

Relationship Between Physical Fitness Levels And Academic Achievement In Physical Education

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ABSTRACT

Physical fitness is an important component of students' readiness to participate effectively in Physical Education, Sports, and Health (PJOK) learning. Adequate fitness may support endurance, concentration, and active participation, which in turn can contribute to learning achievement. This study aimed to determine the physical fitness level, PJOK academic achievement, and the relationship between both variables among eleventh-grade students at Palopo State High School No. 3. A quantitative approach with an ex post facto descriptive-correlational design was employed. The population consisted of 430 eleventh-grade students, from which 40 students were selected using simple random sampling. Physical fitness was measured using the Tes Kebugaran Pelajar Nusantara (TKPN), consisting of the V-Sit and Reach, 60-second Sit-Up, 30-second Squat Thrust, and Progressive Aerobic Cardiovascular Endurance Run (PACER), with Body Mass Index (BMI) recorded as supporting data. PJOK academic achievement was obtained from students' report-card scores. Data were analyzed using descriptive statistics, the Shapiro-Wilk normality test, Pearson's product-moment correlation, and simple linear regression. The results showed that the mean physical fitness score was 2.9638 ± 0.84489 , with 45.0% of students classified in the fair category. PJOK academic achievement had a mean score of 92.23 ± 2.869 , with 62.5% of students classified as excellent and 37.5% as good. Pearson correlation analysis revealed a positive and statistically significant relationship between physical fitness and PJOK academic achievement ($r = 0.436$, $p = 0.005$). The coefficient of determination was approximately 19.0%. In conclusion, better physical fitness was moderately associated with higher PJOK academic achievement, although other factors also contributed to students' learning outcomes.

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INTRODUCTION

Education is a systematic process through which cognitive, affective, and psychomotor competencies are developed to improve the quality of human resources. Within this framework, Physical Education, Sports, and Health (Pendidikan Jasmani, Olahraga, dan Kesehatan [PJOK]) occupies a distinctive position because learning

occurs through movement while simultaneously promoting knowledge, attitudes, motor competence, physical fitness, discipline, and healthy lifestyles. Physical education should therefore not be regarded merely as recreational activity but as an educational process that contributes to students' holistic development through appropriately structured physical experiences (Mendrofa, 2021; Mappaompo & Sudirman, 2023).

Physical fitness constitutes an important foundation for students' participation in learning. It reflects an individual's capacity to perform daily activities efficiently without excessive fatigue while retaining sufficient energy for additional activities (Salam, 2024). Among adolescents, adequate fitness is particularly important because secondary-school learning requires sustained concentration, psychological readiness, and active participation in both classroom and practical activities. Regular physical activity can improve cardiovascular function, muscular endurance, metabolic health, and general physical capacity (Hong & Lee, 2020; Bull et al., 2020). Physical activity has also been associated with psychological benefits, including improved well-being, reduced psychological distress, and greater self-confidence, which may indirectly facilitate students' readiness to learn (Rodriguez-Ayllon et al., 2019; White et al., 2024).

This issue becomes particularly relevant in PJOK because academic achievement involves cognitive, affective, and psychomotor performance. Students are expected not only to understand concepts but also to demonstrate movement skills, participate actively, and display positive learning attitudes (Sari et al., 2025). Preliminary observations at Palopo State High School No. 3 indicated substantial variation in students' physical condition. Some students demonstrated good endurance and sustained participation during PJOK activities, whereas others fatigued relatively quickly and showed lower engagement. Such differences raise an important empirical question concerning whether variations in physical fitness are systematically associated with differences in students' PJOK academic achievement.

Contemporary evidence increasingly positions physical fitness as an educationally relevant factor rather than exclusively a health-related outcome. Physical fitness comprises interconnected attributes such as cardiorespiratory endurance, muscular strength and endurance, speed, flexibility, and other capacities required for efficient movement (Hasanuddin et al., 2022). Cardiorespiratory fitness is especially important during adolescence because it reflects the body's ability to sustain prolonged activity and has consistently been associated with broader health indicators (Lang et al., 2018; Utomo et al., 2024). Moreover, physical fitness develops through the interaction of physical activity, nutritional status, lifestyle, biological characteristics, and environmental conditions (Ana & Sartika, 2021; Bragazzi et al., 2025).

