

THE EFFECT OF THE GROUP INVESTIGATION LEARNING MODEL ON CRITICAL THINKING SKILLS AND LEARNING MOTIVATION IN GRADE V IPAS

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Abstract

This study aims to examine the effect of the Group Investigation (GI) learning model on students' critical thinking skills and learning motivation in the Science and Social Studies (IPAS) subject among fifth-grade elementary school students. This research employed a quantitative approach using a quasi-experimental design, specifically the nonequivalent control group design. The experimental group received instruction using the GI model, while the control group was taught using conventional learning methods. Data were collected through validated and reliable instruments, including a critical thinking test and a learning motivation questionnaire. The data were analyzed using Multivariate Analysis of Variance (MANOVA) with Jamovi 2.6.13 software. The results of the multivariate test showed a significance value of $p < .001$, indicating a significant difference between the experimental and control groups. The univariate tests also revealed significant effects on both critical thinking skills ($p < .001$) and learning motivation ($p < .001$). The application of the GI learning model proved effective in enhancing students' critical thinking skills through collaborative investigation processes and in increasing learning motivation by making the learning activities more engaging, relevant, and participatory. These findings suggest that the GI learning model can serve as an innovative alternative for improving the quality of IPAS learning in elementary schools.

Introduction

Education plays an important role in shaping the quality of human resources that are superior and competitive (Mena Lestari, 2025). In the context of learning in elementary schools, the Natural and Social Sciences (IPAS) subject plays an essential role in fostering students' curiosity and critical thinking skills regarding the natural and social phenomena in their environment (Idayatun & Setiawati, 2022). In particular, the ecosystem material taught in fifth grade is an integral part of IPAS because it provides a foundation for understanding the complex interactions between living things and their environment (Mesi Julianti et al., 2025). However, in practice, IPAS learning in the field often fails to encourage active student involvement in mastering the concepts taught (Eigi Pema Hastiani, Siti Masfuah, 2024). As a result, the learning objectives of fostering critical thinking and active learning have not been optimally achieved.

One of the main obstacles that is often identified is the dominance of conventional learning methods (Thalib et al., 2022). Many teachers still use lecture and question-and-answer models without giving students the opportunity to explore knowledge independently (Siagian et al., 2023). This approach causes students to become passive, only acting as recipients of information

without any in-depth processing (Toto, 2024). This one-way learning provides little space for students to discuss, collaborate, or express their opinions (Nelis et al., 2021). This condition hinders the development of students' critical thinking skills.

In addition, some students also show low interest in learning IPAS subjects (Syarvitra, 2022). The material is considered difficult and abstract, making students feel bored and uninterested in participating in learning. The lack of variety in the use of media and learning models by teachers often triggers a decline in student motivation to learn (Abdulloh, 2023). Students are not actively involved in learning activities such as observing, asking questions, or solving problems (Aziza et al., 2023). This has an impact on low learning outcomes and students' higher-order thinking skills. Another crucial problem is the lack of collaborative learning in the classroom (Priharyanti et al., 2025). In fact, cooperation among students is very important in building activity and social skills (Kholik & Yuhelman, 2025). When students are not accustomed to working in groups, they tend to be individualistic and unable to appreciate the opinions of others (Ni Putu Noviarini et al., 2025). This causes the classroom atmosphere to become less interactive and the learning process to feel monotonous (Sumira, 2024). Teachers also find it difficult to foster meaningful interactions between students.

The GI model provides students with the opportunity to choose topics, collect data, and compile reports based on their investigations (Fitriani & Yuliani, 2023). This process trains students to think critically in finding solutions to problems (Ratna et al., 2024). In addition, students are also encouraged to communicate effectively in groups, thereby promoting active learning (Priharyanti & U.S, 2025). Learning becomes more meaningful because students are directly involved in every stage of the activity (Purba et al., 2024). The application of GI can create a more democratic and participatory learning atmosphere (Rahayu & Sari, 2022). Students are given the space to express their opinions without fear of being wrong (Ni Putu Noviarini et al., 2025). This will foster self-confidence and a high enthusiasm for learning (Fitriani & Yuliani, 2023). Thus, students' critical thinking skills and active participation can develop simultaneously (Aziza et al., 2023). The learning process also becomes more enjoyable and meaningful.

