The Impact of the Independent Curriculum on Student Engagement in Physical Education: A Pretest–Posttest Study

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Abstract. This study investigates the effect of the Independent Curriculum (Kurikulum Merdeka) on student engagement in physical education learning. A quantitative pre-experimental design employing a one-group pretest–posttest model was applied to a sample of 20 secondary-level students. Student engagement was measured using a validated questionnaire encompassing three dimensions: behavioral, emotional, and cognitive engagement. Data were analyzed through descriptive statistics, Shapiro–Wilk normality testing, and paired-sample t-tests to determine the significance of differences between pretest and posttest scores. The findings reveal a statistically significant improvement in student engagement, with mean scores increasing from 38.20 (pretest) to 49.60 (posttest) ($p < 0.001$). The normalized gain (N-Gain) value of 0.61 indicates a moderate level of effectiveness. These results suggest that the Independent Curriculum fosters more active, student-centered learning environments, aligning with constructivist and autonomy-supportive pedagogical frameworks that enhance engagement in physical education contexts [1], [2]. From a sport pedagogy perspective, increased engagement reflects improved learner participation, motivation, and cognitive involvement, which are critical determinants of learning outcomes and physical literacy development [3]. Despite the positive impact, the moderate N-Gain score indicates that further instructional optimization—particularly through differentiated instruction and technology integration—is required to maximize engagement outcomes [4]. In conclusion, the implementation of the Independent Curriculum significantly enhances student engagement in physical education. However, sustained effectiveness depends on pedagogical refinement and contextual adaptation in line with contemporary sport education models.

Keywords: Independent Curriculum; Student Engagement; Physical Education; Sport Pedagogy; Pretest–Posttest Design; N-Gain Analysis; Student-Centered Learning; Learning Outcomes.

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1 Introduction

The implementation of the Independent Curriculum (Kurikulum Merdeka) represents a strategic reform in Indonesia's education system aimed at addressing the demands of 21st-century learning. This curriculum emphasizes flexibility in instructional design, enabling educators to adopt student-centered approaches that accommodate diverse learning needs while fostering competency development and character formation through meaningful learning experiences [1]. By promoting differentiated, contextual, and exploratory learning, the Independent Curriculum encourages students to actively construct knowledge and engage more deeply in the learning process.

Within the domain of physical education, the adoption of the Independent Curriculum is particularly critical due to the inherently active and experiential nature of the subject. Physical education is not limited to the development of motor skills but also encompasses cognitive, social, and affective dimensions, including critical thinking, collaboration, sportsmanship, and health awareness [2], [3]. Consequently, the effectiveness of curriculum implementation in this context is closely linked to the degree of student engagement, which serves as a key indicator of instructional quality and learning success.

Student engagement is widely recognized as a multidimensional construct comprising behavioral, emotional, and cognitive components. In physical education settings, behavioral engagement is reflected in active participation in physical tasks, emotional engagement is evident in students' enthusiasm and interest, and cognitive engagement involves strategic thinking and problem-solving during movement activities. High levels of engagement have been consistently associated with improved learning outcomes, enhanced motivation, and sustained participation in physical activity [4]–[6]. From a sport pedagogy perspective, engagement also contributes to the development of physical literacy, which is essential for lifelong participation in physical activity.

Despite its potential, the implementation of the Independent Curriculum in physical education continues to encounter several practical challenges. Many educators face difficulties in translating the principles of differentiated instruction into structured and meaningful physical activities [7], [8]. In addition, limited pedagogical competence in designing student-centered learning environments often results in the persistence of teacher-centered practices, which restrict opportunities for active student involvement. These challenges highlight the need for empirical evidence on how the curriculum influences student engagement in authentic classroom settings.

Existing research on the Independent Curriculum has predominantly focused on core academic subjects such as mathematics, language, and science. In contrast, studies examining its impact within physical education remain scarce. Furthermore, previous research in physical education has largely concentrated on the effects of specific instructional models on motor performance, motivation, or physical fitness, rather than investigating how curriculum reform shapes the multidimensional nature of student engagement. This indicates a significant gap in the literature, particularly in linking curriculum policy implementation with student learning experiences in physical education contexts [9], [10].

Addressing this gap, the present study offers both theoretical and practical contributions. Theoretically, it extends the discourse on curriculum implementation by incorporating physical education as a primary context of analysis, thereby enriching the field of sport pedagogy. Practically, the findings are expected to inform educators and policymakers in designing more effective, participatory, and student-centered physical education practices aligned with the principles of the Independent Curriculum [11]–[13].

The novelty of this study lies in its focus on a multidimensional assessment of student engagement—encompassing behavioral, emotional, and cognitive aspects—within the framework of the Independent Curriculum. Unlike prior studies that emphasize isolated learning outcomes, this research provides a comprehensive evaluation of how curriculum reform influences the quality of student participation in physical education. By positioning physical education as a central domain for evaluating curriculum effectiveness, this study contributes a new perspective to the broader field of educational innovation.

