the participating Grade VI students and the conditions of the study.

Conclusion

Based on the results of the study, three conclusions can be drawn. First, there was a difference in IPAS achievement between students who learned using Wayground and those who learned using conventional learning media. Second, learning motivation was associated with differences in students' IPAS achievement. Third, there was an interaction effect between learning media and learning motivation on students' IPAS achievement. This interaction indicates that the effectiveness of the learning media differed according to students' level of learning motivation. Therefore, the findings suggest that the use of Wayground should be considered together with students' learning motivation when supporting IPAS learning achievement. These conclusions are limited to the students involved in this study and should not be generalized beyond the research sample without further evidence.

Recommendation

Based on the findings, teachers are recommended to consider using Wayground as an interactive learning medium while also paying attention to students' learning motivation, particularly because the interaction effect indicates that the learning media did not operate independently of students' motivation. Schools can support teachers by providing access to appropriate digital learning resources and opportunities for developing digital learning practices. For future researchers, further studies are recommended to examine the interaction between learning media and learning motivation using larger and more diverse samples, longer implementation periods, and different learning contexts to strengthen the evidence regarding the consistency of these findings.

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