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ANALYSIS OF DEEP LEARNING IMPLEMENTATION IN PHYSICAL EDUCATION, SPORT, AND HEALTH AT GRADE X SMAN 10 SEMARANG

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Abstract

This study aims to analyze the implementation of the deep learning model in Physical Education, Sport, and Health (PJOK) learning at grade X SMAN 10 Semarang. The research employed a quantitative descriptive design with purposive sampling involving 34 students. The research instrument consisted of a 46-item questionnaire developed based on eight dimensions of deep learning using a 5-point Likert scale. Data were analyzed using descriptive statistics, normality test, homogeneity test, and One-Sample T-Test with SPSS version 25. The results showed that the implementation of deep learning was in the high category with a mean score of 193.03 out of a maximum score of 230. The highest dimension was character and learning independence, while higher-order thinking skills and supportive learning environment were in the moderate category. Hypothesis testing results showed a significance value of 0.000 < 0.05 and a t-value of 15.247 > t-table of 1.692, indicating that deep learning implementation had a significant positive effect on the PJOK learning process. This study concludes that the application of deep learning is able to improve student engagement, independence, collaboration, and meaningful learning experiences, although improvements are still needed in higher-order thinking skills and supportive learning environments.

Keywords: Deep Learning, Physical Education, Student Engagement, Meaningful Learning.

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INTRODUCTION

Physical Education, Sports, and Health (PJOK) is an important part of the educational process that functions to develop students' physical, mental, social, and emotional abilities comprehensively. PJOK learning not only emphasizes the improvement of motor skills but also aims to shape character, sportsmanship, cooperation, discipline, and a healthy lifestyle among students (Wiraparatama & Kurniawan, 2025). Quality physical education can create meaningful learning experiences thru physical activities that involve cognitive, affective, and psychomotor aspects in a balanced manner (Rafika Nurratri, 2024).

Nevertheless, the implementation of PJOK learning in schools still often faces various problems (Ari Iswanto, 2021). The learning process tends to use a teacher-centered approach with direct

instruction methods that focus solely on mastering sports techniques (Handayani et al., 2021). Students receive more instructions from teachers without being given the opportunity to explore, analyze, and relate learning to real situations in their surroundings (Afianti et al., 2025). This condition causes learning to become less meaningful and does not yet develop students' critical thinking, creativity, and problem-solving skills (Qiu et al., 2024).

The development of 21st-century education demands a transformation of learning that is more innovative and oriented toward the comprehensive development of students' competencies (Balalle, 2024). Students are required to possess higher-order thinking skills, collaboration, communication, creativity, and problem-solving abilities in various real-life situations (Alaudin & Missouri, 2023). Moreover, the development of technology and the complexity of global challenges require students to be able to integrate knowledge, skills, and attitudes adaptively in both the learning process and daily life (Anthony, 2024). Therefore, a learning approach is needed that not only emphasizes the mastery of knowledge or physical activities alone but also builds a deep and meaningful conceptual understanding for learners (Haq & Rijal, 2026). One of the approaches deemed relevant to these demands is deep learning, which positions learners as active subjects in building knowledge thru reflection, collaboration, and contextual problem-solving (M. Sahrun et al., 2026).

Deep learning is an educational approach that emphasizes deep conceptual understanding thru processes of reflection, collaboration, problem-solving, and the application of knowledge in real-life contexts (Fahmi, 2025). This approach places learners at the center of education, allowing them to actively engage in building knowledge, developing critical thinking skills, and connecting learning experiences with situations encountered in daily life (Correia, F., & Hastie, 2025). In PJOK learning, the deep learning approach can be implemented thru problem-based learning models, project-based learning, game tactic analysis, movement performance reflection, and discussions on contextual health issues so that students not only master movement skills but also understand the meaning and purpose of the activities performed (Hernando-garijo et al., 2021). The implementation of learner-centered education has proven to enhance learning engagement, decision-making abilities, and the development of higher-order thinking skills in physical education (Hardiansyah & Zalindro, 2025).

