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The Influence of Interactive Flat Panel Media and Learning Motivation on Science Learning Outcomes in Fourth Grade Students of Tirtayasa Islamic Elementary School

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ABSTRACT

This study aims to determine the differences in science learning outcomes between students who use Interactive Flat Panel (IFP) media and students who use conventional learning, and to analyze the effect of the use of Interactive Flat Panel (IFP) media and learning motivation on science learning outcomes of fourth-grade students at SD Islam Tirtayasa. The study used a quantitative method with a quasi-experimental design in the form of Nonequivalent Control Group Design. The research sample was determined using a purposive sampling technique, consisting of 12 students in the experimental class and 14 students in the control class. Data were collected through learning outcome tests (pretest-posttest), questionnaires, and observations, then analyzed using the Independent Sample t-Test, N-Gain, multiple linear regression, F test, and coefficient of determination (R^2) with the help of IBM SPSS Statistics 25. The results showed that there was a significant difference in science learning outcomes between the experimental group and the control group (Sig. = 0.000 < 0.05), with the average posttest of the experimental group being 30.42 higher than the control group being 18.29 (average difference of 12.13). The increase (N-Gain) of the experimental group was in the medium category approaching high (average 53.56), better than the control group which was in the low category (average 4.08). The results of multiple regression analysis produced the equation Y = 9.389 + 0.250X1 − 0.002X2, with the use of Interactive Flat Panel (IFP) providing the most dominant contribution to learning outcomes (Beta coefficient = 0.727), but partially not yet significant at the 5% level (Sig. = 0.051); as well as learning motivation (Beta = -0.011; Sig. = 0.975). Simultaneously, the F test showed that the use of IFP and learning motivation had a significant effect on science learning outcomes (F count = 4.835 > F table = 4.26; Sig. F = 0.037 < 0.05), with a contribution of 51.8% to the variation in science learning outcomes (R^2 = 0.518; Adjusted R^2 = 0.411), while the remaining 48.2% was influenced by other factors outside this study. Student responses to the use of Interactive Flat Panel (IFP) were very positive (average 89%), and the learning motivation of students in the experimental group was very high (average 84%). It can be concluded that the Interactive Flat Panel (IFP) media is effective and plays a dominant role in improving science learning outcomes, both directly and simultaneously with learning motivation, while partially the contribution of the two variables is not yet significant.

Article Information

Kata Kunci:
Hasil Belajar IPAS, Interactive Flat Panel, Motivasi Belajar, Sekolah Dasar.