Although numerous previous studies have explored the effectiveness of the *Group Investigation* model in enhancing learning outcomes and critical thinking skills, most have focused on general science subjects or were conducted within curricular contexts prior to the implementation of the Merdeka Curriculum. Furthermore, earlier research tends to examine cognitive outcomes independently, without integrating learning activeness as a complementary variable. Therefore, this study offers novelty by investigating the application of *Group Investigation* in IPAS learning within the Merdeka Curriculum framework while simultaneously analyzing the relationship between students' critical thinking skills and learning activeness on ecosystem material. Consequently, this research is expected to provide empirical contributions to the development of more contextual, participatory, and 21st-century-oriented IPAS instructional strategies. In addition, this model also helps teachers in carrying out comprehensive assessments, not only focusing on the final results, but also on the process of cooperation, activity, and students' thinking skills during activities (Nelis et al., 2021).

This holistic assessment is in line with the demands of 21st-century skills, which include critical thinking, communication, collaboration, and creativity (Ratna et al., 2024). Based on the foregoing discussion, this study aims to examine the effect of implementing the *Group Investigation* learning model on improving fifth-grade students' critical thinking skills and learning activeness in IPAS, particularly on ecosystem topics. Specifically, this research seeks to

investigate how students' engagement in collaborative investigation activities promotes active participation, enhances analytical abilities, and fosters cooperative learning during the instructional process. Thus, Group Investigation can be an effective solution to improve the quality of IPAS learning (Aziza et al., 2023). Based on the above description, the application of the Group Investigation learning model is expected to have a positive impact on improving students' critical thinking and activity in the IPAS subject on the ecosystem material for grade V.

Method

This study is a quantitative study using the Quasi Experimental Design method. This study uses a Nonequivalent Control Group Design, which involves the use of experimental and control groups without randomization. The experimental group received treatment through the application of the group investigation learning model, while the control group continued to follow the conventional learning method. The purpose of using this design is to evaluate the effect of the independent variable, namely the group investigation learning model, on dependent variables such as student learning motivation and critical thinking. The Quasi Experimental Design method is considered appropriate for classroom-based research because it allows for testing interventions without disrupting the natural conditions of the learning environment (Ardiansyah et al., 2023).

The instrument trial was conducted with 120 sixth-grade students to examine validity and reliability prior to implementation. For hypothesis testing, the study involved two fifth-grade classes (Class A and Class B) at SDN 1 Jepun selected through purposive sampling based on comparable academic characteristics and learning conditions. Class A served as the experimental group receiving instruction through the Group Investigation model, while Class B functioned as the control group taught using conventional methods. This nonequivalent control group design was employed to preserve natural classroom settings while enabling systematic comparison of students' learning motivation and critical thinking outcomes.

All instruments underwent validation and reliability testing before being applied in the study. The research subjects consisted of two groups, namely the experimental class that received learning using the group investigation model and the control class that continued to use conventional learning. In this study, validity was determined using Exploratory Factor Analysis (EFA). EFA is applied when the measurement model of the instrument construct is still in the development or exploration stage (Retnawati, 2016). The validity of the instrument was tested using the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO MSA) and Bartlett's Test of Sphericity using the Jamovi 2.6.13 application. The significance criteria used were that the KMO MSA value must be greater than 0.50, while Bartlett's Sphericity must be significant with a value of less than 0.05 for the instrument to be declared valid and the research to continue (Wahab & Junaedi, 2022).

Reliability testing was conducted on the two research instruments, namely the test and questionnaire instruments. Reliability testing used the Cronbach's alpha test with the help of Jamovi ver 2.6.13. The assessment criteria were Cronbach's $\alpha > 0.5$, meaning that the instrument was declared reliable.

