THE INFLUENCE OF THE INTERACTIVE GROUP INVESTIGATION LEARNING MODEL ASSISTED BY INTERACTIVE LKPD ON IPAS LEARNING OUTCOMES, VIEWED FROM THE PERSPECTIVE OF LEARNING MOTIVATION OF FOURTH-GRADE STUDENTS AT UBUD DISTRICT ELEMENTARY SCHOOLS

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ABSTRACT

This study aims to determine the effect of the application of the Group Investigation learning model fostered by interactive LKPD on the learning outcomes of IPAS in terms of learning motivation of grade IV students at SD Gugus Ubud, Ubud District, Bali. The research used a quasi-experimental method. Non-Equivalent Design of Pretest-Posttest Control Groups. The population consists of 194 students and a research sample of 84 students. Data were collected using learning outcome tests and motivational questionnaires. Data were analyzed using Two-Way ANCOVA with one covariate. Research results: first, there is a significant difference in the learning outcomes of IPAS, and second, there is a significant interaction between learning models and learning motivation on IPAS learning outcomes. Thirdly, among students with high learning motivation, the learning outcomes of IPAS differed significantly between those taught using the Group Investigation model assisted by interactive LKPD and lastly among students with low learning motivation, there were also significant differences in IPAS learning outcomes. The conclusion is that the Group Investigation model assisted by interactive LKPD is effective in improving IPAS learning outcomes strengthened by high student learning motivation. The contribution of this research is to have an impact on improving learning and the use of digital learning media in elementary schools.

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INTRODUCTION

IPAS plays an important role in fostering students' curiosity and scientific reasoning skills. This curiosity encourages students to understand the working mechanisms of the universe as well as its relationship to human life. Through this understanding, students can be trained to recognize various problems that arise in life and strive to find

alternative solutions that support the achievement of sustainable development goals (BKSAP Kemendikbudristek, 2022). However, science learning applied in elementary schools has not fully provided optimal learning outcomes. One of the problems that is still faced is that students' learning outcomes in science learning are not optimal (Prayuda, 2023; Sutika et al., 2024). This condition is strengthened by the results of the National Assessment listed in the Indonesian Education Report Card from 2023 to 2025 which shows the development of learning outcomes of elementary school students, especially in literacy and numeracy skills. The achievements in the Indonesian Education Report Card at the elementary level are as follows.

Table 1. Development of Literacy and Numeracy Achievements in Indonesian Education Report Cards at the Elementary/MI/Equivalent Level

Reports Education	Year Implementation of the National Assessment	Literacy Ability	Numeracy Skills
2023	2022	**"Medium"** This year, 61.53% of students have literacy competencies above the minimum, up 8.11 from 2021 (53.42%).	**"Medium"** This year, 46.67% of students have numeracy competence above the minimum, up 16.01 from 2021 (30.66%).
2024	2023	**"Good"** This year it is 70.62%, up 7.99 from 2023 (62.63%).	**"Medium"** This year it is 62.62%, up 14.65% from 2023 (47.97%).
2025	2024	**"Good"** This year it is 71.81%, up 1.19% from 2024 (70.62%).	**"Medium"** This year it is 69.58%, up 6.96% from 2024 (62.62%).

(Source: Education Data Portal, 2025)

Based on the data above, the achievement of literacy and numeracy skills based on the results of the National Assessment shows an increase from year to year, but most of these results are still in the medium category and have not reached the expected target. A similar situation can also be seen in the learning outcomes of fourth grade students of SD Gugus Ubud based on summative data at the end of the Even Semester of the 2024/2025 school year, still in the low category. Of the total 118 students who took part in the assessment, only 36 students (30.5%) obtained a score above the KKTP of 70-85, while the other 82 students (69.5%) obtained a score below the KKTP. Low achievement is caused by several factors, including limited students' understanding of basic science concepts, low motivation to learn, limited variety of teachers' learning strategies, and limited use of media and learning resources that are in accordance with student characteristics (Novita & Maksum, 2021; Ridwan et al., 2025). Another factor that contributes to low learning quality is the use of teacher-centered teaching because it uses conventional learning models (Rani et al., 2025; Tirta & Indrayana, 2022).

One of the alternatives that can be applied is the learning model Group Investigations. Learning model Group Investigations is a model that emphasizes student participation and activity to find the subject matter to be learned through the available materials (Noviarini et al., 2025; Sakinah et al., 2024). Learning model Group Investigations Provide opportunities for students to work collaboratively in small groups, choose topics, formulate questions, explore, analyze information, and present their findings to the class (Amarullah, 2021; Ibrahim, 2021; Prayuda, 2023). Models Group Investigations Contribute to improving student learning outcomes through a comprehensive learning approach (Sri et al., 2021).

