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The Effect of the Deep Learning Approach and Learning Motivation an Fifth-Grade Students' IPAS Learning Achievement at SDB Ujung IX Surabaya

Siti Khoridah*, Hartono, Agung Pramujiono
Department of Education, Graduate School, Universitas PGRI Adi Buana Surabaya
***Corresponding Author e-mail : sugasmine11@gmail.com**

Abstract: This study was motivated by the low level of student engagement in teacher-centered learning, which may affect students' achievement in Science and Social Studies (IPAS). This study aimed to examine the effect of the Deep Learning pedagogical approach, learning motivation, and the interaction between these factors on the IPAS learning achievement of fifth-grade students at SDN Ujung IX Surabaya. This study employed a quantitative quasi-experimental method with a 2 × 2 factorial design. The population consisted of all fifth-grade students at SDN Ujung IX Surabaya during the 2025/2026 academic year. The sample consisted of 49 students divided into an experimental class using the Deep Learning approach and a control class receiving teacher-centered instruction. Data were collected using an IPAS learning achievement test and a learning motivation questionnaire based on McClelland's theory. Data analysis was conducted using the Independent Samples t-test and Two-Way Analysis of Variance (ANOVA) with SPSS. The findings showed that learning motivation had a significant effect on IPAS learning achievement, with F = 2.161 and Sig. = 0.001. A significant interaction was also found between the learning approach and learning motivation, with F = 16.999 and Sig. = 0.000. Descriptively, the highest mean achievement score was obtained by students in the Deep Learning group with high learning motivation (M = 31.56), while the lowest was found in the control group with low learning motivation (M = 19.30). These findings highlight the importance of considering instructional approaches and learning motivation in supporting students' IPAS learning achievement.

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Introduction

Educational demands in the twenty-first century require learning to move beyond the transmission and memorization of information toward the development of understanding, critical thinking, problem-solving, and the ability to apply knowledge in different contexts. In

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Indonesia, this orientation is reflected in the Merdeka Curriculum, which emphasizes student-centered learning, essential competency development, flexibility, and meaningful learning experiences. Students are encouraged not only to acquire information but also to comprehend, process, apply, and reflect on knowledge according to their characteristics and learning needs (Kementerian Pendidikan, Kebudayaan, Riset, 2022). At the elementary school level, this orientation is particularly important because learning provides a foundation for developing intellectual abilities, learning skills, conceptual understanding, and character that students will use in subsequent educational stages and in facing the demands of twenty-first-century life (OECD, 2023).

The implementation of this learning orientation requires teachers to function not only as transmitters of knowledge but also as facilitators who design learning experiences that encourage students to participate actively in the learning process. Learning activities ideally provide opportunities for students to observe, ask questions, process information, exchange ideas, solve problems, and reflect on what they have learned. However, the implementation of student-centered and meaningful learning is not necessarily consistent across all classroom settings. Elementary learning may still involve teacher-led explanations, textbook-based activities, and an emphasis on academic achievement, which can reduce opportunities for students to develop understanding through active and contextual learning experiences.

This issue is particularly relevant to Natural and Social Sciences (Ilmu Pengetahuan Alam dan Sosial/IPAS). IPAS integrates knowledge of natural phenomena and social life, requiring students to understand relationships among concepts and interpret phenomena occurring in their surrounding environment. Consequently, learning IPAS cannot rely solely on memorizing facts. Students need to examine phenomena, identify problems, understand cause-and-effect relationships, use information or evidence in reasoning, formulate conclusions, and apply concepts to everyday situations. These characteristics indicate the need for instructional approaches that facilitate deeper understanding while encouraging students to actively engage in the learning process.

One approach that corresponds to this orientation is deep learning. In this study, deep learning refers to a pedagogical approach that emphasizes meaningful and comprehensive understanding rather than the simple acquisition or reproduction of information. The approach encourages students to connect new knowledge with prior knowledge, examine relationships among concepts, apply knowledge to contextual problems, and reflect on the learning process. Thus, deep learning is operationalized through learning activities that involve understanding the learning material, connecting concepts with prior knowledge and real-life contexts, applying knowledge to problems or situations, and reflecting on the learning experience. These characteristics distinguish deep learning from learning activities that primarily emphasize memorization and reproduction of information (Biggs & Tang, 2022).