Furthermore, data normality analysis was performed using the Shapiro-Wilk Multivariate Normality Test with the help of the Jamovi ver 2.6.13 program. The condition is that if the sig. value is > 0.05 , the data is normally distributed, whereas if the sig. value is < 0.05 , the data is not normally distributed. In other words:

- H₀: The data is normally distributed.
- H₁: The data is not normally distributed.

Then, the homogeneity test in this study used the Homogeneity of Covariance Matrices Test with the help of the Jamovi ver 2.6.13 program with the following conditions: if the sig. value is >0.05, the data comes from the same variance, and if the sig. value is <0.05, the data comes from different variances, with the following hypotheses:

- H₀: Group variance is homogeneous
- H₁: Group variance is not homogeneous

Hypothesis testing in this study used the MANOVA test with the assistance of the Jamovi ver 2.6.13 program to determine whether there was an effect of the group investigation model learning on critical thinking and learning motivation of fifth-grade students at SDN 1 Jepun. The method used in this field trial was a nonequivalent control group design. Analysis of the multivariate test using all tests (Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root) showed a p-value <.001, which is significant at the 0.05 level.

- H₀: There is no significant difference in motivation and critical thinking between students who receive learning using the group investigation learning model and students who do not use it ($\mu_1 = \mu_2$).
- H_a: There is a significant difference in motivation and critical thinking between students who receive learning using the group investigation learning model and students who do not use it ($\mu_1 = \mu_2$).

In addition, the univariate test also showed statistically significant results with $p < 0.001$ at a significance level of 0.05. The hypotheses for each dependent variable are as follows:

- H₀₁: There is no significant difference in learning motivation between students who receive learning using the group investigation learning model and students who do not use it ($\mu_1 = \mu_2$).
- H₀₂: There is no significant difference in critical thinking between students who receive learning using the group investigation learning model and students who do not use it ($\mu_1 = \mu_2$).
- H_{a1}: There is a significant difference in learning motivation between students who receive learning using the group investigation learning model and students who do not use it ($\mu_1 = \mu_2$).
- H_{a2}: There is a significant difference in critical thinking between students who receive learning using the group investigation learning model and students who do not use it ($\mu_1 = \mu_2$).

Result

The validity of the test questions and questionnaires was tested using exploratory factor analysis (EFA) with the help of Jamovi ver 2.6.13, with the following results:

Table 1 . Bartlett's Test of Sphericity “ Test”

Bartlett's Test of Sphericity		
χ^2	df	p
1374	45	<.001

Based on the results in Table 1, it shows that *Bartlett's Sphericity* value is <.001. Retnawati (2016) explains that a p-value less than 0.01 indicates that the sample size used in this factor analysis is sufficient.

Table 2. Bartlett's Test of Sphericity "questionnaire"

Bartlett's Test of Sphericity		
χ^2	df	p
1896	190	<.001

Table 2 shows *Bartlett's Sphericity* value of <.001. Retnawati (2016) states that a p-value of less than 0.01 indicates that the sample size is adequate for factor analysis. Thus, both the test questions and the questionnaire are valid because there is a significant correlation between items. This indicates that the instruments are very suitable for further analysis, especially when supported by the *Kaiser-Meyer-Olkin (KMO)* results:

Table 3. KMO MSA "test"

KMO Measure of Sampling Adequacy	
	MSA
Overall	0.960
S1	0.950
S2	0.966
S3	0.974
S4	0.954
S5	0.956
S6	0.963
S7	0.955
S8	0.948
S9	0.970
S10	0.964

Based on Table 3, it can be seen that the overall KMO value is 0.960, with each item value being >0.5. Retnawati (2016) explains that a Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) greater than 0.5 used in this factor analysis is sufficient. Since the KMO value is 0.960 and greater than 0.5, the sample size used in this factor analysis is sufficient.