The application of deep learning in PJOK education is believed to enhance student engagement in the learning process. Students not only engage in physical activities but also understand the reasons, strategies, and benefits of the activities performed (Aldo Naza et al,. 2026). Active and meaningful learning can help students develop critical thinking skills, decision-making abilities, and teamwork skills (Sari, 2025). In addition, the deep learning approach is also capable of fostering student independence and a sense of responsibility toward their own learning process (Ardiyanto et al., 2025).

Various studies show that the implementation of active learning approaches in Physical Education, Sports, and Health (PJOK) has a positive impact on students' learning outcomes, motivation, and participation during the learning process (Buen et al., 2024). Learning that places students at the

center of the learning activity has been proven to enhance the physical, cognitive, and emotional engagement of learners, making the learning experience more meaningful (Sim et al., 2023). Furthermore, the application of the inquiry learning model in physical education is effective in enhancing students' reflective thinking skills, self-confidence, and conceptual understanding of the material being studied (Hakim et al., 2023). Nevertheless, research specifically examining the implementation of deep learning in PJOK education at the high school level is still relatively limited. Most studies still focus on enhancing student engagement thru active learning models or technology integration, while studies on the implementation of deep learning that emphasize reflection, knowledge connectivity, collaboration, and the development of higher-order thinking skills still require further investigation (Berg-carramusa et al., 2023).

In addition to the limitations of research, the implementation of deep learning in PJOK education also faces various challenges. Teachers still face difficulties in designing lessons that can integrate physical activities with the simultaneous development of critical thinking skills, creativity, and problem-solving (Luo, 2024). On the other hand, the limited learning facilities and infrastructure, as well as the low readiness of students to engage in reflective and student-centered learning processes, also pose obstacles to the implementation of deep learning in schools (Gong et al., 2024). Recent research also shows that the success of implementing learning innovations is greatly influenced by teachers' ability to design learning environments that support active student engagement and develop meaningful learning experiences (Syafruddin et al., 2026). Therefore, the improvement of teachers' professional and pedagogical competencies, as well as adequate school facilities support, are important factors in optimizing the implementation of deep learning in PJOK education (Wang, 2025).

Based on the description, research on the implementation of deep learning in PJOK subjects becomes important to conduct. This research is expected to provide an overview of the application of deep learning in PJOK, understand its impact on student engagement and comprehension, and serve as a basis for evaluating the development of more innovative, effective, and 21st-century education-compliant PJOK learning models.

METHODS

This study utilized a quantitative descriptive design with purposive sampling. The sample comprised 34 grade X students at SMAN 10 Semarang (17 from class X-2 and 17 from class X-3). The instrument was a 46-item questionnaire adapted from eight deep learning dimensions (Fullan & Langworthy, 2020:62; Brookhart, 2022:52). (1) Self-Awareness, (2) Connectivity and Knowledge Integration, (3) Emotional Engagement and Motivation, (4) Supportive Learning Environment, (5) Educator as Facilitator, (6) Higher-Order Thinking Skills, (7) Collaboration, Creativity, and Problem Solving, and (8) Character and Learning Independence. Responses were measured using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) (Roselidyawaty & Rokeman, 2024). Prior to data

collection, validity and reliability tests were conducted, yielding a Cronbach's Alpha of 0.892, indicating high reliability. Data were analyzed using descriptive statistics, normality tests (Kolmogorov-Smirnov and Shapiro-Wilk), homogeneity tests (Levene's Test), and One-Sample T-Test using SPSS version 25.

Data collection was conducted directly (offline) in the classroom after the PJOK learning process was completed. Before filling out the questionnaire, respondents were given an explanation of the research objectives, the procedure for filling out the instrument, and a guaranty of data confidentiality. This procedure is carried out to ensure that respondents understand each statement in the instrument so that the data obtained is more accurate and objective (Weyant, 2020). The time given to fill out the questionnaire is 30 minutes. After all the questionnaires are completed, the researcher checks the completeness of the respondents' answers before proceeding with the tabulation and data analysis process.