The implementation of these characteristics can be reflected in classroom activities such as presenting contextual phenomena or problems, encouraging students to explore and discuss information, guiding students to relate new concepts to their previous knowledge and everyday experiences, providing opportunities to apply concepts in problem-solving activities, and facilitating reflection at the end of learning. Through these activities, students are positioned as active participants who construct and use knowledge rather than merely receive information from the teacher. Previous research has indicated that learning processes emphasizing comprehensive conceptual mastery can support students' analytical and reasoning abilities (Pakpahana & Suyanti, 2025). Ulya et al. (2026) likewise demonstrated

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that deep learning can help students establish connections between the learning material and events encountered in everyday life. These findings provide a basis for examining the application of deep learning in elementary education, particularly in subjects such as IPAS that require conceptual understanding and contextual application.

Although previous studies provide evidence concerning the contribution of deep learning to students' understanding and cognitive development, several aspects remain insufficiently examined. First, existing studies have predominantly examined deep learning in relation to cognitive abilities, conceptual understanding, or students' learning experiences, while empirical evidence concerning its effect on IPAS learning achievement at the elementary school level remains limited. Second, the effectiveness of an instructional approach cannot be separated from students' internal conditions, particularly learning motivation. Students may receive the same learning experience but demonstrate different levels of participation, persistence, and effort because of differences in their motivation. Third, studies examining deep learning and learning motivation simultaneously have not sufficiently addressed whether students' motivation interacts with the instructional approach in explaining differences in learning achievement. Therefore, the research gap is not merely the limited combination of variables, but the limited empirical examination of how an instructional approach emphasizing understanding, connection, application, and reflection relates to IPAS achievement across different levels of students' learning motivation, including the possible interaction between the two factors.

Learning motivation represents an internal factor that can influence students' involvement and persistence during learning. Strong motivation can encourage students to maintain attention, complete learning tasks, overcome difficulties, and actively engage with learning materials. Conversely, students with lower motivation may demonstrate less participation and concentration and may not fully utilize the learning opportunities provided by teachers (Santrock, 2021). In learning activities that require students to explore information, discuss ideas, solve contextual problems, and reflect on their learning, motivation becomes particularly relevant because these activities require sustained student involvement.

Previous research has shown that learning motivation is an important factor in students' IPAS learning achievement. Rizqi et al., (2023) found that learning motivation had a significant effect on IPAS learning outcomes among elementary school students, accounting for 38.3% of the variance in learning outcomes. Similarly, Agustin et al. (2024) reported a significant positive effect of learning motivation on IPAS learning outcomes among fourth-grade elementary students. In addition, Hidayat et al. (2026) emphasized that learning motivation supports students' active participation, attention, persistence, and effort in the IPAS learning process. These findings suggest that learning achievement should be considered not only from the perspective of instructional approaches but also from students' internal characteristics that influence their participation, persistence, and effort.

The relevance of examining these factors together can be observed at SDN Ujung IX Surabaya. Preliminary observations of fifth-grade IPAS learning indicated that some students' enthusiasm and participation were not yet consistent. Several students tended to remain passive when given opportunities to ask questions or express ideas and continued to rely heavily on explanations from the teacher. In addition, students' IPAS learning achievement was not yet fully optimal, particularly when learning activities required them to understand relationships among several concepts and apply acquired knowledge to situations related to everyday life.

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Preliminary interviews with the fifth-grade teacher provided additional information concerning the learning process. In several IPAS learning activities, lecture-based instruction remained commonly used, with textbooks serving as the primary source of learning material. Discussion, simple experiments, contextual problem-solving, and learning reflection had not been implemented consistently. Such conditions may limit opportunities for students to develop understanding through active learning experiences. The teacher also indicated differences in students' levels of learning motivation, which were reflected in variations in their participation and persistence during learning activities.

The preliminary findings illustrate a contextual research problem: there is a difference between the intended orientation of learning toward active, meaningful, and student-centered experiences and the learning practices observed in the fifth-grade IPAS classroom at SDN Ujung IX Surabaya. At the same time, differences in students' motivation indicate that the response to a particular instructional approach may not be uniform across students. This condition creates a need for empirical examination of whether the implementation of deep learning is associated with differences in IPAS learning achievement and whether such differences vary according to students' levels of learning motivation.

The novelty of this study lies in the 2 × 2 factorial examination of the instructional approach and learning motivation in the context of elementary IPAS learning. Rather than examining the effect of deep learning or learning motivation separately, this study examines the main effect of the deep learning approach, the main effect of learning motivation, and the interaction between the instructional approach and learning motivation on IPAS learning achievement. The factorial design makes it possible to examine whether the effectiveness of the instructional approach is consistent across students with different levels of motivation or whether the learning outcomes differ depending on the combination of instructional approach and motivation level. The study is conducted among fifth-grade students at SDN Ujung IX Surabaya, with IPAS achievement measured through learning tasks related to the human organ system and cognitive abilities involving analysis (C4), evaluation (C5), and creation (C6).

