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From Planning to Performing: Improving Critical Thinking Abilities Through The Implementation Of Understanding By Design

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Abstract
This study aims to analyze the effectiveness of the implementation of the Understanding by Design (UbD) framework in improving students' critical thinking skills, especially in Physical Education and Health. The UbD approach, which is oriented towards learning objectives and authentic assessment, is hypothesized to create a learning environment that encourages analysis, evaluation, and synthesis of ideas. A quasi-experiment was used with a one-group pretest-posttest design. The study sample consisted of 32 students selected through the total sample method. A critical thinking ability questionnaire consisting of 17 validated statements was used to collect data. The results were analyzed using descriptive statistics and a Paired Sample T-Test with SPSS. The average score increased from 68.16 in the pretest to 74.69 in the posttest. There was a significant difference between critical thinking skills before and after the intervention, according to the statistical test, which produced a significance value (2-tailed) of 0.000 ($p < 0.05$). Therefore, it can be concluded that the use of the understanding by design framework has a positive and significant effect on improving students' critical thinking skills. The results show that UbD can be used as a pedagogical strategy to enhance higher-order thinking skills in education.

Keywords: *Understanding by Design, Learning Framework, Critical Thinking, Backward Planning, Learning Outcomes.*
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INTRODUCTION

In 21st-century education, the fundamental challenges faced by educators and the design of learning experiences are not limited to the acquisition of procedural motor skills but rather it is crucial that learning is structured to provide significance that can be effectively integrated into everyday life. Within the scope of Physical Education, Sport, and Health (PJOK), pedagogical methodologies often remain rooted in procedural technique frameworks alongside assessments that prioritize only physical competencies (Z. Li et al., 2024). Consequently, the application of UbD design-based understandings in conjunction with critical thinking faces significant obstacles, primarily due to the lack of opportunities for students to develop their capacity to critically analyze important management evaluation principles, assess game strategies with rigor, and reflect on the complex interrelationships between physical activity, lifestyle choices, and holistic well-being (C. Li & Zhang, 2024). In an age

characterized by uncertain health information and prevalent sedentary behavior, it is crucial that graduates demonstrate not only mechanical proficiency in executing movements but also possess the intellectual acumen to cultivate a deep understanding of biomechanical principles aimed at minimizing injury risk, critically evaluating fitness claims, formulating evidence-based personal training programs, and providing ethical and informed judgments within team dynamics (Shi et al., 2024). Therefore, there is an urgent need for PE curriculum to intentionally transition the educational paradigm from a simple emphasis on "being able to do" to a deeper exploration of "understanding why and how" through a UbD framework, which integrates thought-provoking guiding questions, complex authentic performance tasks, and ongoing assessments that measure analytical depth and the capacity to apply knowledge in real-world settings, thus exemplifying a tangible manifestation of 21st-century physical literacy (Larsen et al., 2025). Physical activity design should also encompass the domain of critical thinking skills, which has emerged as a critical competency requiring significant attention (Carl et al., 2022). These skills empower individuals to objectively research information, evaluate arguments, and make informed decisions and problem-solve (Xing & Ironsi, 2024). An increasingly complex world requires graduates who not only master content knowledge but also apply it judiciously to address real-world challenges (Bates et al., 2022). Therefore, the focus of education must evolve from merely transmitting information to fostering deep and reflective thinking skills.

The traditional framework for teaching Physical Education and Health (PJOK), which prioritizes a linear progression of activities and single technical achievements, has created a disconnect with the needs of the 21st century, where the core objectives of physical education should include providing learners with enduring insights such as the capacity to formulate strategic decisions, evaluate risks, and introspect on life values through physical engagement (Pambudi et al., 2019). The Understanding by Design (UbD) paradigm emerged as a systematic solution to this dilemma, offering a retrospective design methodology that fundamentally begins planning with the establishment of a deep understanding goal (Costa et al., 2019) for example, "Learners understand that physical fitness is a multifaceted concept that requires strategic planning, critical assessment, and ongoing adaptation informed by personal metrics and physiological principles." Without this crucial phase, PE education remains entangled in a cycle of disjointed, repetitive activities, with evaluations measuring only the replication of skills (doing) rather than the underlying rationale for actions (thinking), thus failing to facilitate the transfer of knowledge to authentic life situations. Consequently, the incorporation of critical thinking into Physical Education (PJOK) requires a comprehensive reorientation from a focus

on “how to implement” to “what is the significance, how to strengthen understanding, and what are the consequences for my existence,” which can be ensured solely through the tripartite alignment of UbD among objectives centered on conceptual understanding, authentic assessments such as video game analysis or the development of a data-driven fitness portfolio, alongside learning experiences constructed as complex problem-solving simulations and reflective practice (Nurhaswinda et al., 2021). Understanding by Design (UbD), often called backward design, emerged as a response to these challenges (Murod et al., 2020). This framework, developed by Wiggins and McTighe, offers a holistic approach.

