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The Effect of Differentiated Instruction and Learning Motivation on Elementary School Students' Learning Outcomes

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Abstract

This study aimed to examine the effect of differentiated instruction and learning motivation on elementary school students' learning outcomes in Natural and Social Sciences (IPAS), within the context of instructional practices aligned with the principles of the Merdeka Curriculum. A quantitative quasi-experimental design with a 2×2 factorial model was employed to analyze the main and interaction effects of instructional approach and learning motivation. The participants were 46 sixth-grade students from two elementary schools, consisting of an experimental group taught using differentiated instruction and a control group taught using conventional instructional methods. Data were collected through a learning outcomes test and a learning motivation questionnaire and analyzed using Two-Way ANOVA at a significance level of 0.05. The results indicated that students who received differentiated instruction achieved significantly higher learning outcomes than those who received conventional instruction. Learning motivation also had a significant effect, with highly motivated students demonstrating better academic achievement. However, no significant interaction effect was found between instructional approach and learning motivation, suggesting that differentiated instruction is more effective in improving learning outcomes regardless of students' motivation levels. These findings provide empirical evidence supporting the implementation of differentiated instruction in IPAS learning at the elementary school level.
Keywords: *differentiated instruction, learning motivation, learning outcomes, elementary school*

Introduction

Education plays a fundamental role in developing competent, innovative, and competitive human resources in the 21st century (Anis Zohriah et al., 2024). At the elementary school level, learning quality is influenced not only by curriculum design and instructional materials but also by the alignment between instructional strategies and students' internal characteristics (Anwas et al., 2022; Bognar et al., 2025; Dua et al., 2025). Teachers are therefore required to design learning experiences that accommodate learner diversity, foster active engagement, and support meaningful knowledge construction. This challenge is particularly evident in Natural and Social Sciences (IPAS), an integrated subject that requires students to develop analytical, observational, and reflective thinking skills. When instructional practices do not sufficiently address students' varied learning needs, learning outcomes tend to remain suboptimal, as indicated by empirical findings on elementary school students' learning outcomes across diverse educational contexts.

In recent years, differentiated instruction has emerged as a pedagogical approach aimed at responding to student diversity within the same classroom (Kristiyuana et al., 2025; Muh. Asriadi

et al., 2023; Wakifah et al., 2023). Rooted in constructivist learning theory, differentiated instruction emphasizes instructional adaptation based on students' readiness, interests, and learning profiles through modifications of content, learning processes, products, and learning environments (Norhayati Husin & Adnan, 2025; Pebriyandi & Sari Mardian, 2024; Wibowo et al., 2025). Empirical studies have consistently shown that differentiated instruction enhances student engagement and academic achievement by providing equitable learning opportunities and reducing disparities in student performance across different educational contexts (Ramaila, 2025; Ramilo & Ting, 2025; Subandiyah et al., 2025).

Adaptive instructional approaches such as differentiated instruction are also believed to have the potential to strengthen students' learning motivation. Learning motivation has been widely recognized as a crucial factor influencing students' academic success (Gabriel et al., 2025; Huang et al., 2025; Törmänen et al., 2025). Motivation drives students' persistence, effort, and engagement in learning activities, thereby shaping their learning outcomes (Frausto et al., 2024; Lo et al., 2022). Previous studies have indicated that students with higher learning motivation tend to demonstrate better academic performance, whereas low motivation is often associated with disengagement and limited participation in classroom activities (Asadpour et al., 2025; Supartini et al., 2025). In elementary education, low motivation may be further reinforced by conventional teacher-centered instructional practices that provide limited opportunities for active learning and meaningful interaction.

Despite extensive research examining differentiated instruction and learning motivation, existing studies have predominantly investigated these variables independently. Limited attention has been given to their combined effects on students' learning outcomes, particularly in elementary school contexts and within integrated subjects such as IPAS. Moreover, much of the existing empirical evidence has been derived from Western educational settings or focused on secondary education, leaving a contextual gap in understanding how differentiated instruction and learning motivation interact within Indonesian elementary schools. This lack of integrated analysis constrains a comprehensive understanding of how instructional and motivational factors jointly influence students' learning outcomes.