Before being used in the research, the instrument was first tested for validity and reliability thru a trial with 30 students outside the research sample. The validity test was conducted using the Pearson Product Moment correlation with the help of SPSS version 25. A statement item is declared valid if it has an r-count value greater than the r-table at a significance level of 5% (Subhaktiyasa, 2024). The test results show that all 46 statements have an r-count value > 0.361, so all items are declared valid and suitable for use as research instruments.

Next, the reliability test is conducted using the Cronbach's Alpha coefficient to determine the internal consistency level of the instrument. The instrument is declared reliable if it has a Cronbach's Alpha value greater than 0.70, indicating a good level of reliability (Taber, 2021). The results of the reliability test show a Cronbach's Alpha value of 0.892, indicating that the research instrument has a very good level of reliability and can be used in the data collection process of the research.

Data analysis comprised descriptive and inferential statistics:

1. Descriptive Statistics: Used to describe the mean, standard deviation, maximum score, and minimum score of deep learning implementation in PJOK learning.
2. Prerequisite Tests: Normality testing using Kolmogorov-Smirnov and Shapiro-Wilk tests to ensure data distribution normality.
3. Hypothesis Testing: Conducted using a One-Sample T-Test to determine whether the average implementation score significantly differs from the established test value of 139.
   $H_0: \mu = 139$ (The average implementation score equals the established criterion value).
   $H_1: \mu \neq 139$ (The average implementation score differs from the established criterion value).
   The decision-making criterion rejects H_0 if the significance value (Sig. 2-tailed) < 0.05 and accepts H_0 if > 0.05 (Mahendra, 2021). All analyses were processed using SPSS version 25.

RESULTS AND DISCUSSION

Before presenting the statistical analysis results of deep learning implementation, it is essential to outline the demographic and characteristic profile of the respondents to provide proper context for the findings. The respondents comprised 34 grade X students from SMAN 10 Semarang, divided equally between class X-2 (17 students) and class X-3 (17 students). Table 1 summarizes the detailed characteristics of the respondents.

Table 1. Respondent Characteristics

Characteristic	Category	Frequency (f)	Percentage (%)
Gender	Male	18	52,94%
	Female	16	47,06%
Class	Class X-2	17	50,00%
	Class X-3	17	50,00%
Age	15 years old	8	23,53%
	16 years old	21	61,76%
	17 years old	5	14,71%
Interest in PJOK Learning	Highly Interested	7	20,59%
	Interested	19	55,88%
	Moderately Interested	6	17,65%
	Less Interested	2	5,88%

Based on Table 1, the gender distribution of the respondents is well-balanced, consisting of 18 male students (52.94%) and 16 female students (47.06%). The majority of the students are 16 years of age (61.76%), and a large proportion exhibit a positive disposition and high interest in PJOK learning, with 55.88% reporting being "Interested" and 20.59% reporting being "Highly Interested". This positive engagement indicates that the subjects possess a favorable baseline attitude toward the subject matter under investigation.

Table 2. Frequency Distribution of Total Implementation Scores

Score Range	Category	Frequency (f)	Percentage (%)
185 – 230	Very High	12	35.29%
139 – 184	High	22	64.71%
93 – 138	Moderate	0	0.00%
46 – 92	Low	0	0.00%
Total		34	100.00%

Table 2 presents the distribution of respondents' scores across the established categories. The results indicate that the majority of respondents were classified in the High category, with 22 respondents (64.71%), followed by the Very High category, comprising 12 respondents (35.29%). No respondents were classified in the Moderate or Low categories, as both recorded 0%. Overall, the findings demonstrate that all respondents achieved either high or very high scores, suggesting that the measured variable was generally at a favorable level among the study participants. The predominance of the high

and very high categories indicates a consistently positive distribution of scores, reflecting strong performance on the assessed construct.