METHOD

Because this study used only one sample group, a quasi-experimental design was used as a quantitative approach. This approach was chosen to observe the effects of implementing a treatment under conditions where the researcher cannot fully control all variables that might influence the outcome, but still allows for causal inferences (Selvira & Albina, 2025). The design used was a One-Group Pretest-Posttest Design, in which the same group was observed before and after receiving the intervention (Alvin Hananto & Melini, 2023).

The research procedure was carried out in three main sequential stages. The first stage was the pretest, in which all study participants were given a critical thinking skills questionnaire before the UbD framework was implemented. This data served as a baseline to determine their initial ability levels. The second stage was the treatment or intervention, which involved implementing comprehensive learning designed using Understanding by Design (UbD) principles over a specific period. Learning focused on specific material units, with a design that began with the formulation of in-depth understanding objectives, the design of performance tasks as authentic assessments, and the development of learning activities that encouraged inquiry. The third stage was the posttest, which involved administering the same questionnaire as the pretest after the UbD-based learning series was completed, to measure critical thinking skills after the intervention.

The population in this study was all fourth-grade students at SDN Menteng Dalam 11 Pagi. The sample was drawn using a total sampling technique, resulting in all 32 students participating as research subjects. The research instrument, a critical thinking skills questionnaire consisting of 17 statements, had a validity value of 0.34 and a reliability value of 0.846 (Purnomo et al., 2025). Each item was measured using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). The theoretical total score range is 17 to 85. The

instrument underwent expert validation and reliability testing, with a Cronbach's Alpha coefficient meeting the requirements (Maulidia & Ridwan, 2021).

Data analysis was conducted using Statistical Package for the Social Sciences (SPSS) version 25 software. Descriptive statistical analysis (mean, median, standard deviation, range) was used to describe the characteristics of the pretest and posttest data (Hidayah et al., 2023). A Shapiro-Wilk test was used as a prerequisite for normality, given the sample size was less than 50. Hypothesis decisions were made with a significance level of $\alpha = 0.05$ (Sianturi, 2025). Furthermore, to test the research hypothesis regarding differences in critical thinking skills before and after treatment, an inferential statistical test, the Paired Sample T-Test, was used (Ariani et al., 2025).

RESULTS AND DISCUSSION

Result

Based on the data collected from 32 respondents, descriptive statistical analysis produced the following picture. The average score (mean) of critical thinking ability during the pretest was 68.16 with a standard deviation of 4.041. The minimum score obtained was 60 and the maximum score was 78. During the posttest, the average score increased to 74.69 with a standard deviation of 2.978. The minimum posttest score was 67 and the maximum score was 80. This mean increase of 6.53 points indicates progress in students' critical thinking ability after participating in learning with the UbD framework.

Table 1. *Shapiro-Wilk Test Result*

	Statistic	df	Sig.
Pre Test	0,969	32	0,479
Post Test	0,973	32	0.588

Before conducting the hypothesis test, a normality test was first performed on the difference data between the posttest and pretest scores. The Shapiro-Wilk test results showed a significance value (Sig.) of 0.479 for the pretest and 0.588 for the posttest. Since the Sig. value is > 0.05, it can be concluded that the difference data is normally distributed, thus meeting the assumptions for using the parametric Paired Sample T-Test.

Table 2. *Paired Sample T-Test Result*

	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
PreTest	68,12	4,041	0,714	-37,578	32	**0,000**
PostTest	74,69	2,978	0,526	-38,588	32	**0,000**

With 32 degrees of freedom (df), the calculated t-value for the pretest is -37.578 and the calculated t-value for the posttest is -38.588. The null hypothesis (H0) stating that there is no difference in critical thinking skills before and after the treatment is rejected. The alternative hypothesis (Ha) is accepted, stating that there is a difference in critical thinking skills before and after the implementation of the UbD framework. This is because the significance value (0.000) is much smaller than the established significance level α (0.05). According to the negative t-value, the posttest mean is statistically greater than the pretest mean.

Discussion

The results of this study clearly demonstrate that implementing an understanding-based design (UbD) framework is effective in improving students' critical thinking skills in physical education, health, and sports lessons. These findings address the urgent need for a shift in the physical education paradigm from "being able to do" to "understanding why and how." The significant improvement in post-test scores compared to pre-test scores demonstrates that this retrospective, understanding-centered learning design successfully creates a learning environment that enables students to enhance their intelligence (Sirianansopa, 2024).