Evidence from educational and exercise-science research suggests several mechanisms through which fitness may support learning. Regular physical activity can enhance cerebral blood flow, neuroplasticity, executive functioning, attention, and cognitive performance (Donnelly et al., 2016; Lubans et al., 2016). Systematic reviews have further demonstrated that physical activity and fitness interventions can generate positive effects on cognition and academic outcomes among children and adolescents,

although the magnitude of these associations differs according to fitness indicators, study design, and academic measures (Álvarez-Bueno et al., 2017; Singh et al., 2019; de Greeff et al., 2018).

Empirical findings within school populations reinforce this relationship. Physically active students tend to demonstrate stronger classroom engagement, concentration, and readiness to learn (Mayes et al., 2022; Song & Lin, 2022). In the Indonesian educational context, Gustiawan et al. (2020) reported that students with better physical conditions tended to participate more actively in learning and practical activities. Putri et al. (2024) similarly identified physical fitness as an important correlate of students' academic performance, while Adjie et al. (2024) emphasized the contribution of physical activity to classroom participation and learning achievement. Abrilian and Maksum (2024) further demonstrated a favorable relationship between physical fitness and student learning outcomes.

Nevertheless, academic achievement is multidimensional and cannot be attributed to fitness alone. Motivation, learning readiness, family support, school environment, nutritional adequacy, and habitual physical activity can contribute to educational outcomes (Ana & Sartika, 2021; Angelia et al., 2023; Mappaompo & Sudirman, 2023). This complexity makes contextual empirical assessment essential rather than assuming that associations identified in other populations will automatically apply to Indonesian senior high-school students.

Despite the expanding literature, three gaps remain relevant. First, much of the international evidence has investigated the relationship between physical activity or cardiorespiratory fitness and general academic performance, cognitive function, or standardized academic outcomes (Donnelly et al., 2016; Álvarez-Bueno et al., 2017; de Greeff et al., 2018; Singh et al., 2019). Comparatively less attention has been directed toward academic achievement specifically within PJOK, where successful learning depends simultaneously on cognitive understanding, affective engagement, and psychomotor performance.

Second, Indonesian studies have reported associations among physical activity, fitness, motivation, and learning outcomes (Gustiawan et al., 2020; Mappaompo & Sudirman, 2023; Abrilian & Maksum, 2024; Putri et al., 2024), but evidence remains geographically and methodologically fragmented. Findings derived from one student population cannot necessarily represent students in other regions because school environments, physical activity opportunities, lifestyle patterns, and learner characteristics differ.

Third, limited empirical evidence specifically addresses 11th-grade students at Palopo State High School No. 3 by combining PJOK academic achievement data with fitness assessment using the Tes Kebugaran Pelajar Nusantara (TKPN). This constitutes an important contextual and methodological gap. Using a standardized national student fitness assessment provides a more relevant basis for characterizing Indonesian students' physical fitness and examining its educational implications. Accordingly, the present study moves beyond merely describing fitness status by testing whether

variation in measured physical fitness corresponds with variation in PJOK academic achievement.

Based on these gaps, this study aims to (1) identify the physical fitness levels of 11th-grade students at Palopo State High School No. 3 using the TKPN, (2) describe students' academic achievement in PJOK, and (3) analyze the relationship between physical fitness levels and PJOK academic achievement. The study is based on the proposition that students with higher physical fitness are more capable of sustaining participation, concentration, and physical performance during PJOK learning and may consequently demonstrate better learning achievement.

The novelty of this study lies in its population-specific, measurement-based, and subject-specific approach. Rather than examining physical activity behavior alone or relying exclusively on self-reported fitness, this research employs the TKPN as a standardized Indonesian assessment and relates the resulting fitness profiles directly to PJOK academic achievement among upper-secondary students in Palopo. This approach contributes locally grounded evidence to the broader international discussion concerning physical fitness and educational outcomes while simultaneously providing practical information for PJOK teachers regarding the educational relevance of systematic fitness assessment.

In summary, physical fitness represents an important intersection between adolescent health, learning readiness, physical participation, and educational achievement. Although previous research generally supports positive relationships among physical activity, fitness, cognitive functioning, and academic outcomes, evidence specifically connecting standardized physical fitness assessment with PJOK achievement among Indonesian senior high-school students remains limited. By examining 11th-grade students at Palopo State High School No. 3 using the TKPN, this study addresses a specific contextual and methodological gap. Its findings are expected to clarify whether physical fitness is meaningfully associated with PJOK academic achievement and provide an empirical basis for developing more fitness-oriented, measurable, and evidence-based physical education programs in Indonesian secondary schools.