Table 4. KMO MSA "questionnaire"

KMO Measure of Sampling Adequacy	
	MSA
Overall	0.951
S1	0.944
S2	0.971
S3	0.953
S4	0.971
S5	0.969
S6	0.938
S7	0.946
S8	0.942
S9	0.962
S10	0.957
S11	0.971
S12	0.949
S13	0.939
S14	0.930
S15	0.927
S16	0.949
S17	0.943
S18	0.960
S19	0.950
S20	0.956

Based on Table 4, it can be seen that the KMO value is 0.951 with each item having a value >0.5. Retnawati (2016) explains that a *Kaiser-Meyer-Olkin measure of sampling adequacy (KMO)* greater than 0.5 used in this factor analysis is sufficient. Because the KMO value is 0.951 and

greater than 0.5, the sample size of used in this factor analysis is sufficient. The number of factors contained in the instrument can be determined from the scree plot and Eigen value, resulting in a graph that shows steepness and slope (Retnawati, 2016). The following is the *Scree Plot* analysis of the questionnaire instrument. The number of factors contained in the instrument can be determined from the scree plot and Eigen values, resulting in a graph showing steepness and flatness (Retnawati, 2016). The following is the *Scree Plot* analysis of the test questions and questionnaire instruments.

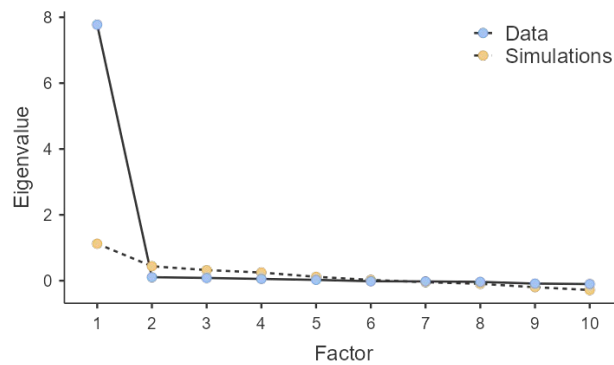


Figure 1. Scree plot critical thinking

Observing the results of the *scree plot*, there is one outlier, so this test instrument is only valid for measuring students' critical thinking. Then, the results of *the scree plot* for measuring learning motivation can be seen as follows:

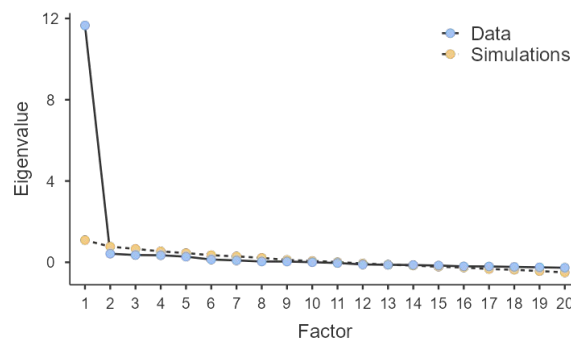


Figure 2. Scree plot motivation

Observing the scree plot results, there is one outlier, so this test instrument is only valid for measuring students' learning interest. This is also confirmed by *the Eigen Values* of both test instruments and questionnaires, which show that only one factor has a value that stands out from the other factors, as presented in the following table:

Table 5. Eigenvalues “Test”

Factor	Initial Eigenvalues Eigenvalue
1	7.7756
2	0.1054
3	0.0830
4	0.0539
5	0.0247
6	-0.0169
7	-0.0225

Initial Eigenvalues	
Factor	Eigenvalue
8	-0.0365
9	-0.0889
10	-0.1023

Based on the exploratory factor analysis, it can be concluded that the test questions are valid for measuring critical thinking among students in general and have been empirically proven. The results of the questionnaire's *eigenvalues* are as follows:

Table 6. Eigenvalues questionnaire

Initial Eigenvalues	
Factor	Eigenvalue
1	11.65620
2	0.42211
3	0.35734
4	0.34624
5	0.27653
6	0.13708
7	0.09205
8	0.03710
9	0.03570
10	0.00391
11	-0.03435
12	-0.10653
13	-0.12316
14	-0.13593
15	-0.16050
16	-0.19999
17	-0.20481
18	-0.22644
19	-0.24803
20	-0.26832

Based on the *exploratory* factor analysis, it can be concluded that the questionnaire instrument is valid for measuring student learning motivation in general and has been empirically proven.