The success of this study hinges on the UbD framework's ability to overcome the limitations of traditional pedagogical methodologies in physical education, which have relied on procedural technique frameworks and physical competency-based assessments (Sari et al., 2024). As literature research has shown, traditional approaches focus solely on linear progression of activities and technical achievements, which tend to deviate from 21st-century needs (González-salamanca et al., 2020). By establishing a goal of deep understanding as the basis for planning, the implementation of UbD in this study appeared to successfully break the cycle of intermittent, repetitive activities (Namus et al., 2024).

Intervention designs that systematically integrate key elements of UbD have shown improvements in critical thinking skills (Ozyurt et al., 2021). The first stage of planning, which begins with the formulation of a goal of deep understanding, shifts the learning focus from mere movement execution to conceptual understanding. This goal formulation intrinsically requires and stimulates higher-order thinking processes. This allows students to enhance their analytical skills (Purdianata & Siswana, 2025).

This research provides teachers with the opportunity to design performance tasks as tests that encourage critical thinking. Tasks such as tactical analysis or developing a fitness portfolio go beyond simply measuring skill replication; they require students to participate in the process of gathering evidence, evaluating arguments, and generating rationale for their

decisions (Kolar et al., 2024). These activities directly teach critical thinking skills, namely the ability to examine and make sound decisions.

The results achieved were significantly influenced by the creation of inquiry-based learning activities as the third stage in UbD design. By using learning experiences as reflective practice and complex problem-solving simulations, students were encouraged to actively interrogate their beliefs about health, fitness, and the dynamics of physical activity (Bjørke & Quennerstedt, 2024). This process of inquiry enabled in-depth inquiry, often lacking in UbD implementations in practice.

These results also confirm the notion that implementing critical thinking in PE requires a complete shift in focus from "how to do it" to "what are the significance and consequences." The improvement in student scores demonstrates that the UbD framework successfully ensured the alignment of conceptual objectives, authentic assessments, and meaningful learning experiences (Lin et al., 2025). Learning was no longer focused on providing students with procedural instructions, but rather on developing their ability to think critically and deeply (Lee & Hannafin, 2016).

Furthermore, the findings of this study shed light on issues frequently cited in the literature on UbD implementation, such as the tendency to ask shallow guiding questions and reducing authentic assessment to administrative tasks. A comprehensively designed, unit-focused treatment procedure appears to successfully avoid these pitfalls (Lander et al., 2016). Students are facilitated to gradually engage in complex analysis and evaluation processes through structured learning scaffolding throughout the UbD stages (Indarwati et al., 2024).

The improvements noted demonstrate that this study's evaluation framework is not limited to measuring normative outcomes such as running speed or technical accuracy. Instead, the assessment aims to measure the cognitive and metacognitive processes that occur while students are physically participating. This method successfully addresses the gap between field practice and the principles of understanding-based pedagogy, a method that has been criticized for overly prioritizing the acquisition of isolated skills (Alali et al., 2024).

These findings are crucial for 21st-century efforts to build physical literacy. Improved critical thinking skills indicate that students are beginning to acquire the cognitive skills necessary to understand deeper biomechanical concepts, critically evaluate fitness claims, and create evidence-based training programs (Fatin et al., 2023). In an era of uncertain health information and prevalent sedentary behavior, these skills are crucial. Graduates are expected to possess not only mechanical abilities but also the ability to make reasoned and informed judgments.

Furthermore, the findings of this study support the idea that physical education should teach students about things like how to make strategic decisions and evaluate risks. The increased critical thinking skills produced by physical education suggest that it can be an effective method for helping children learn life values far beyond motor skills (Nuraini et al., 2024). This aligns with the goal of education, which is to produce students who can use their knowledge wisely to solve real-world problems.

From a methodological perspective, a quasi-experimental design with a single pretest-posttest group has enabled a fairly robust finding of a causal relationship between the UbD intervention and improvements in critical thinking skills (Ardiansya et al., 2024). Although this framework has limitations due to the lack of a control group, the significant mean increase and high statistical significance provide strong empirical support for its effectiveness. This design is suitable for investigating the impact of a treatment in education.

In terms of instrumentation, the use of a critical thinking skills questionnaire, whose validity and credibility have been tested, lends credence to the collected data. The Likert-scale measurement allows for the collection of quantitative data on students' abilities and perceptions (Apezahli et al., 2025). This data can be analyzed to evaluate changes before and after the intervention. The tool remains functional, providing a solid basis for confirming that the progress made truly reflects progress in critical thinking skills.

As demonstrated by the Shapiro-Wilk test, the normal distribution of the data strengthens the validity of the parametric statistical analysis used. Fulfillment of these assumptions indicates that, at least for the population studied, a generalizable pattern follows the increase in sample scores. This condition supports the conclusion that the UbD intervention has a measurable, systematic impact on the expected outcomes.