ABSTRACT

Penelitian ini bertujuan untuk mengetahui perbedaan hasil belajar IPAS antara siswa yang menggunakan media *Interactive Flat Panel* (IFP) dengan siswa yang menggunakan pembelajaran konvensional, serta menganalisis pengaruh penggunaan media *Interactive Flat Panel* (IFP) dan motivasi belajar terhadap hasil belajar IPAS siswa kelas IV di SD Islam Tirtayasa. Penelitian menggunakan metode kuantitatif dengan desain eksperimen semu (*quasi experimental*) bentuk *Nonequivalent Control Group Design*. Sampel penelitian ditentukan menggunakan teknik *purposive sampling*, terdiri atas 12 siswa kelas eksperimen dan 14 siswa kelas kontrol. Data dikumpulkan melalui tes hasil belajar (*pretest-posttest*), angket, dan observasi, kemudian dianalisis menggunakan uji *Independent Sample t-Test*, *N-Gain*, regresi linier berganda, uji F, dan koefisien determinasi (R^2) dengan bantuan *IBM SPSS Statistics 25*. Hasil penelitian menunjukkan terdapat perbedaan hasil belajar IPAS yang signifikan antara kelompok eksperimen dan kelompok kontrol (Sig. = 0,000 < 0,05), dengan rata-rata posttest kelompok eksperimen sebesar 30,42 lebih tinggi dibandingkan kelompok kontrol sebesar 18,29 (selisih rata-rata 12,13). Peningkatan (N-Gain) kelompok eksperimen berada pada kategori sedang mendekati tinggi (rata-rata 53,56), lebih baik dibandingkan kelompok kontrol yang berada pada kategori rendah (rata-rata 4,08). Hasil analisis regresi berganda menghasilkan persamaan Y = 9,389 + 0,250X1 − 0,002X2, dengan penggunaan *Interactive Flat Panel* (IFP) memberikan kontribusi paling dominan terhadap hasil belajar (koefisien Beta = 0,727), namun secara parsial belum signifikan pada taraf 5% (Sig. = 0,051); demikian pula motivasi belajar (Beta = -0,011; Sig. = 0,975). Secara simultan, uji F menunjukkan penggunaan IFP dan motivasi belajar berpengaruh signifikan terhadap hasil belajar IPAS (F hitung = 4,835 > F tabel = 4,26; Sig. F = 0,037 < 0,05), dengan kontribusi sebesar 51,8% terhadap variasi hasil belajar IPAS (R^2 = 0,518; *Adjusted* R^2 = 0,411), sedangkan sisanya 48,2% dipengaruhi faktor lain di luar penelitian ini. Respons siswa terhadap penggunaan *Interactive Flat Panel* (IFP) tergolong sangat positif (rata-rata 89%) dan motivasi belajar siswa kelompok eksperimen tergolong sangat tinggi (rata-rata 84%). Dapat disimpulkan bahwa media *Interactive Flat Panel* (IFP) efektif dan berperan dominan dalam meningkatkan hasil belajar IPAS, baik secara langsung maupun bersama motivasi belajar secara simultan, sedangkan secara parsial kontribusi kedua variabel tersebut belum signifikan.

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1. INTRODUCTION

Education is a planned effort carried out consciously to create an environment and learning process that encourages each student to explore and optimize their potential. Through targeted pedagogical strategies, education serves not only as a transfer of knowledge but also as a transformative vehicle that facilitates students' cognitive, affective, and psychomotor development. This potential can be developed through innovative learning and the use of appropriate learning media, thereby increasing learning motivation and impacting learning outcomes, particularly in Natural and Social Sciences (IPAS) subjects in elementary schools (Sari et al., 2026).

The development of digital technology requires 21st-century teachers to not only act as information transmitters but also to be able to create innovative, interactive, and enjoyable learning. One innovation that is starting to be widely used is the Interactive Flat Panel (IFP), a large interactive touchscreen device that integrates a digital operating system so that teachers can write, display images, animations, videos, and interactive quizzes without the need for a projector or manual whiteboard. The interactive characteristics of IFP have been proven to increase student engagement, interest, and motivation during the classroom learning process (Suryandari et al., 2026).

Science learning integrates the concepts of natural science and social science, studying living things, inanimate objects and their interactions, as well as human life as individuals and social beings, thus requiring students not only to memorize, but also to understand concepts, observe symptoms, think critically, and relate the material to everyday life. In reality, science learning in elementary schools still faces obstacles, such as the many abstract concepts, the broad scope of the material, and the lack of active student involvement, so that students quickly get bored and are less than optimal in achieving learning outcomes.

Low student learning outcomes are also reflected in national educational achievement data. Based on the results of the 2022 Programme for International Student Assessment (PISA), only around 34% of Indonesian students were able to achieve level 2 or minimum competency in science, far below the average for OECD countries (OECD, 2023). This condition is in line with the finding that low social studies learning outcomes in elementary schools remain a problem, especially when classroom learning is still dominated by conventional teacher-centered practices so that active student engagement is not optimally developed (Setiawan et al., 2026). This condition reinforces the urgency of the need for innovation in learning media, including the use of digital media, to encourage improved student learning outcomes in social studies in elementary schools. However, based on observations at Tirtayasa Islamic Elementary School, researchers found that the use of Interactive Flat Panels (IFP) is still not optimally utilized in the learning process. Teachers still tend to use conventional methods and do not utilize the digital media provided by the school, resulting in low motivation and learning outcomes for fourth-grade students in social studies. Based on these problems, this study aims to determine the differences in science learning outcomes between students who use Interactive Flat Panel (IFP) media and students who use conventional learning, as well as to analyze the influence of the use of Interactive Flat Panel (IFP) media and learning motivation on science learning outcomes in fourth grade students at Tirtayasa Islamic Elementary School.