Reliability Test

Reliability testing is a process of evaluating the consistency, stability, and repeatability of measurement results obtained from an instrument. The purpose is to ensure that the instrument is free from random measurement errors. This reliability test, assisted by *Jamovi ver 2.6.13* using *Cronbach's alpha test*, can be seen as follows:

Table 7. reliability test result test

Scale Reliability Statistics	
Cronbach's α	
scale	0.972

Based on Table 7, the *Cronbach's Alpha* coefficient value for the test instrument is 0.972, which is classified as very high reliability. This indicates that the test instrument has a strong and consistent level of reliability in measuring the aspects under study (Retnawati, 2016). This is followed by the results of the questionnaire instrument reliability test, which can be seen as follows:

Table 8. Reliability test result questionnaire

Scale Reliability Statistics	
Cronbach's α	
scale	0.965

Based on the analysis results, the questionnaire instrument has a *Cronbach's Alpha* coefficient value of 0.965, which is classified as very high reliability (Retnawati, 2016). This shows that the questionnaire is very reliable in measuring students' learning motivation. This finding is also reinforced by the results in the *item-rest correlation* table.

Table 9. Item-rest correlation test

Item Reliability Statistics			
	Mean	SD	Item-rest correlation
S1	5.78	1.94	0.872
S2	5.83	1.86	0.880
S3	5.88	1.99	0.854
S4	5.88	2.13	0.879
S5	5.93	2.09	0.880
S6	5.87	2.05	0.880
S7	5.96	1.95	0.852
S8	5.81	1.81	0.839
S9	5.83	2.02	0.851
S10	5.82	1.89	0.893

Table 9 *item-rest correlation* presents important information for analyzing the reliability of instruments, particularly in assessing the internal consistency of each item in a scale. This data helps identify items that function optimally and items that need to be revised or deleted. The *item-rest correlation* table for the questionnaire instrument is presented as follows:

Table 10. Item-rest correlation questionnaire

Item Reliability Statistics			
	Mean	SD	Item-rest correlation
S1	3.68	1.045	0.649
S2	3.81	0.882	0.718
S3	3.73	1.083	0.765
S4	3.51	1.004	0.761
S5	3.63	0.952	0.740
S6	3.41	1.065	0.809
S7	3.50	1.115	0.725
S8	3.39	1.132	0.729
S9	4.27	0.753	0.622
S10	3.77	0.983	0.753
S11	3.78	0.963	0.770
S12	3.62	0.954	0.761
S13	3.63	1.070	0.796
S14	3.53	1.020	0.777
S15	3.78	1.055	0.779
S16	3.51	1.021	0.770
S17	3.69	0.994	0.749
S18	3.62	1.063	0.768
S19	3.60	0.999	0.735
S20	3.52	1.037	0.788

Item-rest correlation from Table 10. The questionnaire instrument measures the extent to which each item in the instrument correlates with the total score of the instrument itself. A

positive correlation result indicates that the item can be used to reflect the concept of " " that is being measured.

Normality Test

In this study, data normality was tested using the *Shapiro-Wilk Multivariate Normality* test with the help of *Jamovi ver 2.6.13*. If $p > 0.05$, the data is normally distributed, and conversely, if $p < 0.05$, the data is not normally distributed.