The results of previous research show that the learning model Group Investigations has a significant influence on student learning outcomes (Buaton et al., 202:) (Nabilah & (Tsani et al., 2020)Pertiwi, 2024). The results of the study also show that the learning model Group Investigations With the help of concrete media, it affects the learning

outcomes of science students at the elementary school level (Mahardika et al., 2021; Nurhakim, 2020; Wedana, 2025). The learning model will be more optimally applied if it is assisted by student worksheets because it has been proven to be effective in improving students' cognitive abilities, especially science learning (Maatita, 2021; Made et al., 2024; Widiarini et al., 2024). Other research shows that the LKPD is structured based on Group Investigations Able to train students' high-level thinking skills (Nabela & Bayu, 2022). Not only that, the success of learning is also influenced by internal factors from within the student (Asrori & Suparman, 2020) one of which is learning motivation. Learning motivation is a moderator variable that affects a person's learning outcomes, learning motivation functions as a variable that can strengthen or weaken the impact of learning on the achievement of science learning outcomes (Fredy et al., 2020; Supriyani et al., 2021).

Therefore, this study is important to determine the empirical effectiveness of the application of learning models Group Investigations assisted by digital-based interactive LKPD by considering students' learning motivation in improving IPAS learning outcomes. The results of this research are expected to contribute to the development of learning practices that are innovative, adaptive, and relevant to the learning needs of the 21st century.

METHOD

This is stuy use a quasi-experimental research chosen was the pretest-posttest control group design, where there were two groups, namely the experimental group and the control group, which were given pretest and posttest, respectively. Individual randomization is not applied due to the intact class setting. The implementation of this study follows three main stages, namely: (1) the preparation stage, (2) the experimental implementation stage, and (3) the final stage of the experiment, which is designed to support the pretest-posttest non-equivalent control group design approach. The population in this study is all grade IV students of the Ubud Cluster Elementary School, Ubud District, Gianyar Regency for the 2025/2026 school year consisting of five elementary schools. In this study, sample selection was not carried out by individual randomization, but was carried out through randomization of existing classes using random sampling techniques. The research sample is.

Table 2. Research Sample

Variable	Experimental Group	Control Group	Quantity
Higher Learning Motivation	20	22	42
Low Learning Motivation	20	22	42
Quantity	**40**	**44**	**84**

The data collection technique can be seen in the table below.

Table 3. Data Collection Methods and Instruments

Data	Method	Instruments	Source	Data Properties
Learning motivation for students of science subjects in grade IV	Questionnaire	Questionnaire	Students	Interval (score)
Learning outcomes of students in science subjects grade IV	Tests	Tests	Students	Nominal (score)

In this study, the data obtained were explained according to their respective variables, namely the learning outcomes of IPAS students who were learned through learning the Group Investigation learning model assisted by interactive LKPD and the learning outcomes of IPAS students who were learned through conventional learning. This data description is useful to provide an overview of the distribution of data by frequency, explain the highs, mid-trends, and lowest trends, and to explain the patterns of the research data.

In order to be able to answer the formulation of the problem or test the hypothesis that has been formulated, it is necessary to analyze the data that has been collected. Because the data is quantitative, the analysis is carried out by

the following statistical prerequisite tests, namely: (1) Data normality tests for Pretest and Posttest scores of IPAS learning outcomes are carried out to determine the distribution of data. Based on the results of the analysis, the data distribution with normal distribution was obtained, so that parametric statistical tests could be carried out. (2) Linearity and Significance Test of Regression Direction, i.e. if the calculation results show that the significance value in the table of Deviation of Linearity is greater than 0.05, then it can be concluded that the relationship between the two variables is linear. Furthermore, the regression direction significance test is carried out by looking at the significance value in the Linearity section, where if the result is smaller than 0.05, then the regression direction coefficient is declared significant. (3) The homogeneity test aims to find out whether several groups of research data have the same variant (homogeneous) or not. (4) The hypothesis was tested using a bidirectional ANCOVA with one covariate.

RESULTS AND DISCUSSION
RESULTS

The data on student learning outcomes is divided into two, namely the pretest result score and the posttest result score. The calculation of each score based on mean (average), data spread size (standard deviation), and variance is presented in table 4 and table 5 below.