2. LITERATURE REVIEW

2.1 Learning Outcomes

Learning outcomes are defined as the level of student success in learning subject matter at school, expressed in the form of scores obtained from test results on a number of specific subject matters, thus providing information about students' ability to understand the material explained by the teacher in the teaching and learning process (Irawati et al., 2021). Learning outcomes are also understood as behavioral changes obtained by students after experiencing learning activities, including cognitive, affective, and psychomotor aspects, which can be seen from changes in students' knowledge, attitudes, and skills (Fernando et al., 2024). Achieving learning outcomes does not occur automatically, but is influenced by internal factors such as motivation, interest, cognitive abilities, and psychological conditions, as well as external factors such as the family environment, school environment, teaching quality, and learning media (Saputra et al., 2025). In the context of modern education, the use of technology-based learning media is becoming an increasingly significant external factor in determining student learning outcomes (BP et al., 2022).

2.2 Science and Science Learning in the Independent Curriculum

Natural and Social Sciences (IPAS) is a subject in the Independent Curriculum that integrates science and social studies for elementary school students in grades I–VI. IPAS learning is designed to provide students with a comprehensive understanding of the interaction between humans and their environment, both from a natural and social perspective, while simultaneously supporting the realization of the Pancasila Student Profile (Izzati et al., 2024). Through IPAS, students are encouraged to develop curiosity about the natural and social phenomena around them, thus requiring active involvement, critical thinking skills, and the ability to relate concepts to everyday life, rather than simply memorizing.

2.3 Interactive Flat Panel (IFP) Learning Media

Learning media is anything that can convey messages from the sender (teacher) to the recipient (student), thereby stimulating students' thoughts, feelings, and learning interests (Wulandari et al., 2023). Effective media are media that can attract students' attention, clarify the presentation of messages, overcome limitations of space and time, and encourage active student involvement in learning (Fadilah et al., 2023). The development of information and communication technology encourages the transformation of learning media from conventional to more interactive digital-based media, one of which is the Interactive Flat Panel (IFP), a large interactive touchscreen device that integrates a digital operating system so that teachers can write, display images, animations, videos, and interactive quizzes without the need for a projector or manual whiteboard (Kurniawan & Hakim, 2024). In the digital era, media such as IFP not only function as teaching aids, but also as a vehicle for transforming the learning paradigm from teacher-centered to student-centered, encouraging students to become active subjects in the learning process (Sinaga & Firmansyah, 2024).

2.4 Learning Motivation

Learning motivation is an internal and external drive that drives students to actively and sustainably engage in learning activities.

It is the overall driving force within students that generates, ensures, and directs learning activities so that desired goals can be optimally achieved (Fernando et al., 2024). Strong learning motivation in students demonstrates interest, focus, persistence, and readiness in learning activities, leading to positive learning outcomes (Agrifina et al., 2024). Student learning motivation is also strongly influenced by the teacher's role in creating a conducive, enjoyable, and meaningful learning environment. The use of innovative and interactive learning media, such as IFP, is one way teachers can enhance students' extrinsic learning motivation (Bariyah et al., 2023).

2.5 Relevant Research

Several previous studies support this research framework. Suryandari et al. (2026) found that the use of Interactive Flat Panels (IFPs) as an active learning tool in science subjects significantly increased student engagement. Aulia et al. (2025) reported that the use of IFPs improved science learning outcomes, as well as the motivation and participation of elementary school students. Rustiyana (2024) demonstrated the effectiveness of Interactive Flat Panel media in improving students' cognitive learning outcomes in science subjects, while Indriansyah (2025) emphasized the role of IFPs in enhancing student motivation and collaboration in learning. Regarding learning motivation, Nurfaliza and Hindrasti (2021) demonstrated a positive and significant influence of learning motivation on student learning outcomes in online learning. These studies served as the basis for researchers to empirically test the effect of Interactive Flat Panel (IFP) use and learning motivation on science learning outcomes in fourth-grade students at SD Islam Tirtayasa.