Based on these considerations, this study aims to examine the effect of differentiated instruction and learning motivation on elementary school students' learning outcomes in the IPAS subject at SDN Tagangser Daya I. Specifically, this study investigates the main effects of differentiated instruction and learning motivation, as well as their interaction effect on students' learning outcomes. The novelty of this research lies in its use of a quasi-experimental factorial design to provide empirical evidence on the combined influence of instructional differentiation and learning motivation within the Indonesian elementary education context. By integrating pedagogical and motivational perspectives, this study is expected to contribute to a more comprehensive understanding of effective instructional practices and support the development of adaptive, inclusive, and motivating learning environments in elementary schools.

Method

This study employed a quantitative quasi-experimental approach with a 2×2 factorial design to examine the effects of differentiated instruction and learning motivation on elementary school students' learning outcomes in Natural and Social Sciences (IPAS). This design was selected because random assignment of participants was not feasible in a natural classroom setting, while still allowing for systematic comparison between experimental and control groups. The factorial design enabled the analysis of the main effects of instructional approach and learning motivation, as well as their interaction effect on students' learning outcomes.

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The participants consisted of 46 sixth-grade students from two public elementary schools in the Tagangser Daya area during the 2025/2026 academic year. The sample was selected using purposive sampling to ensure comparable academic and socioeconomic characteristics between groups. The experimental group included 22 students from SDN Tagangser Daya I who received differentiated instruction, while the control group consisted of 24 students from SDN Tagangser Daya II who were taught using conventional teacher-centered instruction. All participants were aged between 11 and 12 years and had previously followed the same IPAS curriculum.

Data were collected using three instruments. Students' learning motivation was measured using a questionnaire consisting of 25 Likert-scale items that assessed four dimensions: desire for success, persistence, perceived value of learning, and engagement. The questionnaire demonstrated content validity and construct validity, as evaluated by expert judgment and empirical testing. Students' learning outcomes were assessed using a 30-item multiple-choice test aligned with IPAS curriculum indicators to measure conceptual understanding and knowledge application. This test also demonstrated content validity based on expert review. In addition, an observation sheet was used to monitor the implementation of differentiated instruction in the experimental group to ensure instructional fidelity. All instruments demonstrated adequate validity and high reliability. The reliability coefficients were 0.86 for the learning motivation questionnaire and 0.88 for the learning outcomes test.

The research procedure was conducted in three stages. In the preparation stage, lesson plans and research instruments were developed, validated, and approved by the relevant authorities. During the intervention stage, the experimental group received differentiated instruction over six instructional sessions, involving variations in content, learning activities, grouping, and assessment based on students' readiness and learning profiles. Meanwhile, the control group was taught using conventional instructional methods. In the final stage, data were collected by administering the learning motivation questionnaire and learning outcomes test to both groups under standardized conditions.

Data were analyzed through a combination of descriptive and inferential statistical techniques using SPSS version 26. Descriptive analysis was employed to present an overview of the data by calculating the mean scores and standard deviations. Before conducting hypothesis testing, the assumptions required for parametric analysis were evaluated, including tests of normality using the Kolmogorov–Smirnov procedure and tests of variance homogeneity using Levene's test. Subsequently, a Two-Way Analysis of Variance (ANOVA) was applied to examine both the main effects and the interaction effect of differentiated instruction and learning motivation on students' learning outcomes, with a significance level set at 0.05.

Results

Descriptive Test

Descriptive statistical analysis was conducted to illustrate students' learning outcomes based on instructional approach (differentiated instruction and conventional instruction) and levels of learning motivation (high and low). The descriptive results are presented in Table 1.