Table 4. Recapitulation of the Results of the Pretest Score Calculation of IPAS Learning Outcomes

Statistics \ Data	A1	A2	A1B1	A1B2	A2B1	A2B2
Red ($\bar{X}$)	77.15	76.05	80.20	74.10	73.36	78.73
Standard Deviation (SD)	6.007	7.502	5.105	5.33	6.153	7.893
Variance (S^2)	36.079	56.277	26.063	28.411	37.861	62.303
Minimum Score (X_{min})	62	62	70	62	62	62
Maximum Score (X_{maks})	90	90	90	86	86	90
Range/Range	28	28	20	24	24	28
Median	78.64	78.17	80.68	75.14	76.00	82.50

Table 5. Recapitulation of Posttest Score Calculation Results for IPAS Learning Outcomes

Statistics \ Data	A1	A2	A1B1	A1B2	A2B1	A2B2
Red ($\bar{X}$)	85.20	80.36	88.40	82.00	76.18	84.55
Standard Deviation (SD)	6.124	6.616	5.567	4.942	5.27	5.021
Variance (S^2)	37.497	43.772	30.989	24.421	27.775	25.212
Minimum Score (X_{min})	70	64	78	70	64	72
Maximum Score (X_{maks})	100	94	100	88	84	94
Range/Range	30	30	22	18	20	22
Median	86.843	82.91	88.83	85.5	77.5	87.75

Prerequisite Test Results

Before the hypothesis test is carried out through a statistical method with the Anacova Two-Path formula with One Covariat (Pretest value), a prerequisite test is carried out first. The prerequisite test is the normality test of the

data distribution has been declared normal, the linearity test and significance of the direction of regression have been qualified, and the variance homogeneity test has been qualified, then followed by the hypothesis test as follows:

Hypothesis Test Results

The hypothesis test in this study was carried out through a statistical method using the two-path Anacova formula with one covariable. Furthermore, if it is known that there is an interaction between learning motivation and IPAS learning outcomes, then it is followed by a dunnet test to find out which interaction effect is better.

Table 6. Summary of the Results of the Two-Track ANACOVA Analysis with One Covariable of IPAS Learning Outcomes

Source	Type III Number of Squares	Df	Square Average	F	Sig.
Corrected Model	3604.291a	4	901.073	308.994	.000
Intercept	263.001	1	263.001	90.188	.000
X	1960.352	1	1960.352	672.240	.000
B	39.451	1	39.451	13.528	.000
A	326.473	1	326.473	111.954	.000
B*A	130.119	1	130.119	44.620	.000
Error	230.376	79	2.916		
Quantity	577872.000	84			
Corrected Total	3834.667	83			

a. R squared = .940 (Adjusted R squared = .937)

Based on the calculation of Anacova Two Pathways with One Covariate in the table above, it can be concluded that;

The first hypothesis, namely the null hypothesis, is rejected and the alternative hypothesis is accepted (the results of the analysis: the significance value of the "Model" (A) F is calculated = 111.954 (sig.<0.001 <0.050). This means that there is a significant difference in the learning outcomes of IPAS between the group of students who study with the group investigation learning model assisted by interactive LKPD and the group of students who study with conventional learning.

The second hypothesis: zero is rejected and an alternative hypothesis is accepted (analysis results: significance value of "Model*Learning motivation" (A*B) Calculation F = 44.620 (sig. <0.001<0.050). This means that there is a significant influence of interaction between the learning model and learning motivation on IPAS learning outcomes. The results of the second hypothesis test showed that there was a significant interaction between the LKPD interactive Group Investigation learning model and learning motivation on IPAS learning outcomes. The interaction between the Group Investigation learning model used for student treatment and motivation can be illustrated through the following figure.
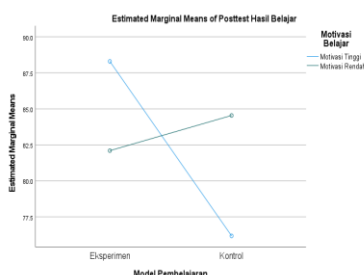
Figure 1. The Interaction Between Learning Models and Learning Motivation

The results of the above hypothesis test show that there is a significant interaction between the learning model Group Investigations and students' learning motivation to IPAS learning outcomes, then hypothesis testing can be continued on the influence of interaction using advanced tests Post Hoc i.e. test Dunnet. The criteria for testing a hypothesis whether a hypothesis is subsequently acceptable or rejected can be seen as follows:

Third hypothesis: for the Dunnet test between A1B1 and A2B1, if the Qcal value is greater than the $t >_{t\ table\ value}$, meaning that the null hypothesis is rejected and the alternative hypothesis is accepted or in the group of students who have high learning motivation, there is a difference in the learning outcomes of the IPAS between groups of students who study with the Group Investigation learning modelassisted by interactive LKPD and student groups who learn with conventional learning.