Therefore, this study aims to analyze the impact of the implementation of the Independent Curriculum on student engagement in physical education learning. The results are expected to contribute to the advancement of curriculum-based sport pedagogy research and provide evidence-based recommendations for improving the quality of physical education practices in Indonesia.

2 Methods

2.1 Research Design

This study employed a quantitative approach using a pre-experimental design, specifically the one-group pretest–posttest model [14]. This design was selected to examine the effect of the implementation of the Independent Curriculum on student engagement in physical education learning.

In this framework, participants were assessed prior to the intervention (pretest) to establish baseline engagement levels, followed by the implementation of Independent Curriculum-based instructional practices, and subsequently reassessed (posttest) to evaluate changes in engagement. Although this design does not include a control group, it is appropriate for preliminary investigations aimed at identifying causal tendencies in educational interventions [15].

From a sport pedagogy perspective, this design enables the observation of changes in multidimensional engagement—behavioral, emotional, and cognitive—as a response to student-centered learning environments [16].

2.2 Participants

The study involved 20 students, selected through purposive sampling, a non-probability technique based on predefined inclusion criteria relevant to the research objectives [17]. The selection criteria were as follows: (1) students actively participating in physical education classes, (2) enrollment in the same instructional group to ensure homogeneity of learning conditions, and (3) full participation in all intervention sessions.

This sampling strategy ensures contextual relevance and internal consistency, particularly in small-scale experimental studies in physical education settings [18].

2.3 Research Instruments

Student engagement was measured using a structured questionnaire instrument grounded in the multidimensional engagement framework, encompassing behavioral, emotional, and cognitive dimensions [19]. The instrument consisted of 15 items, each rated on a 4-point Likert scale ranging from strongly disagree (1) to strongly agree (4). The use of a forced-choice scale (without a neutral midpoint) was intended to minimize response bias and encourage more definitive participant responses [20].

Operational indicators for each dimension were defined as follows:

- Behavioral engagement: active participation, involvement in physical activities, and persistence during tasks
- Emotional engagement: interest, enjoyment, enthusiasm, and comfort during learning
- Cognitive engagement: concentration, effort, strategic thinking, and error correction

Prior to data collection, the instrument underwent validity and reliability testing. Construct validity was assessed using Pearson Product-Moment correlation, while internal consistency reliability was evaluated using the Cronbach's Alpha coefficient, with a threshold of ≥ 0.70 indicating acceptable reliability [21].

Table 1. Student Engagement Instrument Structure

Dimensions	Indicator	Item No.	Number of Items
Behavioral Engagement	Active participation in learning activities	1, 2	2
	Involvement in physical tasks/activities	3, 4	2
	Persistent in tasks	5	1
Emotional Engagement	Enjoyment in learning	6, 10	2
	Interest	7	1
	Enthusiasm comfort in participation	8	1
	Comfort in participating in learning	9	1
Cognitive Engagement	Concentration	12	1
	Effort to understand material	11	1
	Error correction ability	13	1
	Skill execution accuracy	14	1
	Strategic Thinking	15	1

Dimensions	Indicator	Item No.	Number of Items
	Total	**1–15**	**15 Item**

2.4 Data Analysis

Data were analyzed using both descriptive and inferential statistical techniques to evaluate the effectiveness of the Independent Curriculum intervention. Descriptive statistics, including mean, standard deviation, and percentage scores, were used to summarize student engagement levels before and after the intervention.

Prior to hypothesis testing, a normality test (Shapiro–Wilk) was conducted to ensure that the data met parametric assumptions [22]. Subsequently, a paired-sample t-test was employed to determine whether there was a statistically significant difference between pretest and posttest scores [23].

To further interpret the magnitude of the intervention effect, the normalized gain (N-Gain) score was calculated, providing a standardized measure of improvement in student engagement [24]. This combination of analyses enables a comprehensive evaluation of both statistical significance and practical effectiveness within physical education learning contexts.

3 Results and Discussion

3.1 Results

3.1.1. Descriptive Statistics

The descriptive analysis indicates a substantial increase in student engagement following the implementation of the Independent Curriculum in physical education learning.

Table 2. Descriptive Statistics of Student Engagement

Variable	N	Mean	Std. Deviation	Minimum	Maximum
Pretest	20	38,20	4,15	31	45
Posttest	20	49,60	3,80	43	56

The mean score increased from 38.20 (moderate category) to 49.60 (high category), indicating a meaningful improvement in student engagement. The reduction in standard deviation from 4.15 to 3.80 also suggests more consistent engagement levels among participants after the intervention.

3.1.2. Normality Test

Normality testing was conducted using the Shapiro–Wilk test due to the relatively small sample size ($n < 50$).

Table 3. Normality Test Results

Data	Sig.Value	Interpretation
Pretest	0,112	Normal
Posttest	0,087	Normal

Both datasets yielded significance values greater than 0.05, confirming that the data are normally distributed. Therefore, parametric statistical analysis was deemed appropriate.

3.1.3. Hypothesis Testing (Paired Sample t-Test)

A paired-sample t-test was employed to determine the effect of the Independent Curriculum on student engagement.