Table 3. Statistics of Deep Learning Implementation

Dimension	N	Min	Max	Mean	Std. Deviation	Category
Self-Awareness	34	18	30	24,56	2,87	High
Connectivity & Knowledge Integration	34	19	30	23,88	2,64	High
Emotional Engagement & Motivation	34	20	30	24,12	2,71	High
Supportive Learning Environment	34	18	30	23,44	2,93	High
Educator as Facilitator	34	19	30	24,32	2,68	High
Higher-Order Thinking Skills (HOTS)	34	17	30	23,21	3,12	High
Collaboration, Creativity & Problem Solving	34	19	30	25,03	2,75	High
Character & Learning Independence	34	12	20	16,47	2,42	High
Total Implementation	34	150	230	193,03	21,12	High

Descriptive statistical analysis on table 3 was conducted to provide an overview of the implementation of the deep learning model in PJOK learning across the eight established dimensions. The total implementation score averaged 193.03 with a standard deviation of 21.12, ranging from a minimum score of 150 to a maximum of 230, which falls into the High category (categorization threshold: Low = 46–92; Moderate = 93–138; High = 139–184; Very High = 185–230). Table 3 outlines the descriptive results for each dimension. As presented in Table 3, almost all dimensions achieved scores within the high category. The highest mean score was recorded in the *Collaboration, Creativity, and Problem-Solving* dimension (Mean = 25.03), indicating that students possess a strong capacity for teamwork, creative ideation, and collaborative problem-solving. Conversely, the *Higher-Order Thinking Skills (HOTS)* dimension recorded the lowest mean score relative to the others (Mean = 23.21), suggesting that analytical, evaluative, and creative cognitive processes still require further pedagogical enhancement and reinforcement.

Table 4. One-Sample T-Test Results of Total Deep Learning Implementation

Variable	*N*	*Mean*	*Test Value = 139 t*	*Df*	*Sig. (2-tailed)*	*Mean Difference*
Deep Learning Implementation	34	193,03	15,247	33	0,000	54,03

Based on the hypothesis testing results in Table 4, the t-count value is 15.247 with a degree of freedom (df) of 33 and a significance value (Sig. 2-tailed) of 0.000. Because the significance value is

less than 0.05 ($0.000 < 0.05$), H_0 is rejected and H_1 is accepted. This confirms that there is a very significant difference between the empirical mean implementation score (193.03) and the reference test value (139.00). The positive mean difference of 54.03 indicates that the implementation of deep learning in PJOK learning at SMAN 10 Semarang is significantly higher than the expected baseline threshold.

The research results show that the implementation of the deep learning model in the PJOK subject at SMAN 10 Semarang falls into the high category, indicating that the learning process has been successful in integrating the cognitive, affective, and psychomotor aspects of the students (Li, 2025). Deep learning is not just active learning, but a transformational process that encourages students to build meaning thru reflection, collaboration, authentic problem-solving, and the integration of character competencies (Lalog, 2026). These findings indicate that the implementation of deep learning has led to active and meaningful learning practices, although the achievement levels at the highest tier have not yet been fully optimal within the framework of transformative learning (Ima Hikmayati et al. , 2025).

In a theoretical perspective, deep learning is a constructive process that emphasizes reflection, collaboration, authentic problem-solving, and the integration of character competencies (Liang & Liang, 2025). Being in the high category indicates that students have experienced active engagement in learning, but have not yet fully reached the level of cognitive elaboration and deep reflection that are the main characteristics of deep learning (Darling-hammond et al., 2020).

In the context of PJOK, this condition indicates that students have been active in movement and play activities, but have not yet fully reached the stage of strategy analysis, tactical decision evaluation, and conceptual reflection on the physical activities performed (Guo et al., 2025). This is in line with the concept of modern physical education, which emphasizes the balanced integration of cognitive, affective, and psychomotor domains in the learning process (Kartikasari et al., 2023).

The quality of PJOK learning is not only measured by motor skills but also by higher-order thinking abilities such as analysis, evaluation, and creation in the context of movement (Destya et al., 2025). When students are able to reflect on game strategies or understand the reasons behind a technique, then the learning has reached a deeper level of meaningful learning (Valle-muñoz & Mendoza-muñoz, 2025). Most indicators in the high category mean that the learning process has only consistently reached the levels of understanding and application, but has not yet fully stabilized at the evaluative and creative levels (Ulfa et al., 2021). This is reinforced by the revised Bloom's Taxonomy framework (Anderson & Krathwohl, 2021:53) which places analysis, evaluation, and creation as higher-order thinking levels.