3. METHOD

This research is a quantitative study with a quasi-experimental approach using a Nonequivalent Control Group Design. This design was chosen because the researcher could not perform full randomization of the research subjects in a real classroom setting in an elementary school. In this design, there are two groups: the experimental group that received treatment in the form of learning using Interactive Flat Panel (IFP) media combined with the Problem Based Learning (PBL) model, and the control group that used conventional learning media. Both groups were given a pretest before treatment and a posttest after treatment to measure differences in science learning outcomes.

The target population in this study was all fourth-grade students of Islamic Elementary Schools in Cipocok Jaya District, totaling 66 students and spread across three classes. However, the research sample was limited to fourth-grade students of Tirtayasa Islamic Elementary School, consisting of 12 students from class IV Ammar as the experimental group and 14 students from class IV Thalhah as the control group, resulting in a total sample of 26 students. The sample selection was carried out using a purposive sampling technique by considering the suitability of the grade level, the subjects studied, the learning materials, and the availability of two complete classes for the implementation of the quasi-experimental design. The equality of the initial abilities of the two groups was examined through the results of the pretest and tested using the Independent Sample t-Test. The test results showed a significance value of 0.105 (> 0.05), so that no statistically significant differences in initial abilities were found between the two groups. However, the test results only showed no significant differences in pretest scores, not proving that the two groups were completely equivalent in all characteristics. Therefore, the research results are interpreted in the context of fourth-grade students of Tirtayasa Islamic Elementary School who are the research sample and are not directly generalized to all fourth-grade students of Islamic Elementary Schools in Cipocok Jaya District.

Data were collected through three techniques: a learning outcome test (pretest and posttest) to measure students' cognitive learning outcomes on the topic of changes in state of matter, a questionnaire to measure the use of IFP and students' learning motivation, and observation to observe student engagement during the learning process. The test and questionnaire instruments underwent validity and reliability tests before being used in data collection.

The research instruments consisted of a 10-item social science learning outcome test, a 24-item Interactive Flat Panel (IFP) usage questionnaire, and a 24-item learning motivation questionnaire. Item validity was analyzed using Product Moment correlation. Based on the test results listed in the instrument analysis document, all items in the three instruments were declared valid. The validity coefficient of the learning outcome test ranged from 0.51–0.80, the IFP usage questionnaire between 0.51–0.91, and the learning motivation questionnaire between 0.54–0.98.

Instrument reliability was analyzed using Cronbach's Alpha coefficient. The reported reliability values for the social science learning outcome test were 0.84, the IFP questionnaire was 0.97, and the learning motivation questionnaire was 0.99. Furthermore, the quality of the learning outcome test items was analyzed based on their difficulty level and discriminatory power. The difficulty level analysis showed that nine items were categorized as moderate and one item was categorized as easy. The discriminatory power analysis showed that six items were categorized as good and four items were categorized as sufficient. All items were retained based on the analysis results listed in the research document.

Data analysis techniques include descriptive analysis, prerequisite analysis test, and hypothesis test, all of which are processed with the help of Microsoft Excel and IBM SPSS Statistics 25 programs. The prerequisite test consists of a normality test using Shapiro-Wilk (because the number of samples is less than 50) and a homogeneity test using Levene's Test. Hypothesis testing is carried out through: (1) Independent Sample t-Test to test the difference in science learning outcomes between the experimental group and the control group; (2) N-Gain (Normalized Gain) to measure the magnitude of the increase in learning outcomes before and after treatment, with high categories ($g > 0.7$), medium ($0.3 \leq g \leq 0.7$), and low ($g < 0.3$); (3) multiple linear regression with the equation $Y = a + b_1X_1 + b_2X_2 + \varepsilon$ to test the effect of the use of IFP (X_1) and learning motivation (X_2) on science learning outcomes (Y); (4) F test to test the simultaneous influence of the two independent variables on the dependent variable; and (5) coefficient of determination (R^2) to determine the extent of the contribution of the independent variables to the dependent variable.