Table 1. Descriptive Statistics

Descriptive Statistics				
Dependent Variable: Learning Outcomes				
Instructional Approach	Learning Motivation	Mean	Std. Deviation	N
Experimental	High	83.1818	1.40130	11
	Low	79.0000	1.61245	11

	Total	81.0909	2.59870	22
Control	High	67.0833	.99620	12
	Low	63.7500	1.13818	12
	Total	65.4167	1.99819	24
Total	High	74.7826	8.30639	23
	Low	71.0435	7.90557	23
	Total	72.9130	8.23765	46

Source: Primary data processed using SPSS 26 (2025)

Based on Table 1, students in the experimental group who received differentiated instruction obtained higher mean scores (M = 81.09, SD = 2.60) than those in the control group who were taught using conventional instruction (M = 65.42, SD = 2.00). This pattern was observed for both levels of learning motivation. In the experimental group, students with high motivation achieved a higher mean score (M = 83.18) than those with low motivation (M = 79.00). Similarly, in the control group, students with high motivation (M = 67.08) outperformed students with low motivation (M = 63.75).

Overall, students with high learning motivation demonstrated higher average learning outcomes (M = 74.78) than students with low learning motivation (M = 71.04), regardless of instructional approach.

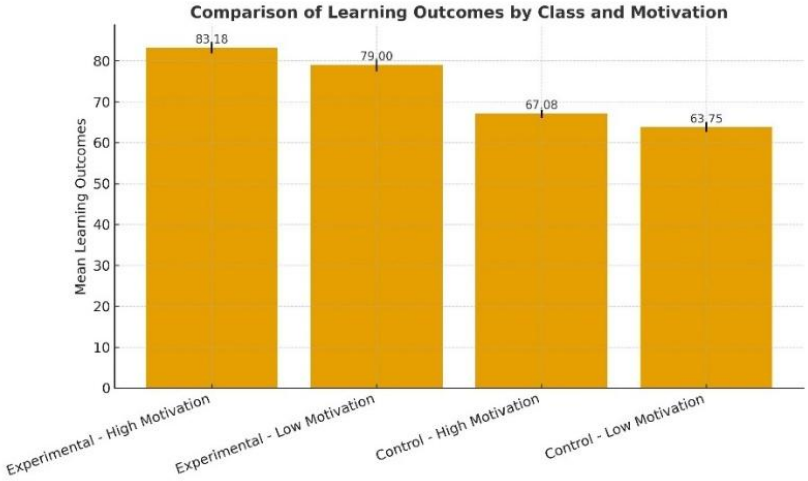


Figure 1. Comparison of Students' Learning Outcomes Based on Instructional Approach and Learning Motivation

Figure 1 illustrates the pattern of differences in students' learning outcomes across instructional approaches and motivation levels. The figure shows that students in the differentiated instruction group consistently achieved higher scores than those in the conventional instruction group for both high- and low-motivation categories. Additionally, within each instructional approach, students with high learning motivation obtained higher mean scores than students with low motivation.

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Normality Test

The distribution normality of the data was assessed by applying the Kolmogorov–Smirnov and Shapiro–Wilk tests to the standardized residuals of students' learning outcome scores.

Table 2. Test of Normality

Tests of Normality						
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual for Learning Outcomes	.116	46	.140	.972	46	.334

a. Lilliefors Significance Correction

Source: SPSS Output, 2025 (processed primary data).

As shown in Table 2, the significance values obtained from the Kolmogorov–Smirnov test (p = 0.140) and the Shapiro–Wilk test (p = 0.334) are greater than the significance level of 0.05. These results indicate that the standardized residuals are normally distributed. Therefore, the assumption of normality required for further parametric analysis, particularly Two-Way ANOVA, is satisfied.

Homogeneity Test

The assumption of variance homogeneity was tested using Levene's Test of Equality of Error Variances to verify whether the variances of students' learning outcome scores were consistent across the comparison groups.

Table 3. Homogeneity of Variances Test

Levene's Test of Equality of Error Variances[a]			
Dependent Variable: Learning Outcomes			
F	df1	df2	Sig.
1.103	3	42	.358

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + Instructional Approach + Learning Motivation + Instructional Approach * Learning Motivation

Source: SPSS Output, 2025 (processed primary data)

As shown in Table 3, Levene's test produced a significance value of 0.358, exceeding the 0.05 threshold. This finding indicates that the variance across groups is equal, confirming that the homogeneity assumption necessary for applying Two-Way ANOVA has been satisfied.