Compared to previous research, the active learning approach in PJOK has proven to enhance student engagement, but the success of deep learning highly depends on a systematic and consistent instructional design (Hidayat, 2021). This difference in achievement indicates that the intensity of implementing learning strategies is an important factor in achieving optimal learning depth (Hindawi, 2023). Deep learning demands a learning experience that is systematically designed—not just a variety of methods, but a structure of reflection, open-ended questions, authentic assessments, and in-depth feedback (Adnyana, 2024).

If analyzed further, the teacher factor becomes one of the main determinants. The transformation from a direct instruction approach to reflective learning is not easy. In the research conducted by (Raup et al., 2022) note that many PE teachers are still accustomed to the command and demonstration model, thus requiring time and support to transition to a collaborative and problem-based approach. If pedagogical competencies related to reflective task design, authentic assessment, and discussion facilitation are not strong, then deep learning has the potential to stop at the level of enjoyable physical activity without conceptual depth (Arya et al., 2026).

This is reinforced by the views of (Darling-hammond et al., 2017) who emphasize that changes in teaching practices require ongoing professional development, not just short-term training. Beside the teacher factor, student readiness and motivation also play a significant role. Deep learning requires self-regulation, the courage to express opinions, and critical thinking skills (Bd & Natasya, 2026) If the previous learning culture was more passive or oriented toward single instruction, then students need time to adapt. High-level cognitive engagement only emerges when students feel emotionally safe and supported by a classroom culture that values the process, not just the outcome (Rahmat et al., 2026).

In the context of PJOK, some students may still view this subject as merely a space for physical activity, rather than a space for reflection and tactical discussion. This perception can hinder the deepening of the thinking process. The factors of facilities and institutional support cannot be overlooked either. Reflection-based and collaborative learning requires space that allows for discussion, sufficient time for debriefing, and tools that support a variety of activities. Pedagogical innovation is greatly influenced by the availability of resources and the flexibility of the school system (Yusdiantara, 2025). If the teacher-student ratio is high or resources are limited, teachers tend to revert to more manageable approaches, such as direct instruction.

In such a situation, deep learning can be reduced to a slogan without any real transformation in practice. Overall, the findings of this research indicate that the implementation of deep learning in PJOK at SMAN 10 Semarang is on the right track, but still in the developing stage. The high category achievements reflect a fairly strong foundation, but there is a need to strengthen aspects of instructional design, teacher professional development, the formation of a reflective culture, and the enhancement of student motivation and readiness to learn. With a more systematic approach and sustained support, the potential of deep learning in integrating cognitive, psychomotor, and affective aspects in PJOK can be achieved more evenly and profoundly.

CONCLUSION

Based on the research results, the implementation of the deep learning model in the Physical Education, Sports, and Health (PJOK) subject at SMAN 10 Semarang falls into the high category with an average score of 193.03 out of a maximum score of 230. The results of the One-Sample T-Test statistical test show that the average implementation score is significantly above the reference criterion

value of 139, as evidenced by a significance value of 0.000 (< 0.05) and a calculated 15,247 > table value of 1,692.

The dimensions that achieved the highest results are Character and Learning Independence, which indicate that the application of deep learning has supported the formation of independent attitudes, responsibility, mutual cooperation, and student motivation. Additionally, the dimensions of Self-Awareness, Connectivity and Knowledge Integration, Emotional Engagement and Motivation, the Role of Educators as Facilitators, as well as Collaboration, Creativity, and Problem Solving consistently fall into the high category.

Nevertheless, the dimensions of Higher Order Thinking Skills and a Supportive Learning Environment still show room for further development. Strengthening can be achieved thru learning designs that emphasize problem-solving, reflection, the use of open-ended questions, and the optimization of learning environments that support student exploration and discussion processes.

Overall, the results of this study provide an empirical picture that the level of deep learning implementation in PJOK learning at SMAN 10 Semarang has been running well, actively, and meaningfully. However, improvement and reinforcement are still necessary, especially in the aspects of higher-order thinking and learning environment support, so that the implementation of this learning model can develop more optimally and evenly across all its dimensions.

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