Table 11. Normality test for test

Shapiro-Wilk Multivariate Normality Test	
W	p
0.961	0.052

Based on the data processing from the table above, it can be seen from *the Shapiro-Wilk Multivariate Normality Test* that the p-value is 0.52, which means that the result is $p > 0.05$, so the data can be said to be normally distributed. Thus, the null hypothesis H_0 is accepted. In addition, normally distributed data can be seen through *the Q-Q Plot (Quantile-Quantile Plot)*. If the data points are close to the diagonal line (), then the data can be said to be normally distributed. The graph of *the Q-Q Plot* can be seen as follows:

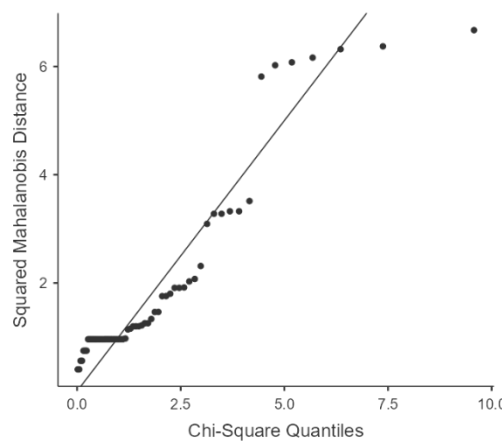


Figure 3. Q-Q Plot Assessing Multivariate Normality

The Q-Q Plot graph shows data points that are close to the diagonal line, so it can be concluded that the data is normally distributed.

Homogeneity Test

The homogeneity test was conducted to determine whether the research samples had the same variance. The test was performed using the *Jamovi 2.6.13* program, with the stipulation that the data was considered homogeneous if the significance value (sig.) was > 0.05 , and not homogeneous if the sig. value was < 0.05 . Therefore, the data was declared not homogeneous.

Table 12. Homogeneity test

Box's Homogeneity of Covariance Matrices Test			
χ^2	df	p	
1.90	3	0.594	

Based on the results of *Box's Homogeneity of Covariance Matrices* test, the significance value is > 0.05 , which means that the null hypothesis (H_0) is accepted and the data comes from the

same variance. Thus, the data meets the assumptions of normality and homogeneity, so it is suitable for analysis using parametric statistical techniques.

Hypothesis Testing

The next test conducted was a hypothesis test using *MANOVA*. The hypothesis test using *MANOVA* was assisted by the *Jamovi* application ver 2.6.13 with the following results in the *multivariate test*:

Table 13. Hypothesis testing *Multivariate Test's*

Multivariate Tests		value	F	df1	df2	p
Group	Pillai's Trace	0.976	1157	2	57	<.001
	Wilks' Lambda	0.0240	1157	2	57	<.001
	Hotelling's Trace	40.6	1157	2	57	<.001
	Roy's Largest Root	40.6	1157	2	57	<.001

The *Multivariate Tests* table shows that all multivariate statistics (*Pillai's Trace*, *Wilks' Lambda*, *Hotelling's Trace*, and *Roy's Largest Root*) have a significance value of $p < 0.001$. This indicates that there are statistically significant differences between the groups being compared. Thus, the null hypothesis (H_0) is rejected, and it can be concluded that the treatment given has a substantial and significant effect on the dependent variable in the study.

Table 14. Hypothesis testing *Univariate Test's*

Univariate Tests		Sum of Squares	df	Mean Square	F	p
Group	Dependent Variable					
	Motivasi Belajar	4369	1	4369.07	1982	<.001
	Berpikir	4318	1	4318.02	1829	<.001
Residuals	Motivasi Belajar	128	58	2.20		
	Berpikir	137	58	2.36		

Based on the table above, it can be seen that the *univariate* test results show a p-value of <0.001 , which means that H_{a2} and H_{a3} are accepted. This means that there is a significant effect of learning with the group investigation model on critical thinking, and it can be stated that there is a significant effect of group investigation learning on student motivation.