4. RESULTS AND DISCUSSION

4.1 Descriptive Analysis

The study was conducted on fourth-grade students of Tirtayasa Islamic Elementary School, divided into fourth-grade Ammar as the experimental class and fourth-grade Thalhah as the control

class. Learning was conducted in four meetings, including a pretest, treatment in both classes, and a posttest. In the experimental class, learning used Interactive Flat Panel media combined with the Problem Based Learning model, where researchers displayed videos, images, animations, and interactive quizzes so that students were more active in observing, discussing, and presenting the results of group discussions. In contrast, the control class used textbooks, a whiteboard, and direct explanations without the use of IFP. During learning, students in the experimental class showed higher enthusiasm than students in the control class, who tended to be more passive.

The results of the descriptive statistical analysis showed that the average pretest score for the control group was 15.50, while the experimental group was 15.25. Both scores were in a relatively close range. The pretest t-test results also showed a significance value of 0.105 (> 0.05), so there was no significant difference between the initial abilities of the two groups. After treatment, the average posttest score for the experimental group increased to 30.42, while the control group reached 18.29, with an average difference of 12.13 points. These results indicate that the increase in learning outcomes in the group using Interactive Flat Panel (IFP) media was greater than the group using conventional learning.

Table 1. Results of Descriptive Statistical Analysis of Learning Outcome Tests

Group	N	Minimum	Maximum	Average	Elementary School
Pretest–Control	14	12	20	15.50	2.44
Posttest–Control	14	15	23	18.29	2.73
Pretest–Experiment	12	12	21	15.25	3.31
Posttest–Experiment	12	25	37	30.42	3.73

Source: adapted from IBM SPSS Statistics 25, 2026 output

4.2 Prerequisite Analysis Test

The normality test using Shapiro-Wilk showed that the significance value of the control group pretest (0.582), the control group posttest (0.155), the experimental group pretest (0.051), and the experimental group posttest (0.795) were all greater than 0.05, so that the pretest and posttest data in both groups were declared normally distributed. Furthermore, the homogeneity test using Levene's Test showed a significance value Based on Mean of 0.395 (> 0.05), so that the variance of the science learning outcome data between the control group and the experimental group was declared homogeneous. With the fulfillment of the assumptions of normality and homogeneity, further hypothesis testing was carried out using the parametric Independent Sample t-Test with the assumption of Equal Variances Assumed.

4.3 Hypothesis Testing

The results of the Independent Sample t-Test in the Equal Variances Assumed row obtained a calculated t value of -9.56 with df = 24 and a significance (2-tailed) of 0.00 (<0.05), with a Mean Difference of -12.13 at a 95% confidence interval between -14.75 to -9.51 which does not pass zero. Because the significance value is far below 0.05, H_0 is rejected and H_1 is accepted, meaning that there is a significant difference in the average results of learning science between the group using Interactive Flat Panel (IFP) media and the group using conventional learning.

Table 2. Summary of the Results of the Mean Difference Test with the Independent Sample t-Test

Science Learning Outcomes	Sig.	Interpretation
Pretest	0.105	There was no difference in initial learning outcomes between the experimental group and the control group at a significance level of 5%
Posttest	0,000	The learning outcomes of the experimental group (IFP treatment) were better than those of the control group at a significance level of 5%.