Fourth hypothesis: for the Dunnet test between A1B2 and A2B2, if the tcount value is greater than the $t >_{t\ table\ value}$, meaning that the null hypothesis is rejected and the alternative hypothesis is accepted or in the group of students who have low learning motivation, there is a difference in IPAS learning outcomes between the group of students who study with the Group Investigation learning modelassisted by interactive LKPD and groups of students who learn with conventional learning.

Table 7. Summary of the Third Hypothesis Test

	GROUPS		There	Tabs $_{(0.05)}$	Remarks
	A1B1	**A2B1**			
Average score	88.40	76.18			Ho rejected
Average in	2.916		23.298	Ttab $_{(0.05, dk=40)} = 2.86$	HA is accepted

The results of the above analysis show that the tcount value is 23.298 and the t-table $_{value}$ is 10. Therefore, it can be seen that the tcount value is greater than the ttable (t calculated$>t_{table}$), this means that the null hypothesis is rejected and the alternative hypothesis is accepted, which means that in the group of students who have high learning motivation, there is a difference in the learning outcomes of IPAS between groups of students who study with Group Investigation The learning model is assisted by interactive LKPD and groups of students who learn with conventional learning.

Table 8. Summary of the Fourth Hypothesis Test

	GROUPS		There	Tabs $_{(0.05)}$	Remarks
	A2B2	**A1B2**			
Average score	84.55	82.00			Ho rejected
Average in	2.916		4.834	Ttab $_{(0.05, dk=40)} = 2.86$	HA is accepted

The results of the above analysis show that the tcount value is 4.834 and the table value is 2.86. Therefore, it can be seen that the tcount value is greater than ttable ($t_{is\ calculated}>t_{table}$), this means that the null hypothesis is rejected and the alternative hypothesis is accepted or in the group of students who have low learning motivation, there is a

difference in the learning outcomes of IPAS between groups of students who study with Group Investigation The learning model is assisted by interactive LKPD and groups of students who learn with conventional learning.

DISCUSSION

There is a Difference in Social Science Learning Outcomes between the Student Group Learning Group Learned Model with the Interactive LKPD Assisted Group Investigation Learning Model and the Student Group Learning with Conventional Learning.

Testing the first hypothesis, the null hypothesis is rejected and the alternative hypothesis is accepted ("Model" (A) Calculation F = 111.954 (sig.<0.001 <0.050). This means that there is a significant difference in the learning outcomes of IPAS between the group of students who study with the group investigation learning model assisted by interactive LKPD and the group of students who study with conventional learning.

Significant differences in learning outcomes between students who follow the learning model Group Investigations assisted by interactive LKPD with students who participate in conventional learning, due to differences in treatment in the learning model Group Investigations which emphasizes learning centered on student activities through six steps, namely topic identification, task planning, group investigation, presentation of results, analysis and evaluation, and reflection (Stuart & Scott, 2022; Kurniasih et al., 2024; Novantoro et al., 2025). Through the learning stages on the model syntax Group Investigations, students obtain information through interaction with direct learning resources, such as scientific activities with investigative techniques. In addition, the use of learning media such as digital-based interactive LKPD through the platform Canva Worksheets providing support in every phase of the learning model Group Investigations by displaying activities, work instructions, and multimedia materials in an attractive format that is easily accessible to students. This digital medium makes it easier for students to search for information faster and increases curiosity about the topic being studied (Octaviyantari et al., 2020).

There is an Interaction Effect between the Application of the Learning Model and Learning Motivation.

Testing the second hypothesis, the null hypothesis is rejected and the alternative hypothesis is accepted (analysis results: significance value of "Model*Learning Motivation" (A*B) Count F = 44.620 (<0.001<0.050 mark). This means that there is a significant interaction between Learning models and learning motivation for IPAS learning outcomes. IPAS learning outcomes cannot be separated from the influence of various aspects, both from within students and from the learning environment. Learning approaches and models continue to evolve according to the characteristics of students and the demands of the times. Learning model Group Investigations This is seen as very effective for students who have high learning motivation because it provides a wide space to actively participate, seek information, and develop their potential so that they can achieve maximum learning outcomes (Ardithayasa & Yudiana, 2020; Ayu et al., 2023). In contrast, conventional lecture-based learning is better suited for students with low motivation, as they tend to be passive and more comfortable receiving information directly from teachers without in-depth investigative involvement.