Theoretically, the relationship between the two factors can be understood from the characteristics of the learning process. Deep learning provides students with opportunities to understand concepts, connect new information with prior knowledge and real-life situations, apply knowledge to problems, and reflect on their learning. Meanwhile, learning motivation can influence students' willingness to participate, maintain effort, and respond to the learning opportunities provided. The interaction between these factors is therefore important to examine because an instructional approach that requires active cognitive and learning engagement may produce different outcomes among students with different levels of motivation.

Based on the research problem and identified gap, this study addresses three questions: (1) Does the deep learning approach significantly affect fifth-grade students' IPAS learning achievement at SDN Ujung IX Surabaya? (2) Does learning motivation significantly affect fifth-grade students' IPAS learning achievement at SDN Ujung IX Surabaya? and (3) Is there a significant interaction between the deep learning approach and learning motivation in affecting fifth-grade students' IPAS learning achievement at SDN Ujung IX Surabaya? These questions are examined through a quantitative quasi-experimental study using a non-randomized 2 × 2 factorial design.

Based on these research questions, the study aims to examine the effect of the deep learning approach on IPAS learning achievement, examine the effect of learning motivation

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on IPAS learning achievement, and determine the interaction between the deep learning approach and learning motivation in relation to IPAS learning achievement among fifth-grade students at SDN Ujung IX Surabaya. The findings are expected to contribute empirical evidence concerning the implementation of understanding-oriented learning in elementary IPAS education and provide a more specific understanding of the role of students' learning motivation within such instructional conditions.

Research Method

This study used a quantitative approach with a quasi-experimental non-randomized 2 × 2 factorial design. The study examined the effects of the Deep Learning approach and learning motivation on students' IPAS achievement, including the interaction between the two factors. The instructional approach consisted of Deep Learning and teacher-centered learning, while learning motivation was categorized into high and low levels. Students' IPAS learning achievement served as the dependent variable.

The study employed a non-randomized factorial design because the experimental and control groups were based on intact classes that had already been established by the school. Class VE, consisting of 24 students, served as the experimental group and received instruction using the Deep Learning approach, while Class VC, consisting of 25 students, served as the control group and received teacher-centered learning. No random assignment of individual students to the two instructional groups was conducted. Thus, the study was categorized as a quasi-experimental study rather than a true experimental study.

The 2 × 2 factorial structure was used to examine the main effects of the instructional approach and learning motivation, as well as the interaction between these two factors in relation to students' IPAS learning achievement. The instructional approach constituted the first factor, with two levels: Deep Learning and teacher-centered learning. Learning motivation constituted the second factor, with two levels: high and low motivation. The structure of the research design is presented as follows.

Table 1. 2 × 2 Factorial Research Design

Learning Approach	High Motivation	Low Motivation
Deep Learning	P1	P2
Teacher-Centered Learning	P3	P4

Note: P1 represents the group of students who received deep learning with high learning motivation; P2 represents the group who received deep learning with low learning motivation; P3 represents the group who received teacher-centered learning with high learning motivation; and P4 represents the group who received teacher-centered learning with low learning motivation.

Population and Sample

The study involved all fifth-grade students at SDN Ujung IX Surabaya in the 2025/2026 academic year, totaling 49 students. Since the population was relatively small and all students could be included, a saturated sampling method (total sampling) was applied. Accordingly, the entire population was used as the research sample.

The study used two intact classes that had already been established by the school. Class VE, comprising 24 students, served as the experimental group and received instruction using the Deep Learning approach. Class VC, comprising 25 students, served as the control group and received teacher-centered instruction. The two groups were not formed through

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individual randomization because the students remained in their existing school classes. Therefore, the study used a non-randomized quasi-experimental design.

Instruments and Data Collection Techniques

Data were collected using two instruments: a learning motivation questionnaire and an IPAS achievement test. The questionnaire assessed students' motivation and involvement in learning, while the test measured their mastery of IPAS competencies following the instructional treatment. The motivation instrument was developed based on McClelland's Needs Theory, covering achievement, affiliation, and power needs. Its development involved defining the variable operationally, designing an instrument blueprint, preparing items, expert evaluation, revision, pilot testing, and validity and reliability assessment. A dichotomous response format was used. Of the 40 items initially tested, 39 were confirmed as valid.

The learning achievement in IPAS was assessed using an objective test consisting of 25 multiple-choice questions. The questions covered material related to the human organ system. The development of the instrument was aligned with the predetermined learning outcomes and designed to assess Higher Order Thinking Skills (HOTS). The cognitive aspects measured focused on the abilities to analyze (C4), evaluate (C5), and create (C6). The test was administered to all research groups after the completion of the learning activities involving the predetermined treatment. The test results were subsequently used as the posttest to obtain an overview of students' mastery of the learning material after participating in the applied instructional approach.

