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Active Learning Time In Physical Education As Assessed By The Body Mass Index Of Elementary School Students

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Abstract:
Academic Learning Time in Physical Education (ALT-PE) refers to the proportion of class time during which students are actively engaged in motor tasks aligned with instructional objectives. Although ALT-PE is a key indicator of instructional quality, evidence linking it to students' nutritional status remains scarce, particularly in regular elementary physical education settings in Indonesia. This study addresses that gap by examining ALT-PE among elementary students in Kraton District, Pasuruan Regency, and comparing engagement across Body Mass Index (BMI) categories. Using a descriptive-comparative cross-sectional design, 60 grade IV–VI students were selected via stratified random sampling and divided equally into underweight, normal, and overweight groups. BMI was measured with a digital scale and stadiometer; ALT-PE was recorded via 6-second interval observation. Overall mean ALT-PE was 34.7%, significantly below the 50% benchmark ($p < .001$; Cohen's $d = -2.04$). The normal-BMI group showed the highest engagement (44.2%), versus underweight (30.0%) and overweight (29.8%) groups. Welch's ANOVA confirmed significant differences, $F(2, 34.9) = 189.00$, $p < .001$; Tukey tests indicated the normal group differed from both others, while underweight and overweight groups did not. Findings demonstrate that nutritional status is associated with PE engagement and underscore the need for inclusive, differentiated instructional strategies.

Introduction (مقدمة)

The Physical Education, Sports, and Health (PJOK) curriculum plays a strategic role in fostering active movement habits while preventing health issues among school-aged children, including the risk of obesity (Bailey, 2006; Graham, Holt/Hale, & Parker, 2020). This perspective aligns with UNESCO (2015), which emphasizes that physical education and physical activity are fundamental rights of every child that support their holistic growth and development. The success of PJOK learning cannot be judged solely by the implementation of the lesson schedule; rather, it must be assessed by examining the extent to which students actually use class time to engage in meaningful physical activity. A commonly used concept to analyze this is Academic Learning Time in Physical Education (ALT-PE), which refers to the proportion of class time students spend performing movement tasks that align with learning objectives (Siedentop, Tousignant, & Parker, 1982). The higher this proportion, the greater the opportunity for students to gain fitness benefits and master motor skills from the classes they attend.

Commonly accepted standards state that truly productive physical activity should ideally account for half of the total Physical Education class time (Siedentop et al., 1982). In reality, however, the duration of physical education classes in Indonesian elementary schools ranges only from 70 to 120 minutes per week—far below the World Health Organization's recommendation that children engage in at least 60 minutes of physical activity every day (World Health Organization, 2020). This time constraint is further exacerbated by the fact that most class time is actually spent on lining up, verbal explanations, and waiting for turns, so that the amount of active movement by students often falls far short of the recommended standard (McKenzie & Lounsbery, 2013).

This issue is becoming increasingly relevant given that childhood obesity rates continue to rise. Global data estimate that hundreds of millions of children and adolescents are overweight (World Health Organization, 2025b), while in Indonesia itself, the Basic Health Research found that nearly one in ten children aged 5–12 falls into the obese category (Ministry of Health of the Republic of Indonesia, 2018). Low levels of physical activity and high levels of sedentary behavior are cited as the main contributors to this condition, making effective Physical Education (PJOK) instruction one of the intervention strategies capable of reaching nearly all school-aged children.

A number of studies have shown that nutritional status influences how physically active children are. Mayrhofer, Müller, Bachner, and Schwameder (2024), who observed more than a thousand children in Austria, found that children classified as overweight or obese had fitness levels approximately 15–25% lower than those with normal nutritional status, particularly in terms of cardiorespiratory endurance and muscle strength. Similar findings were reported by Ługowska, Kolanowski, and Trafialek (2022) in Poland, who found that increasing the number of hours of physical activity at school was able to slow the rate of weight gain in children, while the group with standard activity hours actually experienced an increase in the proportion of overweight children. On the other hand, a study by Munn, Rinehart, Lieberman, and Casebolt (2022) on children with autism spectrum disorder participating in an adaptive tennis program actually recorded ALT-PE achievement rates exceeding 50%, indicating that adaptively and differentially designed instruction has the potential to promote higher levels of physical engagement even among students with certain limitations.