The intervention effect was not only statistically significant but also practically meaningful, as demonstrated by the large mean increase from pretest to posttest (Fitriasari et al., 2024). This change indicates a substantial shift in how students approach problems, analyze data, and reflect on what they have learned in Physical Education and Health. This improvement is clear evidence of the internalization of the goal of deep understanding planned in the learning.

Furthermore, it is noteworthy to note the decrease in standard deviation in posttest scores compared to pretest scores. This phenomenon suggests that UbD-based learning may have an equalizing effect, where students with lower initial abilities experience faster progress, reducing gaps within the group (Meyer et al., 2024). This means that this method is not only

effective in increasing average ability but also has the potential to create an inclusive learning environment for developing thinking skills.

Previous research has identified a limited knowledge gap regarding the impact of macro-planning frameworks like UbD on critical thinking skills in the context of physical education and health in Indonesia. This study fills a gap in previous research, which has focused more on micro-level learning models, but demonstrates that a fundamental curriculum design approach can also have a significant impact on the development of 21st-century skills like critical thinking.

These results align with other research showing that innovative learning models can be beneficial. However, these results also make a unique contribution by demonstrating the effectiveness of the backward design framework as a systemic planning method. The success of this research provides new insights for educators and curriculum developers, demonstrating that innovation in learning strategies and revolutionizing the learning planning and design process are two ways to improve the quality of learning (Hasni et al., 2024).

The results can be seen in the elementary school context. This demonstrates that a complex UbD framework can be adapted and implemented effectively, even at the elementary level. The ability of fourth-grade students to respond positively to understanding-based learning designs demonstrates that appropriate teaching methods can and should foster critical thinking skills from an early age (Jannah et al., 2023). With its practical and relevant context, Physical Education (PJOK) proves to be a suitable environment for developing these skills.

Utilizing UbD to enhance critical thinking skills demonstrates that PJOK has significant untapped potential. When designed properly, PJOK can serve as a living laboratory for developing higher-order cognitive capacities rather than simply being a skill-focused subject. This suggests that efforts to elevate physical education (PE) to the same level in terms of its contribution to holistic educational goals should be undertaken.

Practically, this study provides concrete evidence that PE educators can use to create meaningful learning designs. It has been shown that the systematic steps of UbD can be used to achieve broader goals, such as developing thinking skills. This includes identifying desired learning outcomes, identifying evidence of achievement, and designing learning experiences. It also answers potential questions about whether the theoretical framework can be applied in practice (Ashraf, 2022).

These findings also have implications for curriculum development policies at the institutional and national levels. The results suggest that understanding-based design principles should be incorporated into curriculum documents and teacher training for PE. Without

structural support, individual teachers' efforts to implement a similar approach may face significant challenges in terms of time, resources, and pedagogical readiness (Ahmad, 2025).

While this research is highly instructive, it is important to remember that the success of UbD implementation depends heavily on the quality of execution of each stage. The extent to which critical thinking improvements can be achieved is greatly influenced by factors such as the depth of guiding questions, the validity of performance tasks, and the teacher's ability to foster reflective discussion (Ghanizadeh, 2016). Consequently, these results underscore the importance of enhancing teachers' capacity to master the philosophy and techniques of implementing UbD.

This study also opens up opportunities for further research. Whether the learning activity, assessment design, or objective formulation phase is addressed, specific UbD design elements that enhance critical thinking should be considered. To increase the generalizability of the findings, research with designs involving control groups and larger, more diverse samples is also needed (Stuart et al., 2014).

Finally, these results reinforce the notion that education, including physical education, is a process of developing understanding and thinking skills. Improving students' critical thinking skills through the UbD framework demonstrates that education can produce graduates who are not only technically skilled but also intellectually intelligent and personally reflective (Ramadhanti et al., 2024). This occurs when learning is designed with a clear goal of understanding the essence, supported by authentic evidence, and conducted through challenging experiences. This is the essence of education that is relevant to the problems of the twenty-first century.

CONCLUSION

Based on the data analysis conducted, it can be concluded that implementing the UbD framework can indeed improve students' critical thinking skills. This improvement is evidenced by a 6.53-point increase in the mean score, which is further corroborated by greater homogeneity of abilities among participants, as indicated by a reduction in the standard deviation. Parametric statistical analysis supports the robustness of this finding, where the difference in scores before and after the intervention is statistically significant at the 95% confidence interval. Consequently, the UbD framework can be considered a viable pedagogical methodology to cultivate in efforts to strengthen the critical thinking dimension in the educational process, while simultaneously reducing achievement disparities in the classroom. The practical consequences of this research encourage educators to embrace the principle of

backward design, focusing on deep understanding as a strategic approach to facilitate the improvement of students' advanced cognitive competencies.

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