METHODS

This study employed a quantitative ex post facto approach with a descriptive correlational design to investigate the relationship between physical fitness level and academic achievement in Physical Education, Sports, and Health (PJOK) without manipulating the variables under investigation. A correlational design is appropriate when the primary objective is to estimate the direction and magnitude of an association between naturally occurring quantitative variables rather than establish an experimental causal effect (Sugiyono, 2024; Behringer et al., 2022). The study was conducted in January 2026 at Palopo State High School No. 3. The population comprised 430 eleventh-grade students enrolled in the 2025–2026 academic year, from whom 40 students were

selected using simple random sampling. This probability-based procedure was applied to provide each eligible student with an equal opportunity for selection and to minimize systematic selection bias (Firmansyah, 2022).

Physical fitness was specified as the independent variable, whereas PJOK academic achievement was treated as the dependent variable. Physical fitness was assessed using the Tes Kebugaran Pelajar Nusantara (TKPN) developed by the Indonesian Ministry of Youth and Sports as a standardized national framework for monitoring student fitness (Ministry of Youth and Sports of the Republic of Indonesia, 2024). The TKPN included Body Mass Index (BMI) as supporting body-composition information and four performance components: V-Sit and Reach for flexibility, 60-second Sit-Up for abdominal muscular endurance, 30-second Squat Thrust for strength-endurance performance, and the Progressive Aerobic Cardiovascular Endurance Run (PACER) for cardiorespiratory endurance. Recent validation research has specifically examined BMI, V-Sit and Reach, Sit-Up, Squat Thrust, PACER, and the overall TKPN construct, supporting its application in Indonesian student fitness assessment (Hasibuan et al., 2024). Field-based fitness testing is also considered practical for school populations because it permits standardized assessment of multiple fitness dimensions with limited equipment (Krochmal et al., 2021). PACER-based assessment is particularly relevant for estimating aerobic capacity among children and adolescents (Scott et al., 2019).

Before testing, participants received standardized instructions concerning procedures, correct movement execution, test sequence, and safety requirements. Students wore appropriate sports clothing and athletic shoes. Standardized administration was emphasized because consistency of procedures improves the comparability and interpretability of field-based fitness measurements (Johanis et al., 2025).

PJOK academic achievement was obtained from students' official report-card grades, representing accumulated assessment of cognitive, affective, and psychomotor competencies during the relevant academic period (Astuti et al., 2022). Data were analyzed using SPSS version 20. Descriptive statistics were calculated first, followed by the Shapiro-Wilk test to evaluate normality; this procedure is particularly appropriate for relatively small samples (Mishra et al., 2019; Habibzadeh, 2024). Subsequently, Pearson's product-moment correlation was used to determine the strength and direction of the linear association between physical fitness and PJOK achievement, followed by simple linear regression to estimate the contribution of physical fitness to variation in academic achievement. Statistical significance was established at $p < .05$.

RESULTS AND DISCUSSION

Result

The results of this study describe the physical fitness levels and Physical Education, Sports, and Health (PJOK) academic achievement of 40 eleventh-grade

students at Palopo State High School No. 3. The analysis consisted of descriptive statistics, classification of physical fitness and academic achievement, assumption testing, Pearson product-moment correlation, and simple linear regression.

Descriptive Statistics

Descriptive statistics were used to provide an overview of the distribution of physical fitness scores and PJOK academic achievement scores. The results are presented in Table 1.

Table 1.

Descriptive Statistics of Physical Fitness and Academic Achievement

Variable	N	Minimum	Maximum	Mean	SD
Physical Fitness	40	1.15	4.15	2.9638	0.84489
PJOK Academic Achievement	40	86	97	92.23	2.869

As shown in Table 1, all 40 students provided complete data for both study variables. Physical fitness scores ranged from 1.15 to 4.15, with a mean of 2.9638 (SD = 0.84489). This average indicates that, overall, the students demonstrated a moderate level of physical fitness. Meanwhile, PJOK academic achievement scores ranged from 86 to 97, with a mean of 92.23 (SD = 2.869). These results indicate that the students generally demonstrated high academic achievement in PJOK despite greater variability in their physical fitness levels.

Distribution of Physical Fitness Levels

To provide a clearer interpretation of students' physical condition, the physical fitness scores were classified into five categories. The distribution is presented in Table 2.

Table 2.