Despite these findings, a clear research gap remains: previous studies have largely been conducted in international contexts or focused on populations with special needs, and thus do not provide a comprehensive picture of ALT-PE patterns in regular physical education classes in Indonesian elementary schools, particularly when directly linked to students' Body Mass Index (BMI) categories. Empirical evidence examining the association between nutritional status (underweight, normal, and overweight) and actual motor engagement time during standard

PJOK lessons in Indonesian primary education is still scarce. This study addresses that gap by investigating ALT-PE across BMI categories among regular elementary students in Kraton Subdistrict, Pasuruan Regency—a setting characterized by diverse socioeconomic conditions and facilities that may produce varied engagement patterns.

From a policy perspective, the implementation of the Merdeka Curriculum through Ministerial Regulation No. 12 of 2024 issued by the Ministry of Education, Culture, Research, and Technology emphasizes student-centered learning that addresses the diverse physical conditions of students. By providing context-specific data from Indonesian elementary schools, the present research offers novel empirical insights into how nutritional status relates to learning time in physical education and supports the development of more inclusive, differentiated instructional approaches.

Based on the above description, this study aims to (1) determine whether the ALT-PE levels of elementary school students in Kraton Subdistrict meet the minimum standard of 50%, and (2) analyze differences in ALT-PE across BMI categories (underweight, normal, and overweight). The research findings are expected to serve as an empirical basis for physical education teachers in designing more inclusive lessons that are responsive to students' physical conditions, while also enriching the study of ALT-PE in the context of elementary education in Indonesia.

Method (منهج)

This study employed a quantitative approach with a descriptive-comparative design and cross-sectional data collection (Creswell & Creswell, 2023; Creswell & Poth, 2018). The descriptive component was used to capture the ALT-PE profiles and the distribution of students' Body Mass Index (BMI), while the comparative component was used to test differences in mean ALT-PE scores across BMI groups. BMI and ALT-PE data were collected simultaneously without any experimental treatment of the subjects (Levin, 2022; Setia, 2016), allowing the study to efficiently and objectively document existing field conditions (Sugiyono, 2023).

The research was conducted in public elementary schools in Kraton Subdistrict, Pasuruan Regency, during the second semester of the 2025/2026 academic year. The target population comprised all students in grades 4–6 across 28 public elementary schools in the subdistrict. Ten schools were selected purposively based on institutional willingness to participate and logistical accessibility. From these schools, 60 students were recruited through stratified random sampling stratified by grade level and preliminary BMI category. The final sample was balanced into three equal groups of 20 students each: underweight, normal nutritional status, and overweight, classified according to World Health Organization (2007) age- and sex-specific z-score standards.

The independent variable was students' BMI category, and the dependent variable was ALT-PE, defined as the percentage of physical education class time during which students were actively engaged in motor activities aligned with instructional objectives.

BMI Measurement Procedures

BMI was calculated by dividing body weight in kilograms by the square of height in meters (kg/m^2) and categorized using WHO growth curves based on z-scores for age and sex (World Health Organization, 2007, 2025a). Body weight was measured with a calibrated digital scale accurate to 0.1 kg, and height was measured with a stadiometer accurate to 0.1 cm. All anthropometric measurements were taken once per student under standardized conditions (light clothing, no shoes) by trained research assistants.

ALT-PE Data Collection Procedures

ALT-PE data were collected through systematic direct observation using the Academic Learning Time–Physical Education (ALT-PE) coding instrument developed by Siedentop, Tousignant, and Parker (1982) and further elaborated by Parker (1989). The instrument simultaneously records two levels of behavior: (1) Context Level, which describes the overall classroom situation, and (2) Learner Involvement Level, which describes each student's motor activity. A summary of the coding categories is presented in Table 1.