The research instruments were evaluated for validity and reliability. The learning achievement test was validated using Pearson Product-Moment correlation and tested for reliability with KR-20, while the learning motivation scale was assessed through item-total correlation and Cronbach's Alpha. The results showed that all 25 achievement test items were valid, with coefficients between 0.345 and 0.806, and 39 motivation scale items were valid, ranging from 0.180 to 0.796. The reliability coefficients were 0.729 for the achievement test and 0.925 for the motivation scale. Thus, both instruments demonstrated adequate validity and reliability and were suitable for collecting research data.

Data Analysis Techniques

Data were analyzed quantitatively using SPSS version 30.0. Before hypothesis testing, normality and homogeneity assumptions were examined. The Shapiro-Wilk test was used to assess data normality because each group contained fewer than 50 students, while Levene's Test was applied to evaluate variance homogeneity, both at a significance level of 0.05. The results indicated that the data satisfied both assumptions, allowing the use of parametric statistical analysis.

Hypothesis testing was subsequently conducted using Two-Way ANOVA to determine the effects of the *deep learning* approach and students' learning motivation on IPAS learning outcomes, as well as the interaction between these two factors. The analysis used a 5% significance level, with Sig. < 0.05 indicating a significant effect or interaction, whereas Sig. > 0.05 indicated the absence of statistical significance. When a significant interaction was identified, a *simple effect* analysis was performed to further examine differences in learning outcomes across combinations of the learning approach and students' motivation levels.

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Results and Discussion

Results

This study examined the effects of the *Deep Learning* approach and learning motivation on IPAS learning achievement among 49 fifth-grade students at SDN Ujung IX Surabaya. The study employed a non-randomized quasi-experimental 2 × 2 factorial design using two intact classes. Class VE, consisting of 24 students, served as the experimental group and received the *Deep Learning* approach, while Class VC, consisting of 25 students, served as the control group and received Teacher-Centered Learning. The students remained in their existing classes, and no individual random assignment was conducted. Learning achievement was measured using a posttest administered after the learning activities.

Before the inferential analysis, assumption testing was conducted. The Shapiro-Wilk test was used because the number of students in each main group was fewer than 50. The results showed that the posttest scores in the *Deep Learning* group were normally distributed (p = .589), as were those in the Teacher-Centered Learning group (p = .804). Based on learning motivation, the high-motivation group also showed a normal distribution (p = .088), as did the low-motivation group (p = .414). The homogeneity test using Levene's test indicated homogeneous variances for the learning-approach groups (p = .080) and the learning-motivation groups (p = .084). Since all significance values were greater than .05, the assumptions of normality and homogeneity were considered satisfied.

Table 2. Results of the Normality Test

Test	Group/Factor	p-value	Decision
Shapiro-Wilk	*Deep Learning*	.589	Normal
Shapiro-Wilk	Teacher-Centered Learning	.804	Normal
Shapiro-Wilk	High Motivation	.088	Normal
Shapiro-Wilk	Low Motivation	.414	Normal

The normality test was conducted to determine whether the IPAS learning achievement data were normally distributed in each learning approach and learning motivation group. Because the number of students in each group was less than 50, the Shapiro-Wilk test was used as the basis for decision-making. The results showed that the *Deep Learning* group obtained a significance value of .589, while the Teacher-Centered Learning group obtained .804. Both values were greater than .05, indicating that the data were normally distributed. Similarly, the high-motivation group obtained a significance value of .088 and the low-motivation group obtained .414. Since both values were greater than .05, the data in the two motivation groups were also normally distributed. Thus, the normality assumption was fulfilled.

Table 3. Results of the Homogeneity Test

Test	Variable	Levene Statistic	p-value	Decision
Levene's Test	Learning Approach	3.208	.080	Homogeneous
Levene's Test	Learning Motivation	3.116	.084	Homogeneous

The homogeneity test was conducted to determine whether the variances among the groups were equal. The Levene's Test results showed a statistic of 3.208 with a significance value of .080 for the learning approach and a statistic of 3.116 with a significance value of .084 for learning motivation. Both significance values were greater than .05, indicating that

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the variances were homogeneous. Therefore, the homogeneity assumption was fulfilled, and the data met the assumptions required for the subsequent Two-Way ANOVA analysis.