Table 4. Paired Sample t-Test Results

Comparison	Mean Difference	*t* value	Sig. (2-tailed)
Pretest–Posttest	-11,40	-12,35	0,000

The analysis revealed a statistically significant difference between pretest and posttest scores ($p < 0.001$). This indicates that the implementation of the Independent Curriculum had a significant positive effect on student engagement, leading to the acceptance of the alternative hypothesis (H_1).

3.1. 4 Effectiveness Analysis (N-Gain)

To determine the level of effectiveness of the treatment, an N-Gain analysis was carried out.

Table 5. N-Gain

Mean Pretest	Mean Posttest	N-Gain	Category
38,20	49,60	0,61	Currently

The normalized gain (N-Gain) value of 0.61 falls within the moderate effectiveness category, indicating that the intervention produced a meaningful, though not maximal, improvement in student engagement.

3.2 Discussion

The findings demonstrate that the implementation of the Independent Curriculum significantly enhances student engagement in physical education. The transition from moderate to high engagement levels suggests that student-centered, flexible, and contextually relevant instructional approaches effectively promote active participation. These results reinforce the premise that curriculum design plays a pivotal role in shaping the quality of learning experiences.

From a theoretical standpoint, the results align with the multidimensional framework of student engagement, which integrates behavioral, emotional, and cognitive

components [1], [2]. The observed improvements indicate that the Independent Curriculum successfully facilitates not only physical participation but also emotional involvement and cognitive investment. In physical education settings, this is reflected in increased participation in movement activities, heightened enthusiasm, and improved focus on skill execution and tactical understanding.

In the context of sport pedagogy, these findings support constructivist learning principles, which emphasize active knowledge construction through experiential learning [3]. Physical education inherently relies on learning by doing, where motor experiences contribute to deeper cognitive processing and skill acquisition. The Independent Curriculum provides teachers with greater flexibility to design meaningful learning activities—such as game-based learning, movement exploration, and problem-solving tasks—that enhance engagement and promote holistic development.

The results are consistent with previous studies indicating that student-centered instructional models, including Teaching Games for Understanding (TGfU), significantly improve engagement and learning outcomes in physical education [4], [5]. However, this study offers a novel contribution by demonstrating that engagement enhancement can also be driven by curriculum-level reform, rather than solely by instructional models. This suggests that effective educational change requires alignment between pedagogical strategies and curriculum frameworks [6], [7].

Despite the statistically significant improvement, the moderate N-Gain value indicates that the effectiveness of the intervention remains suboptimal. Several factors may explain this outcome, including limited teacher adaptation time, variability in student readiness, and constraints related to facilities and instructional resources. These findings highlight that successful curriculum implementation depends not only on policy design but also on teacher competence, institutional support, and the learning environment.

Furthermore, the increase in student engagement suggests the potential of the Independent Curriculum to foster 21st-century competencies, such as collaboration, communication, and problem-solving skills. These competencies are integral to contemporary sport education, which emphasizes not only physical performance but also cognitive and social development.

However, this study is subject to several limitations. The relatively small sample size ($n = 20$) and the use of a pre-experimental design without a control group limit the generalizability of the findings. Future research is recommended to employ more rigorous experimental designs, such as randomized controlled trials, and to incorporate additional variables, including learning motivation, academic achievement, and physical fitness indicators, to provide a more comprehensive evaluation of curriculum effectiveness.

4 Conclusion

This study demonstrates that the implementation of the Independent Curriculum (Kurikulum Merdeka) in physical education significantly enhances student engagement across behavioral, emotional, and cognitive dimensions. Empirical evidence from the

pretest–posttest analysis confirms a statistically significant improvement in engagement levels ($p < 0.001$), indicating that student-centered and flexible instructional approaches effectively promote active participation in physical education learning. These findings support contemporary perspectives on engagement as a critical determinant of learning quality and student development [1], [2].

The obtained N-Gain value in the moderate category suggests that, while the intervention yields meaningful improvements, its effectiveness remains subject to optimization. From a sport pedagogy standpoint, this implies that the successful implementation of curriculum reform depends not only on policy design but also on pedagogical execution, teacher readiness, and the availability of supportive learning environments [3], [4]. The results further highlight that experiential and movement-based learning—central to physical education—can be significantly enhanced through curriculum frameworks that prioritize autonomy, differentiation, and meaningful learning experiences.

Theoretically, this study contributes to the literature by establishing a direct linkage between national curriculum reform and multidimensional student engagement within the physical education context, which has received limited empirical attention. Practically, the findings provide evidence-based insights for educators and policymakers to strengthen curriculum implementation strategies aimed at improving student participation and learning outcomes.

Nevertheless, this study is constrained by a relatively small sample size and the use of a pre-experimental design without a control group, which may limit the generalizability of the findings. Future research is therefore recommended to employ more robust experimental designs, larger and more diverse samples, and additional outcome variables—such as learning achievement, motivation, and physical fitness—to provide a more comprehensive evaluation of curriculum effectiveness.

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