Table 1. Summary of the ALT-PE Instrument Categories (Siedentop, Tousignant, & Parker, 1982)

Level	Category	Main Code	Brief Description
Context Level	General Content	T, M, B, WU	Transitions, classroom management, breaks, and warm-ups
Context Level	Subject Matter Knowledge	TN, ST, R, SB, BK	Explanation of techniques, strategies, rules, and social behavior
Context Level	Subject Matter Motor	P, S, G, F	Skill practice, game simulations, games, and physical fitness
Learner Involvement	Not Motor-Engaged	I, W, OF, ON, C	Students are not actively engaged: they are waiting, passive, or engaged only cognitively
Learner Involvement	Motor Engagement	MA, MI, MS	Students are physically active: appropriate movements (MA), inappropriate movements (MI), or with assistance (MS)

Observers employed a 6-second interval-recording technique: 6 seconds of observation followed by 6 seconds of coding. Each student's ALT-PE score was calculated using the formula:

$$ALT - PE(\%) = \left(\frac{Number\ of\ intervals\ coded\ as\ MA}{Total\ number\ of\ intervals\ in\ the\ lesson}\right) x\ 100\%$$

Data Analysis Procedures

Data were analyzed using Jamovi software version 2.7.31. The analysis proceeded in sequential stages:

1. Descriptive statistics (mean, median, standard deviation, and frequency distributions) were calculated to characterize the overall ALT-PE and BMI profiles.
2. Prerequisite tests were performed: the Shapiro–Wilk test for normality and Levene's test for homogeneity of variances.
3. The first hypothesis (whether overall mean ALT-PE met the 50% benchmark) was tested using a one-sample t-test.
4. The second hypothesis (differences in ALT-PE across BMI categories) was tested using one-way ANOVA with Welch's correction to account for potential variance heterogeneity, followed by Tukey's post-hoc test when significant group differences were detected.

The significance level was set at $\alpha = 0.05$ for all statistical tests.

Ethical Considerations

The study protocol was reviewed and approved by the relevant institutional ethics

committee. Written informed consent was obtained from the parents or legal guardians of all participating students, and verbal assent was obtained from the students themselves. Participation was voluntary, and students could withdraw at any time without penalty. All data were anonymized and treated confidentially in accordance with research ethics guidelines for studies involving minors.

Result (نتائج)

This study involved 60 students in grades 4–6 from ten elementary schools in Kraton Subdistrict, who were evenly divided into three BMI groups: 20 students (33.3%) in the underweight category, 20 students (33.3%) in the normal weight category, and 20 students (33.3%) in the overweight category.

Table 2. Descriptive Statistics for ALT-PE by BMI Category

BMI Category	N	Mean (%)	Median (%)	SD	Min	Max
Overweight	20	29.8	29.4	3.77	23.4	38.4
Underweight	20	30.0	29.1	3.48	25.2	36.9
Normal	20	44.2	44.4	2.03	40.6	47.8

As shown in Table 2, the normal group recorded the highest average ALT-PE score of 44.2% with the smallest data variation (SD = 2.03), indicating that the level of physical activity in this group was relatively uniform across students. In contrast, the underweight and overweight groups recorded nearly equivalent averages—30.0% and 29.8%, respectively—but with greater data variation (SDs of 3.48 and 3.77, respectively).

Table 3. Results of the Shapiro-Wilk Normality Test by BMI Category

BMI Category	N	Skewness	Kurtosis	W	p
Fatness	20	0.444	0.397	0.972	.794
Underweight	20	0.594	-0.777	0.928	.142
Normal	20	-0.169	-0.684	0.979	.913

The Shapiro-Wilk normality test showed that the p-values for all groups were above 0.05 (Table 3), specifically 0.794 for the obese group, 0.142 for the underweight group, and 0.913 for the normal-weight group. The skewness and kurtosis values for all three groups were also within a reasonable range (skewness between -1 and +1; kurtosis between -2 and +2), so the ALT-PE data for each group can be considered to follow a normal distribution.