Table 4. Descriptive Statistics of IPAS Learning Achievement Based on Learning Approach

Learning Approach	N	Mean	SD
Deep Learning	24	25.46	8.562
Teacher-Centered Learning	25	19.32	6.854

Learning motivation was classified into high and low categories. Based on the classification used in this study, 31 students were included in the high-motivation group and 18 students were included in the low-motivation group. The high-motivation group obtained a mean posttest score of 26.74 (SD = 7.137), while the low-motivation group obtained a mean of 14.72 (SD = 2.446). The difference between the two means was 12.02 points, equivalent to a 44.91% difference. Descriptively, students in the high-motivation group obtained higher IPAS achievement scores than those in the low-motivation group.

Table 5. Descriptive Statistics of IPAS Learning Achievement Based on Learning Motivation

Learning Motivation	N	Mean	SD
High	31	26.74	7.137
Low	18	14.72	2.446

The factorial cell means provide a more detailed description of the relationship between learning approach and motivation. Students who received *Deep Learning* and had high motivation obtained the highest mean score, namely 31.56 (SD = 3.847; n = 16). Students receiving *Deep Learning* with low motivation obtained a mean score of 22.63 (SD = 3.462; n = 8). In the Teacher-Centered Learning group, students with high motivation obtained a mean score of 22.27 (SD = 5.599; n = 15), while students with low motivation obtained a mean score of 19.30 (SD = 5.638; n = 10).

Table 6. Descriptive Statistics Based on the Combination of Learning Approach and Motivation

Learning Approach	Motivation	N	Mean	SD
Deep Learning	High	16	31.56	3.847
Deep Learning	Low	8	22.63	3.462
Teacher-Centered Learning	High	15	22.27	5.599
Teacher-Centered Learning	Low	10	19.30	5.638

The cell means show that the difference between the two learning approaches was larger among highly motivated students than among students with low motivation. Among highly motivated students, the difference between *Deep Learning* and Teacher-Centered Learning was 9.29 points (31.56 versus 22.27). Among students with low motivation, the difference was 3.33 points (22.63 versus 19.30). This pattern provides a descriptive indication that the relationship between learning approach and achievement may differ according to students' motivation level.

The main hypothesis testing was conducted using Two-Way ANOVA. The analysis examined three effects: the main effect of learning approach, the main effect of learning

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motivation, and the interaction between learning approach and learning motivation. The results are presented in Table 7.

Table 7. Results of Two-Way ANOVA

Tested Factor	F	Sig.	Decision
Learning approach	0.003	0.000	Significant
Learning motivation	2.161	0.001	Significant
Learning approach × motivation	16.999	0.000	Significant

The analysis showed a significant effect of the learning approach on IPAS learning achievement (Sig. = 0.000 < 0.05). This indicates that students in the *Deep Learning* and Teacher-Centered Learning conditions differed significantly in their IPAS achievement. The descriptive statistics showed that the mean posttest score was higher in the *Deep Learning* group (25.46) than in the Teacher-Centered Learning group (19.32).

Learning motivation also showed a statistically significant effect on IPAS learning achievement (Sig. = 0.001 < 0.05). This indicates that achievement differed significantly between students classified as having high and low learning motivation. Consistent with the descriptive findings, the high-motivation group obtained a higher mean score (26.74) than the low-motivation group (14.72).

The interaction between learning approach and learning motivation was also statistically significant (F = 16.999, Sig. = 0.000 < 0.05). This finding indicates that the relationship between the learning approach and IPAS achievement differed according to students' motivation category. The descriptive pattern supports this result: the difference between *Deep Learning* and Teacher-Centered Learning was 9.29 points among highly motivated students, compared with 3.33 points among students with low motivation.

Because the interaction effect was significant, interpretation of the main effects should be accompanied by a simple-effects analysis. The simple-effects analysis examines the effect of the learning approach separately among students with high motivation and among students with low motivation. Based on the cell means, the *Deep Learning* group had a higher mean than the Teacher-Centered Learning group in both motivation categories. The difference was 9.29 points in the high-motivation category and 3.33 points in the low-motivation category. These results indicate that the magnitude of the observed difference between learning approaches was greater among highly motivated students.