Two-Way ANOVA Test

Two-Way ANOVA was used to analyze the effects of instructional approach and learning motivation, as well as their interaction, on students' learning outcomes in IPAS, following confirmation that all parametric assumptions were met.

Table 4. Two-Way ANOVA Results (Tests of Between-Subjects Effects)

Tests of Between-Subjects Effects					
Dependent Variable: Learning Outcomes					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2982.849[a]	3	994.283	589.804	.000
Intercept	246374.783	1	246374.783	146148.277	.000
Instructional Approach	2820.001	1	2820.001	1672.810	.000

Learning Motivation	162.066	1	162.066	96.137	.000
Instructional Approach * Learning Motivation	2.066	1	2.066	1.225	.275
Error	70.803	42	1.686		
Total	247604.000	46			
Corrected Total	3053.652	45			

a. R Squared = ,977 (Adjusted R Squared = ,975)

Source: SPSS Output, processed primary data (2025).

The results indicate that the instructional approach had a statistically significant main effect on students' learning outcomes, $F(1, 42) = 1672.810$, $p < 0.001$. Students who were taught using differentiated instruction achieved significantly higher learning outcomes than those who received conventional instruction. The effect size analysis revealed a very large effect of instructional approach ($\eta^2p = 0.976$), indicating that differentiated instruction had a substantial practical impact on students' academic achievement.

Learning motivation also showed a significant main effect on learning outcomes, $F(1, 42) = 96.137$, $p < 0.001$. Students with high learning motivation consistently outperformed those with low motivation across instructional conditions. The effect size for learning motivation was large ($\eta^2p = 0.696$), confirming that motivation plays a crucial role as an internal factor influencing students' academic performance.

In contrast, the interaction effect between instructional approach and learning motivation was not statistically significant, $F(1, 42) = 1.225$, $p = 0.275$. The corresponding effect size was small ($\eta^2p = 0.028$), indicating that the interaction was not practically meaningful. This finding suggests that differentiated instruction is effective in improving learning outcomes regardless of students' motivation levels, and similarly, learning motivation contributes positively to achievement under both instructional approaches.

Overall, the ANOVA model explained a substantial proportion of variance in students' learning outcomes ($R^2 = 0.977$), demonstrating that instructional approach and learning motivation together provide a strong explanatory framework for understanding differences in elementary school students' academic achievement in IPAS.

Discussion

The findings of this study demonstrate that differentiated instruction has a significant and positive effect on elementary school students' learning outcomes. Students who were taught using differentiated instructional strategies consistently achieved higher academic performance than those who received conventional instruction. This result indicates that instructional approaches accommodating students' diverse readiness levels, interests, and learning profiles are more effective than uniform teaching methods (Kristiawan et al., 2025). Moreover, the very large effect size observed in this study, as indicated by partial eta squared (η^2p), confirms that differentiated instruction is not only statistically significant but also has strong practical relevance in improving students' learning outcomes.

Learning motivation was also found to have a significant influence on students' academic achievement. Students with higher levels of learning motivation demonstrated better learning outcomes than their less motivated peers, regardless of the instructional approach applied. This finding reinforces the view that motivation functions as a key internal driver of students' effort, persistence, and engagement in learning activities. From a theoretical perspective, this result aligns with self-determination theory, which emphasizes the role of intrinsic motivation in

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sustaining engagement and promoting meaningful learning (Deci & Ryan, 2000). The large effect size associated with learning motivation further highlights its substantial contribution to students' academic success at the elementary school level.

Interestingly, this study did not find a significant interaction effect between differentiated instruction and learning motivation. This suggests that the effectiveness of differentiated instruction does not depend on students' motivation levels, and similarly, learning motivation contributes positively to achievement under both differentiated and conventional instructional conditions. In this context, differentiated instruction and learning motivation function as independent predictors of learning outcomes. This finding underscores the robustness of differentiated instruction as an inclusive instructional model that benefits both highly motivated and less motivated students by providing flexible learning pathways and reducing learning barriers.