Source: adapted from IBM SPSS Statistics 25, 2026 output

The results of the N-Gain calculation strengthen the findings of the t-test. The experimental group obtained an average N-Gain of 53.56, which is in the medium to high category, reflecting a significant increase in learning outcomes after learning using the Interactive Flat Panel (IFP). In contrast, the control group obtained an average N-Gain of 4.08, which is in the low category, indicating a much more limited increase in learning outcomes in conventional learning. Viewed from the cognitive domain, the highest increase in the experimental group occurred in the low-level thinking domain (remembering and understanding), while the increase in the high-level thinking domain (applying and analyzing) was still smaller. In the control group, all indicators showed very low N-Gain, even in the remembering indicator there was a negative value, which indicates that some students in the control group actually experienced a decrease in scores from the pretest to the posttest. The results of the partial regression analysis indicate that the Interactive Flat Panel (IFP) usage variable has a significance value of 0.051, while the learning motivation variable has a significance value of 0.975. At the 5% significance level, both variables have not shown a statistically significant partial effect in the tested model. However, these results cannot be directly interpreted as evidence that the two variables have no relationship with learning outcomes. The limited sample size needs to be considered in interpreting the results, particularly regarding the accuracy of coefficient estimates and the analysis's ability to detect existing relationships.

Table 3. Multiple Linear Regression Test Results

Variables	Coefficient B	Beta	t	Sig.
Constant	9,389	-	1,373	0.203
Use of IFP (X_1)	0.250	0.727	2,245	0.051
Learning	-0.002	-0.011	-0.033	0.975

Motivation (X_2)				

Source: adapted from IBM SPSS Statistics 25, 2026 output

The F test results show a calculated F value of 4.835 with a significance of 0.037. At a significance level of 5%, the significance value of 0.037 is smaller than 0.05 and the calculated F value is greater than the F table of 4.26, so H_0 is rejected and H_1 is accepted. Thus, the use of Interactive Flat Panel (IFP) media and learning motivation simultaneously have a significant effect on science learning outcomes in fourth-grade elementary school students. The results of the coefficient of determination test show an R value of 0.720 which indicates a strong relationship between the two independent variables and science learning outcomes. The R Square value of 0.518 indicates that the use of IFP and learning motivation together contribute 51.8% to the variation in science learning outcomes, while the remaining 48.2% is influenced by other factors outside this study. The Adjusted R Square value of 0.411 indicates the model's ability after being adjusted for the number of variables and sample size.

The questionnaire results showed that the response of students in the experimental group to the use of Interactive Flat Panel (IFP) was very positive with an average score of 89%, including indicators of increased enthusiasm (88%), a surge in learning motivation (89%), and effectiveness of material delivery (89%). 9 of the 12 students (75%) were in the very good category, while the rest were in the good category, and there were no students in the sufficient or less category, as presented in Table 4.

Table 4. Frequency Distribution of Student Response Categories to the IFP Usage Questionnaire

Category	Range (%)	Frequency	Percentage (%)
Very good	76–100%	9	75%
Good	51–75%	3	25%
Enough	26–50%	0	0%
Not enough	0–25%	0	0%
Total	-	12	100%

Source: adapted from data processed using Microsoft Excel, 2026

Meanwhile, the results of the learning motivation questionnaire showed an average score of 84% in the strongly agree category, with the indicator of the ability to defend opinions showing the highest score (89%), indicating that IFP-based learning also encourages students' courage and confidence in conveying ideas. The frequency distribution of the learning motivation questionnaire response categories is presented in Table 5, which shows that the majority of students (75%) are in the strongly agree category, but there are also 25% of students whose responses are in the disagree category, indicating variations in motivation levels between students despite receiving the same learning media treatment.

Table 5. Frequency Distribution of Student Response Categories to the Learning Motivation Questionnaire

Category	Range (%)	Frequency	Percentage (%)
Very good	76–100%	9	75%
Good	51–75%	3	25%
Enough	26–50%	0	0%
Not enough	0–25%	0	0%
Total	-	12	100%

Source: adapted from data processed using Microsoft Excel, 2026

4.4 Discussion

The finding that the experimental group achieved improved learning outcomes and better comprehension effectiveness compared to the control group reinforces the view that interactive learning media plays a crucial role in the student learning process. This condition aligns with the findings of Suryandari et al. (2026) who showed that the use of IFP in science learning can significantly increase student active engagement and understanding of the material, because this media provides a concrete learning experience through rich visualizations and direct interaction between students and the learning content. Rahayu and Makmur (2024) also emphasized that interactive media such as IFP makes it easier for students to understand and remember the material, thus contributing to improved learning outcomes. A similar opinion was expressed by Rustiyana (2024) who demonstrated the superiority of visual and interactive-based media over conventional methods.