Table 4. Results of Levene's Test for Homogeneity of Variances

Variable	F	df1	df2	p
ALT-PE	2.72	2	57	.074

Levene's test of homogeneity yielded F(2, 57) = 2.72 with p = 0.074 (Table 4). Since the significance value is above 0.05, the variances of ALT-PE across the three BMI groups are considered homogeneous, thus fulfilling the assumption for further parametric analysis.

Table 5. Results of the One-Sample t-Test (Reference Value 50%)

N	Mean (%)	SD	t	df	p	Mean Diff.	Cohen's d
60	34.7	7.50	-15.8	59	<.001	-15.3	-2.04

The first hypothesis was tested using a one-sample t-test with a reference value of 50%. Of the 60 students studied, the overall average ALT-PE score was 34.7% (SD = 7.50). The test results showed t(59) = -15.8 with p < 0.001 and a Cohen's d effect size of -2.04, which is classified as very large (Table 5). These findings confirm that the level of students' physical engagement during physical education classes in Kraton Subdistrict remains far below the 50% standard recommended by Siedentop et al. (1982), with an average difference of approximately 15.3 percentage points.

Table 6. Results of One-Way ANOVA (Welch)

Variable	F	df1	df2	p
ALT-PE	189.00	2	34.9	<.001

The results of the one-way ANOVA with Welch's correction showed a significant difference in ALT-PE between BMI groups, F(2, 34.9) = 189.00, p < 0.001 (Table 6). The large F-value indicates that the variation in means between groups is far more dominant than the variation within each group.

Table 7. Results of Tukey's Post Hoc Test

Group Comparison	Mean Difference	p	Description
Overweight vs. Underweight	-0.25	.966	Not significant
Overweight vs. Normal Weight	-14.5	<.001	Significant
Underweight vs. Normal	-14.2	<.001	Significant

Tukey's post hoc test (Table 7) showed that significant differences occurred only between the obese group and the normal-weight group (mean difference -14.5; p < 0.001) and between the underweight group and the normal-weight group (mean difference -14.2; p< 0.001). Conversely, no significant difference was found between the obese and underweight groups (mean difference -0.25; p = 0.966), indicating that both groups exhibited relatively equivalent levels of physical activity.

Discussion (مناقشة)

The finding that students' average ALT-PE score (34.7%) was significantly below the 50% standard reinforces the general picture reported by McKenzie and Lounsbery (2013), who noted that most of the Physical Education class time is still consumed by classroom management, verbal instruction, and waiting time, rather than by students' active movement. This situation indicates that the already limited duration of physical education classes at elementary school (70–120 minutes per week) has not been optimally utilized to support students' fitness and motor skills development.

The differences in ALT-PE across BMI categories found in this study are consistent with the findings of Dreiskämper, Tietjens, Honemann, Naul, and Freund (2020) as well as Ortega, Ruiz, Castillo, and Sjöström (2008), who both reported an association between body weight status and children's motor ability. Students with normal nutritional status in this study recorded the highest ALT-PE scores, consistent with the findings of Mayrhofer et al. (2024) that children with normal BMI have better cardiorespiratory fitness and muscle strength compared to overweight children. Physiologically, a proportional body composition allows students to move more nimbly and not tire as quickly, thereby increasing their chances of remaining in the "Motor Appropriate"

category during class.

Interestingly, the underweight group in this study actually showed ALT-PE levels equivalent to those of the overweight group, rather than higher. This pattern supports the idea put forward by Fairclough and Stratton (2005) that students' physical activity participation does not depend solely on the direction of body weight deviation, but rather on overall physical readiness. Students with a low BMI are thought to have limited energy reserves and muscle mass, thereby reducing their ability to sustain active movement over extended periods—a finding consistent with the pattern identified by Ługowska et al. (2022), who noted that sufficient physical activity at school plays a crucial role in maintaining a healthy body weight, including preventing the persistence of malnutrition.