These findings are consistent with previous studies reporting that differentiated instruction enhances student achievement by promoting equitable access to learning and accommodating individual differences (Rudd et al., 2021; Subandiyah et al., 2025). Likewise, prior research has consistently emphasized the strong relationship between learning motivation and academic achievement (Masaha & Jamaluddin, 2023). However, unlike studies suggesting a synergistic interaction between instructional strategies and motivation, the present study did not observe such an interaction effect (Demir, 2021; Törmänen et al., 2025). This discrepancy may be attributed to contextual factors such as students' developmental stage, the integrated nature of IPAS as a subject, and the relatively short duration of the instructional intervention.

From a practical perspective, these findings imply that elementary school teachers should consistently implement differentiated instructional practices to address learner diversity and enhance learning outcomes. Differentiated instruction enables teachers to design inclusive and responsive learning experiences that support all students, regardless of their motivation levels. This implication is particularly relevant within the context of the Merdeka Curriculum, which emphasizes flexible, student-centered, and inclusive learning practices. In addition, the findings highlight the importance of teacher professional development focused on designing and implementing differentiated instruction to support diverse learners effectively.

From a policy perspective, the findings of this study provide important implications for the implementation of IPAS learning at the elementary school level. Differentiated instruction aligns closely with the objectives of IPAS learning, which integrates scientific and social perspectives and requires adaptive instructional strategies. The results suggest that IPAS learning policies should encourage teachers to design instruction that dredges from students' diverse readiness levels, interests, and learning profiles. At the institutional level, schools may integrate differentiated instruction into IPAS lesson planning guidelines and instructional supervision. Furthermore, education authorities may consider incorporating differentiated instruction as a core component of IPAS teacher training and curriculum support programs to enhance the quality of elementary school learning.

Despite its contributions, this study has several limitations. The sample size was relatively small and limited to two elementary schools, which may restrict the generalizability of the findings. In addition, the study focused on a single subject area (IPAS) and was conducted over a relatively short intervention period. Learning motivation was measured using self-report questionnaires, which may be subject to response bias.

Future research is encouraged to involve larger and more diverse samples across different educational contexts and subject areas to strengthen the external validity of the findings. Longitudinal studies could further explore the long term effects of differentiated instruction and learning motivation on students' learning outcomes. Moreover, future studies may examine

additional moderating or mediating variables such as self regulated learning, learning styles, or teacher pedagogical competence to provide a more comprehensive understanding of the factors influencing academic achievement in elementary education.

Conclusion

This study provides empirical evidence that differentiated instruction significantly improves elementary school students' learning outcomes in Natural and Social Sciences (IPAS) compared to conventional teaching approaches. Instruction tailored to students' readiness, interests, and learning profiles resulted in higher academic achievement across both high and low motivation groups. These findings confirm that differentiated instruction serves as an effective and inclusive pedagogical strategy for enhancing students' conceptual understanding and academic performance in heterogeneous elementary classrooms.

In addition, learning motivation was found to independently influence students' learning outcomes, with highly motivated students demonstrating better academic achievement than those with lower motivation levels. The absence of a significant interaction effect between instructional approach and learning motivation indicates that the effectiveness of differentiated instruction is not dependent on students' motivational levels. Rather, instructional differentiation and learning motivation function as separate yet complementary contributors to students' academic achievement.

Several limitations should be considered when interpreting these findings. The study involved a relatively small sample drawn from only two elementary schools within a single geographic area, which may limit the generalizability of the results. The short duration of the intervention also restricted the examination of long-term instructional effects. In addition, learning outcomes were measured primarily through cognitive achievement tests, without incorporating qualitative data or affective and behavioral dimensions of learning.

Despite these limitations, this research advances scientific knowledge by providing robust empirical evidence on the effectiveness of differentiated instruction at the elementary school level within the Indonesian educational context. By employing a quasi-experimental factorial design that integrates instructional and motivational variables, this study contributes to a deeper understanding of how pedagogical and psychological factors independently shape students' academic achievement. The findings offer a valuable foundation for future research and for the development of evidence-based instructional practices aimed at improving the quality of elementary education.

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