In addition to its impact on cognitive aspects, the advantages of IFP are also evident in the affective aspects of learning. Aulia et al. (2025) found that the implementation of IFP not only improved learning outcomes but also encouraged student motivation, activeness, and participation, resulting in more enthusiasm and confidence in expressing opinions. This pattern is consistent with student-centered learning based on a constructivist approach and may explain why the experimental group in this study demonstrated more optimal learning outcomes than the control group.

Theoretically, learning motivation is a key factor determining student learning success. Nurfaliza and Hindrasti (2021) found a positive and significant influence between learning motivation and learning outcomes, as students with high motivation tend to be more diligent, active, and persistent in facing learning challenges. A summary of student responses in this study showed that the learning motivation of students in the experimental group was in the very high category across all indicators, thus descriptively supporting this theory. However, the results of the regression analysis indicated that the contribution of learning motivation to learning outcomes was not yet statistically apparent. This discrepancy between descriptive findings and statistical test results is common in small-scale experimental studies and can be explained by several possibilities, including the relatively short treatment duration, the dominant influence of IFP media in the regression model, which may mask the contribution of learning motivation, and the measurement instrument for learning motivation that may not fully capture variations in motivation between students. Thus, these findings do not necessarily deny the role of learning motivation, but rather indicate that its influence in this study appears more as an accompanying condition supporting the learning process.

Wulandari and Mudinillah (2022) found that the combination of appropriate digital media use and high student learning motivation creates a positive synergy in the learning process, ultimately resulting in more optimal learning outcomes. This view is relevant to the findings of Indriansyah (2025), who concluded that IFP not only serves as a medium for conveying

information but also as a stimulus that increases student motivation and collaboration in learning. In line with these two views, the joint contribution of IFP use and learning motivation to science learning outcomes in this study was quite significant simultaneously, although the partial power of the statistical test was still limited by the relatively small sample size.

This study implemented a combination of Interactive Flat Panel (IFP) and Problem-Based Learning (PBL) models. Therefore, the results obtained cannot be used to identify the contribution of IFP separately from the PBL model. Both components are implemented as a single learning series, so the contribution of each component cannot be distinguished empirically. Furthermore, the limited sample size needs to be considered in interpreting the results of the regression analysis, particularly when determining which variables have a relatively greater contribution. Therefore, the research findings are more appropriately understood in the context of the application of the combination of IFP and PBL to the study group.

5. CONCLUSION

The results of this study need to be interpreted according to the scope of the sample studied. Data from 66 students in Cipocok Jaya District is presented as the context of the study population, while data collection was conducted on students in grades IV Ammar and IV Thalhah at SD Islam Tirtayasa. Therefore, the conclusions of the study primarily apply to the group of students who served as the research sample. These findings cannot be directly generalized to all students in Cipocok Jaya District without adequate empirical evidence.

Based on the research results, the combined application of Interactive Flat Panel (IFP) and Problem-Based Learning (PBL) models is related to student learning outcomes in the studied group. The results of the regression analysis indicate that the IFP variable and learning motivation do not yet have a statistically significant partial relationship at the 5% significance level. Therefore, these results are not sufficient to conclude that IFP is a dominant factor determining learning outcomes. Furthermore, because IFP was implemented in conjunction with the PBL model, the contribution of each treatment component cannot be empirically separated. These findings need to be interpreted cautiously, considering the limited sample size and the scope of the study on fourth-grade students at SD Islam Tirtayasa.

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