Tabel 15. Effect Size (Partial Eta Squared)

Dependent Variable	SS Effect	SS Error	Partial η^2	Interpretation
Learning Motivation	4369	128	0.972	Very large
Critical Thinking	4318	137	0.969	Very large

The univariate analysis revealed a very large effect of the Group Investigation model on learning motivation ($\eta^2 = .972$) and critical thinking skills ($\eta^2 = .969$), indicating that the instructional intervention contributed substantially to improvements in both dependent variables.

Discussion

The application of the Group Investigation (GI) learning model has a significant positive effect on increasing the learning motivation of fifth-grade students. Before the intervention of this model, students' learning motivation was low in science subjects because they were considered difficult, abstract, and boring. However, through GI, students transformed from recipients to discoverers and processors of information, making the learning process more interesting (Agustian & Ariani, 2024). The GI model provides students with the opportunity to

choose investigation topics and collect data, making learning more relevant and challenging, rather than just a monotonous task (Runengtih et al., 2020). Thus, GI effectively addresses the issue of limited variety in learning models, which has been a trigger for declining student learning motivation.

The influence of the GI model is also evident in its ability to create a fun and relaxed learning environment. This atmosphere is key to changing students' perception that learning is an interesting activity (María & Londa, 2023). Students no longer feel afraid of making mistakes when expressing their opinions, which fosters self-confidence and a high enthusiasm for learning. This condition is very important because conventional learning approaches often only make students passive listeners without any in-depth processing of the material (Haliza & Nugrahani, 2021). The GI model successfully reverses this situation and encourages learning initiatives.

Furthermore, the impact of GI on learning motivation was confirmed by the increase in students' active involvement in classroom activities. Students who initially appeared passive and waited for instructions now showed initiative to discuss, collaborate, and solve problems in their groups (Srimuliyani, 2023). This increase in learning motivation is directly correlated with the potential for improved learning outcomes and higher-order thinking skills in students in the future (Virliana & Fauziah, 2025). GI also encourages healthy collaboration and competition among students, as shown in game-based research, which further enhances their confidence during the learning process.

The Group Investigation model has been proven to have a significant impact on fostering students' critical thinking skills, an ability that remains low due to a learning focus dominated by material transfer (Istiana et al., 2023). The investigation process in GI trains students to analyze problems, compare opinions, or draw conclusions from their observations systematically (Runengtih et al., 2020). Thus, GI is a solution to overcome the crucial problem where students tend to prefer memorizing concepts rather than understanding their essence (Yolanda et al., 2024). This model shifts the focus of learning from memorization to analytical reasoning, so that students are trained to find solutions to problems.

Conclusion

The application of the Group Investigation learning model in Natural and Social Sciences (IPAS) in fifth-grade elementary school has been proven to have a significant effect on improving students' critical thinking skills and learning motivation. Through this approach, students are encouraged to actively engage in group investigations, formulate questions, collect data, analyze information, and collaboratively draw conclusions, thereby substantially enhancing their critical thinking abilities as they are trained to evaluate, compare, and synthesize diverse perspectives. Simultaneously, learning activities that involve discussion, shared responsibility, and a sense of group achievement stimulate students' learning motivation, making them more enthusiastic, confident, and intrinsically motivated to participate in the learning process. Thus, the Group Investigation model positively influences both cognitive aspects, particularly critical thinking skills, and affective aspects, namely learning motivation, contributing significantly to the effectiveness of IPAS instruction at the elementary school level. From a practical perspective, these findings imply that IPAS teachers are encouraged to integrate the Group Investigation model into classroom instruction as an alternative to conventional teaching methods, particularly when aiming to foster active learning, collaborative skills, and higher-order thinking. Teachers should also design learning activities that provide sufficient opportunities for

inquiry, discussion, and reflection to maximize the benefits of this model. Furthermore, future research is recommended to explore the long-term impact of Group Investigation on other learning outcomes, such as creativity and problem-solving skills, as well as to examine its effectiveness across different grade levels, subject areas, and learning contexts. Such studies would provide deeper insights into the broader applicability of this model within elementary education.

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