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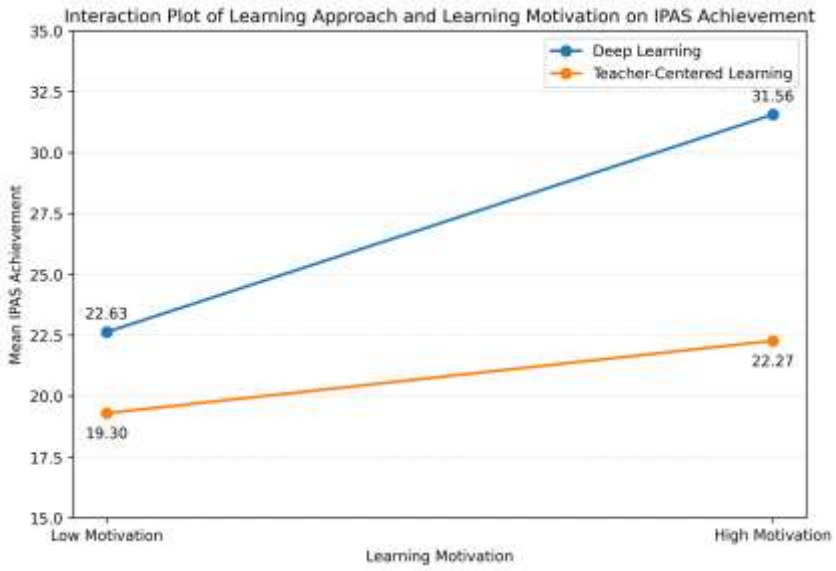


Figure 1. Interaction Plot of Learning Approach and Learning Motivation on IPAS Achievement

The interaction pattern can be visualized through an interaction plot with learning motivation on the horizontal axis and mean IPAS achievement on the vertical axis, using separate lines for *Deep Learning* and Teacher-Centered Learning. The plot is expected to show that the *Deep Learning* group has a mean of 31.56 for highly motivated students and 22.63 for students with low motivation, whereas the Teacher-Centered Learning group has means of 22.27 and 19.30, respectively. The difference in the slopes reflects the significant interaction found in the Two-Way ANOVA.

Discussion

1. The Effect of the Deep Learning Approach on IPAS Learning Achievement

The findings indicate that students who participated in the *Deep Learning* approach achieved higher IPAS learning outcomes than students who experienced Teacher-Centered Learning. Rather than relying primarily on teacher explanation and students' reception of information, the *Deep Learning* approach creates learning experiences in which students are encouraged to construct understanding through contextual problems, exploration, discussion, application, and reflection. These activities provide opportunities for students to process information actively and connect new knowledge with concepts and experiences they already possess.

The higher achievement associated with the *Deep Learning* group can be understood through the way learning activities require students to engage in cognitive processes beyond recalling information. In IPAS learning, particularly when discussing the human organ system, students need to identify relationships between structures and functions, interpret information, explain phenomena, and apply concepts to situations encountered in everyday life. Learning activities that require students to investigate and reason about such relationships can support more organized and meaningful understanding. Reflection also provides an opportunity for students to reconsider whether their understanding is consistent with the evidence or explanation developed during the learning process.

This mechanism helps explain why *Deep Learning* may provide a different learning experience from Teacher-Centered Learning. In a predominantly teacher-centered setting,

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information is more often organized and delivered by the teacher, while students have fewer opportunities to construct explanations independently. In contrast, *Deep Learning* positions students as active participants who are expected to interpret information, communicate ideas, solve problems, and evaluate their understanding. The difference therefore concerns not merely the learning technique but also the cognitive and participatory demands placed on students.

The finding is in line with Dewi and Rusilowati, who reported differences in IPAS learning achievement following the implementation of the *Deep Learning* approach among fifth-grade elementary school students. Mandasari et al. (2025) similarly found that *Deep Learning* could support active participation, conceptual understanding, collaboration, and reflection. The similarity between these findings can be explained by the common emphasis on active and meaningful learning experiences. However, the present study extends this discussion by examining the learning approach together with students' learning motivation through a 2 × 2 factorial design. Thus, the contribution of the present study is not limited to identifying whether *Deep Learning* is associated with differences in achievement but also examining whether its effectiveness varies according to students' motivational conditions.

2. The Effect of Learning Motivation on IPAS Learning Achievement

The findings also show that learning motivation is related to differences in IPAS learning achievement. Students with higher motivation demonstrated better achievement than students with lower motivation. This pattern can be explained by the role of motivation in directing students' attention, persistence, effort, and willingness to engage in learning activities. Motivation becomes particularly relevant when learning requires students to participate actively rather than simply receive information from the teacher.

In IPAS learning, students encounter activities that require observation, questioning, information processing, reasoning, discussion, and problem solving. Such activities demand sustained involvement from students. Students with stronger motivation may be more willing to continue working when they encounter difficult concepts, seek additional explanations, and participate in discussions. In contrast, students with lower motivation may not utilize learning opportunities as consistently, even when the same instructional environment is provided. Motivation therefore influences not only students' willingness to begin learning but also the extent to which they sustain their involvement throughout the learning process.

This finding is consistent with Lusiani et al., who reported a positive and significant contribution of learning motivation to IPAS learning achievement among elementary school students. Khusnaeni et al. (2025) likewise found that stronger motivation to engage in IPAS learning was associated with better learning outcomes. The present finding supports these studies in demonstrating the importance of motivation in IPAS achievement. At the same time, the present study provides a more specific perspective by examining motivation together with the instructional approach rather than treating motivation only as an independent factor.