Distribution of Physical Fitness Level Categories

Physical Fitness Category	Frequency (n)	Percentage (%)
Excellent	0	0.0
Good	9	22.5
Fair	18	45.0
Poor	10	25.0
Very Poor	3	7.5
Total	40	100.0

Table 2 shows that the largest proportion of students was classified in the **fair** physical fitness category, comprising 18 students (45.0%). Nine students (22.5%) were classified as having good physical fitness, while 10 students (25.0%) were categorized as poor and three students (7.5%) as very poor. No students (0.0%) reached the excellent category. Overall, 32.5% of the sample remained in the poor or very poor categories, whereas only 22.5% achieved the good category. These results demonstrate that the physical fitness profile of the sample was predominantly moderate and that considerable variation existed among students.

Distribution of PJOK Academic Achievement

Students' PJOK academic achievement was also classified into five performance categories. The results are presented in Table 3.

Table 3.
 Distribution of PJOK Academic Achievement Categories

Academic Achievement Category	Frequency (n)	Percentage (%)
Excellent	25	62.5
Good	15	37.5
Fair	0	0.0
Poor	0	0.0
Very Poor	0	0.0
Total	40	100.0

As presented in Table 3, 25 students (62.5%) were classified in the excellent category for PJOK academic achievement, while the remaining 15 students (37.5%) were classified in the good category. None of the respondents was categorized as fair, poor, or very poor. These findings demonstrate a concentration of academic achievement at the upper end of the classification range, indicating that the participating students generally achieved favorable learning outcomes in PJOK.

Normality Test

Before inferential analysis was conducted, the normality assumption was examined using the Shapiro-Wilk test. The results are shown in Table 4.

Table 4.
 Shapiro-Wilk Normality Test

Variable	Shapiro-Wilk Statistic	df	Sig.
Physical Fitness	0.959	40	0.155
PJOK Academic Achievement	0.951	40	0.082

The Shapiro-Wilk test showed a significance value of $p = 0.155$ for physical fitness and $p = 0.082$ for PJOK academic achievement. Both values exceeded the predetermined significance level of 0.05. Therefore, there was insufficient evidence to reject the assumption of normality for either variable. Consequently, the data were considered appropriate for parametric analysis using Pearson's product-moment correlation.

Relationship Between Physical Fitness and PJOK Academic Achievement

Pearson's product-moment correlation was used to determine the direction and strength of the relationship between students' physical fitness and PJOK academic achievement. The results are presented in Table 5.

Table 5.
 Pearson Correlation Between Physical Fitness and PJOK Academic Achievement

Variables	r	Sig. (2-tailed)	Interpretation
Physical Fitness × PJOK Academic Achievement	0.436	0.005	Moderate positive, significant

The correlation analysis yielded $r = 0.436$ with $p = 0.005$. Because the significance value was below 0.05, the relationship between physical fitness and PJOK academic achievement was statistically significant. The positive correlation coefficient indicates

that students with higher physical fitness scores tended to obtain higher PJOK academic achievement scores. Based on the magnitude of the correlation coefficient, the relationship can be interpreted as moderate and positive.

The coefficient of determination derived from the correlation coefficient was approximately $R^2 = 0.190$, indicating that about 19.0% of the variation shared between PJOK academic achievement and physical fitness was represented by the linear model. The remaining variation was associated with other factors not examined in the present analysis.

Simple Linear Regression Analysis

Simple linear regression was conducted to further examine the statistical relationship between physical fitness as the predictor variable and PJOK academic achievement as the outcome variable. The reported regression coefficients are shown in Table 6.

Table 6.

Simple Linear Regression of Physical Fitness on PJOK Academic Achievement

Model	B	Std. Error	Standardized Beta	t	Sig.
Constant	84.602	2.585	–	32.734	<0.001
Physical Fitness	0.038	0.013	0.436	2.988	0.005

The regression analysis indicated that physical fitness was a statistically significant predictor of PJOK academic achievement ($\beta = 0.436$, $t = 2.988$, $p = 0.005$). The positive standardized coefficient confirms the direction observed in the Pearson correlation analysis: higher levels of physical fitness were associated with higher PJOK academic achievement. Thus, the null hypothesis stating that there is no significant relationship between physical fitness and PJOK academic achievement was rejected.