Although BMI status has been shown to be associated with ALT-PE, studies by Bailey (2006) and Morgan and Hansen (2008) highlight that student engagement in physical education is also significantly influenced by teachers' competence in managing the classroom and designing engaging activities. This means that physical condition is not the sole determinant; inclusive learning strategies still have the potential to improve students' ALT-PE across all BMI categories. This is supported by the findings of Munn et al. (2022), who showed that adaptively designed physical activity programs can boost ALT-PE achievement to over 50% even among students with certain limitations.

These findings have practical implications: Physical Education teachers in Kraton Subdistrict need to take into account the varying physical conditions of students when designing learning activities—for example, by modifying games, implementing station-based learning, and differentiating movement tasks—in line with the student-centered learning philosophy of the Merdeka Curriculum. Regular monitoring of nutritional status and collaboration with parents are also important to ensure that improvements in ALT-PE go hand in hand with improvements in students' nutritional status, as emphasized by Gupta and Lal (2024) in their review of school-based physical activity programs.

This study has several limitations. The sample scope is limited to a single subdistrict, so the results should be generalized with caution. This study also considers only BMI as a distinguishing variable, even though ALT-PE can be influenced by many other factors, such as motor skills, learning motivation, and the quality of teachers' instruction. Direct observation-based assessments, even when using standardized instruments, still leave room for observer subjectivity.

Conclusion (خاتمة)

This study reached two primary conclusions. First, the average ALT-PE among elementary school students in Kraton Subdistrict was 34.7%, significantly below the recommended 50% standard for effective physical education. Second, significant differences existed across BMI categories: students with normal nutritional status achieved the highest ALT-PE (44.2%), while underweight (30.0%) and overweight (29.8%) students showed substantially lower and statistically equivalent engagement levels.

Practical Implications

These findings demonstrate that nutritional status is meaningfully associated with students' motor engagement during PJOK lessons. Physical education teachers are therefore encouraged to move beyond uniform instructional approaches and adopt more inclusive, differentiated strategies. Such strategies may include modifying task difficulty, adjusting equipment or space requirements, providing varied activity options, and offering individualized

support so that students across the BMI spectrum can experience meaningful physical engagement. School administrators and curriculum developers should also consider allocating greater attention to lesson structure and time management in order to reduce non-instructional time (e.g., excessive waiting or lengthy explanations) and maximize opportunities for active participation.

Research Limitations

Several limitations should be acknowledged. The sample size of 60 students, although balanced across BMI categories, remains relatively small and was drawn from only ten schools within a single subdistrict, limiting the generalizability of the findings to broader populations. The cross-sectional design captures ALT-PE and BMI at a single point in time and therefore cannot establish causal relationships or track changes over the school year. In addition, the study focused solely on BMI category and did not control for potentially influential variables such as prior motor skill level, physical fitness, motivation, teacher pedagogical quality, or class size. Finally, although inter-observer reliability procedures were implemented, observation-based data remain susceptible to residual coding subjectivity.

Recommendations for Future Research

Future studies should recruit larger and more geographically diverse samples to strengthen external validity. Longitudinal or quasi-experimental designs would allow researchers to examine how ALT-PE and nutritional status interact over time and to evaluate the effectiveness of differentiated instructional interventions. Incorporating additional variables—such as fundamental motor skill proficiency, cardiovascular fitness, student motivation, teaching quality, and classroom management practices—would provide a more comprehensive model of the factors that shape academic learning time in physical education. Mixed-methods approaches that combine systematic observation with teacher and student interviews could further enrich understanding of the contextual barriers and facilitators of active engagement in Indonesian elementary schools.

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