The findings suggest that motivation should be understood as a condition that determines how effectively students utilize the learning opportunities provided by teachers. A well-designed learning environment may provide opportunities for investigation, discussion, application, and reflection, but these opportunities require students to invest attention and effort. Consequently, improving learning achievement cannot rely solely on changing instructional techniques; teachers also need to create classroom conditions that encourage students to participate, persevere, and recognize the relevance of the learning activities.

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3. The Interaction between the Deep Learning Approach and Learning Motivation on IPAS Learning Achievement

The most important finding of this study is the significant interaction between the *Deep Learning* approach and learning motivation. The interaction indicates that the relationship between instructional approach and IPAS achievement is not uniform across students with different levels of motivation. In other words, the learning approach and students' motivational conditions work together in shaping the learning experience. This finding is important because it suggests that the effectiveness of an instructional approach cannot be interpreted independently from the characteristics of the students who experience it.

The pattern of the four experimental cells provides a clearer explanation of this interaction. The strongest achievement was observed among students who experienced *Deep Learning* and had high motivation, whereas the difference between *Deep Learning* and Teacher-Centered Learning was considerably smaller among students with low motivation. This pattern suggests that motivation may function as a condition that strengthens students' ability to take advantage of the characteristics of *Deep Learning*. However, because the study used intact classes without individual random assignment, this pattern should be interpreted as an interaction observed under the conditions of the present quasi-experimental study rather than as evidence of a universal causal relationship.

The interaction can be explained through the reciprocal relationship between instructional demands and student engagement. *Deep Learning* requires students to do more than receive explanations. Students are expected to interpret information, connect concepts, discuss ideas, investigate problems, apply knowledge, and reflect on what they have learned. These activities provide greater opportunities for students who are willing to invest effort and maintain attention. Highly motivated students may therefore be more capable of converting the opportunities provided by *Deep Learning* into active learning behavior and deeper understanding.

The same mechanism also helps explain why the advantage of *Deep Learning* may be less pronounced among students with lower motivation. When students are less willing to participate, persist, or invest cognitive effort, the additional learning opportunities provided by *Deep Learning* may not be fully utilized. The instructional approach provides opportunities, but students' motivation influences whether those opportunities are actively taken up. Thus, motivation does not simply operate as a separate predictor of achievement; it can condition how students respond to an instructional environment that requires active participation.

This interpretation is consistent with the constructivist perspective, which emphasizes that knowledge is constructed through students' active engagement with learning experiences. However, the present findings add a motivational dimension to this perspective. Active construction of knowledge requires not only an instructional environment that facilitates exploration and reflection but also students who are sufficiently engaged to participate in those processes. The significant interaction therefore suggests that the learning environment and students' internal conditions should be considered together when explaining differences in learning achievement.

The finding also provides a point of comparison with previous *Deep Learning* studies. Earlier research, including Dewi & Rusilowati (2025) and Mandasari et al. (2025), emphasizes the contribution of *Deep Learning* to active participation, conceptual understanding, collaboration, and reflection. The present study reaches a similar conclusion

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regarding the relevance of active learning processes but extends the explanation by demonstrating that the observed learning pattern differs according to students' motivation. The difference in emphasis is important because studies focusing only on the main effect of an instructional approach may overlook the possibility that students do not respond to the same approach in exactly the same way.

Theoretical Contribution

Theoretically, this study contributes to the understanding of *Deep Learning* by demonstrating that deep learning experiences involve an interaction between the learning environment and students' motivational conditions. The findings support the view that meaningful understanding develops through active processes such as connecting prior knowledge, examining information, applying concepts, discussing ideas, and reflecting on learning. At the same time, the interaction finding indicates that these processes are more likely to be fully utilized when students possess sufficient motivation to engage with them. Thus, the study connects principles of deep and constructivist learning with the motivational dimension of learning, showing that instructional design and student motivation should not be considered as completely separate elements when explaining IPAS achievement.

The findings also contribute to motivation theory by indicating that motivation has a role beyond its direct association with achievement. The significant interaction suggests that motivation may influence how students respond to a particular instructional environment. In the context of this study, higher motivation appears to coincide with greater benefits from learning activities that require active exploration, problem solving, discussion, and reflection. This provides a basis for viewing motivation as a student condition that can shape the utilization of learning opportunities rather than merely as an individual characteristic associated with higher scores.