In the Group of Students Who Have High Learning Motivation, There is a Difference in the Learning Outcomes of IPAS between the Group of Students who Study with the Interactive LKPD Assisted Group Investigation Learning Model and the Group of Students who Study with Conventional Learning.

Testing the third hypothesis, the null hypothesis is rejected and the alternative hypothesis is accepted (ttable $_{(0,05)}$ = 2.86, tcount = 23,298, tcalculation>ttable). What it means, in the group of students who have high learning motivation, there is a difference in the learning outcomes of IPAS between the group of students who study with the learning model Group Investigation interactive LKPD and student groups learning with conventional learning. The differences that arise are influenced by characteristics Group Investigation Learning Model which provides opportunities for students to be more dominant in their learning activities of teacher. This model requires students to be directly involved in the process of searching for information, working together in groups, and presenting findings openly. For highly motivated students, this series of activities is very suitable because it is able to channel their interest in learning through opportunities to think critically, discuss, and build knowledge independently or collaboratively (Sojayapan & Khlaisang, 2020).

The effectiveness of this learning model is further strengthened with the help of digital-based interactive LKPD that provide systematic guidance, multimedia materials, and interactive exercises that facilitate the student investigation process (Handayani & Alexon, 2024; Hidayat & Aripin, 2023). The integration of these three aspects, namely high learning motivation, the application of learning models Group Investigations, and interactive media support, contribute to improved learning quality as students are encouraged to explore, reflect and present their learning outcomes in greater depth (Agustian & Ariani, 2024; Bamabang, 2023; Pramita et al., 2025). On the other hand, conventional learning is not able to facilitate the learning needs of highly motivated students to the maximum, so the learning outcomes are not as good as the group of students who receive investigation-based learning. Thus, the selection of a learning model that places students as active subjects is very important to support the achievement of science competencies, especially for students who have high learning motivation (Alfateza et al., 2025).

In the group of students with low learning motivation, there was a difference in the learning outcomes of IPAS between the group of students who studied with the LKPD-assisted group investigation learning model and the group of students who learned with conventional learning.

Testing the fourth hypothesis, the null hypothesis is rejected and the alternative hypothesis is accepted (Table $_{(0.05)}$ = 2.86, Stuttgart = 4,834, Table Stuttgar>t). This means In the group of students who have low learning motivation, there is a difference in the learning outcomes of IPAS between the group of students who study with the learning model Group Investigations Interactive groups fostered by LKPD and students who study with Conventional Learning. The difference in IPAS learning outcomes is closely related to the learning characteristics applied. On the learning model Group Investigations With the help of interactive LKPD, students are given the opportunity to play an active role in the investigation process, information gathering, and collaborative discussions (Artawan, 2023; Fadila et al., 2019). However, students with low motivation tend to show less interest in participating in the investigative process. Digital-based interactive LKPD does provide a learning stimulus through teaching, multimedia, and interactive activities, but without strong internal encouragement, the use of media and the active role of students in groups do not take place optimally (Zorlu & Sezek, 2020). This condition causes the achievement of student learning outcomes that are low motivation through Group Investigations does not reach the maximum level, although the model presents a learning environment rich in activities (Indrawati et al., 2021)

CONCLUSION

Based on the results of data analysis, hypothesis testing, and discussions that have been presented in the previous chapter, it can be concluded that: First, there is a difference in the learning outcomes of IPAS between the group of students who study with the group investigation learning model assisted by interactive LKPD and the group of students who learn with conventional learning. Second, there is an influence of interaction between learning models and learning motivation on IPAS learning outcomes. Third, in the group of students who had high learning motivation,

there was a difference in the learning outcomes of IPAS between the group of students who studied with the group investigation learning model assisted by interactive LKPD and the group of students who learned with conventional learning. Fourth, in the group of students who had low learning motivation, there was a difference in the learning outcomes of IPAS between the group of students who studied with the investigative learning model assisted by interactive LKPD and the group of students who learned with conventional learning. Theoretically, this study reinforces the evidence that cooperative investigation-based learning models are more effective when integrated with digital instructional media and supported by student motivation. Practically, the findings provide guidance for elementary school teachers in designing student-centered IPAS teaching. It is suggested that further research could explore the effectiveness of the Group Investigation learning model in different subjects, other levels of education, or test additional variables such as proficiency according to the 21st century.

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