Practical Implications

The findings have several implications for elementary school teachers implementing *Deep Learning* in IPAS. Because the effectiveness of the approach is associated with students' motivational conditions, teachers should design learning activities that simultaneously develop understanding and sustain student engagement. Contextual problems can be used to connect IPAS concepts with students' everyday experiences, while simple investigations can provide opportunities for students to examine phenomena directly. Group discussions can encourage students to explain and compare their ideas, whereas constructive feedback can help students identify and improve their understanding.

The interaction finding also indicates the importance of strengthening motivation during *Deep Learning* activities. Teachers can provide clear learning goals, connect tasks with meaningful situations, acknowledge students' effort and progress, and provide sufficient support when students experience difficulty. Reflection activities should also be maintained so that students can evaluate what they have learned and recognize the relevance of the concepts studied. These practices are particularly important because *Deep Learning* requires active student participation; simply changing the instructional method without supporting students' willingness to engage may not produce the same learning experience for all students.

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Limitations

Several limitations should be considered when interpreting the findings. First, the study was conducted in only one elementary school, SDN Ujung IX Surabaya, with a total of 49 fifth-grade students. Therefore, the findings cannot be generalized directly to all elementary school students or other educational contexts. Second, the study used a non-randomized quasi-experimental design involving intact classes, meaning that students were not individually assigned randomly to the learning conditions. Differences between the classes that existed before the intervention may therefore have contributed to the observed results.

Third, the analysis focused on posttest achievement. Without a baseline comparison incorporated into the main analysis, the findings primarily describe differences in achievement after the learning activities rather than providing a complete estimate of individual change from pretest to posttest. Fourth, the classification of students into high- and low-motivation groups may influence the interaction analysis, particularly because the four factorial cells contained different numbers of students and the smallest cell consisted of only eight students. Finally, the achievement assessment was based on a posttest, so the results reflect students' performance on the specific IPAS content and assessment used in this study. These limitations should be considered when interpreting the interaction effect and when applying the findings to other populations or learning contexts.

Overall, the findings suggest that IPAS learning achievement is associated with both the instructional approach and students' learning motivation, with the interaction between these factors providing an important explanation of differences across students. The central implication is not simply that *Deep Learning* should replace Teacher-Centered Learning, but that the implementation of *Deep Learning* needs to consider students' readiness and motivation to engage in active, meaningful, and reflective learning processes.

Conclusion

Based on the research objectives and hypothesis testing, the Deep Learning approach and learning motivation were significantly associated with fifth-grade students' IPAS learning achievement at SDN Ujung IX Surabaya. The analysis also showed a significant interaction between the learning approach and learning motivation. Students in the Deep Learning group obtained higher posttest achievement than students in the Teacher-Centered Learning group. The learning activities implemented in the Deep Learning group emphasized active exploration, discussion, application of concepts, reflection, and connections between learning materials and real-life situations, which provided opportunities for students to engage more deeply with the IPAS material.

Learning motivation was also significantly associated with IPAS learning achievement. Students with high learning motivation obtained higher achievement than those with low learning motivation. Higher motivation may support students' attention, persistence, participation, and willingness to engage with learning tasks, particularly when learning activities require students to analyze information, discuss ideas, solve problems, and reflect on their learning.

A significant interaction was also found between the Deep Learning approach and learning motivation. The pattern of the group means indicates that the difference in achievement between the Deep Learning and Teacher-Centered Learning groups was greater among students with high motivation than among students with low motivation. This finding

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suggests that students' motivational conditions may shape how they respond to an instructional approach that requires active participation, exploration, and deeper engagement. However, because the study used intact classes without individual random assignment and involved only 49 fifth-grade students from one elementary school, the findings should be interpreted within the context of the study and should not be generalized directly to elementary school students more broadly.

Recommendation

Teachers are recommended to implement and develop learning activities that encourage students to actively observe phenomena, explore and process information, exchange ideas, analyze problems, connect IPAS concepts with real-life situations, and reflect on their learning. The implementation of Deep Learning should also consider students' levels of learning motivation by providing clear learning objectives, constructive feedback, appreciation of students' efforts and progress, relevant learning activities, and a classroom environment that supports active participation. These adjustments may help teachers accommodate differences in students' responses to learning activities.

For future research, studies should involve larger and more diverse samples from several elementary schools to examine whether the findings are applicable across different educational contexts. Future studies may also use longer intervention periods, include measures of students' initial achievement, and examine other factors related to IPAS learning achievement, such as learning engagement, self-efficacy, critical thinking, scientific literacy, learning environment, instructional media, and parental involvement. Given the non-randomized design and the unequal number of students in the factorial cells, further research with stronger experimental controls and more balanced groups is also recommended to provide more robust evidence regarding the interaction between learning approach and learning motivation.

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