Overall, the results demonstrate a positive and statistically significant relationship between physical fitness and PJOK academic achievement among eleventh-grade students at Palopo State High School No. 3. Although most students demonstrated excellent or good academic achievement, their physical fitness levels were more heterogeneous and predominantly fell within the fair category. The inferential findings nevertheless indicate that students with better physical fitness tended to demonstrate higher levels of achievement in Physical Education, Sports, and Health.

Discussion

The present study demonstrates that the physical fitness profile of eleventh-grade students at Palopo State High School No. 3 was predominantly moderate, with a mean score of 2.9638 ± 0.84489 . Specifically, 45.0% of students were classified in the fair category, whereas 22.5% were good, 25.0% were poor, and 7.5% were very poor; no students reached the excellent category. This distribution indicates that although most students possessed sufficient functional capacity to participate in school-based physical activities, substantial scope remains for improving their overall fitness. Physical fitness represents the integrated capacity to perform physical tasks efficiently without excessive fatigue and is fundamental to adolescents' participation in sustained physical

activity (Salam, 2024; Lang et al., 2018). School-aged adolescents with higher physical activity levels generally demonstrate more favorable cardiorespiratory and muscular fitness profiles (Bull et al., 2020; García-Hermoso et al., 2020). Accordingly, the absence of students in the excellent category deserves attention because adolescence is a critical developmental period for establishing active lifestyle behaviors that may persist into adulthood.

In contrast to the heterogeneous fitness profile, PJOK academic achievement was consistently high. The mean achievement score was 92.23 ± 2.869 , with 62.5% of students classified as excellent and 37.5% as good. These findings suggest that students were generally successful in attaining PJOK learning competencies. Academic achievement in physical education is multidimensional because it reflects not only knowledge acquisition but also practical performance, participation, attitudes, and learning engagement (Shamad et al., 2023; Mappaompo & Sudirman, 2023). Consequently, high PJOK grades among students with varying fitness levels are plausible because assessment outcomes can incorporate cognitive and affective competencies in addition to physical performance.

The principal finding was a moderate, positive, and statistically significant relationship between physical fitness and PJOK academic achievement ($r = 0.436$, $p = 0.005$). Approximately 19.0% of the variation represented by the linear relationship was associated with physical fitness ($R^2 \approx 0.190$). Thus, students with better physical fitness tended to demonstrate higher PJOK achievement. This result supports previous Indonesian evidence indicating that physically fit or physically active students tend to display stronger learning participation and educational outcomes (Nugraha & Wibowo, 2021; Samsidar et al., 2022; Marsanda & Kurniawan, 2023; Masagena & Fernando, 2024; Abrilian & Maksum, 2024). International evidence similarly suggests favorable associations among physical activity, physical fitness, cognition, and academic performance in school-aged populations (Donnelly et al., 2016; Álvarez-Bueno et al., 2017; de Greeff et al., 2018; Singh et al., 2019).

Several physiological and cognitive mechanisms may explain this relationship. Regular physical activity and higher cardiorespiratory fitness may facilitate cerebral blood flow, oxygen delivery, neuroplasticity, and neural processes involved in attention and executive functioning (Lubans et al., 2016; Hillman et al., 2019). Evidence also indicates that physical activity interventions can positively influence executive function, attention, and academic-related cognitive performance in children and adolescents (de Greeff et al., 2018; Xue et al., 2019; Álvarez-Bueno et al., 2020). Song and Lin (2022) similarly emphasized the relationship between physical activity and cognitive functioning. In the specific context of PJOK, these mechanisms may operate alongside improved muscular endurance and movement capacity, enabling fitter students to maintain participation and technical performance throughout practical learning sessions.

Psychological mechanisms should also be considered. Physical activity has been associated with more favorable mental health, psychological well-being, self-perception, and reduced symptoms of psychological distress among young people

(Rodriguez-Ayllon et al., 2019; Biddle et al., 2019; White et al., 2024). Such characteristics may indirectly support motivation, classroom engagement, and learning readiness. Students who experience less fatigue and greater physical self-efficacy may participate more confidently in PJOK activities, creating additional opportunities to practice movement skills and satisfy learning objectives (Samsidar et al., 2022; Umar et al., 2025).

An important methodological feature of this study was the use of the Tes Kebugaran Pelajar Nusantara (TKPN). Unlike relying exclusively on self-reported physical activity, TKPN provides direct field-based information through fitness indicators relevant to Indonesian students. Its components address complementary dimensions: V-Sit and Reach represents flexibility, Sit-Up assesses abdominal muscular endurance, Squat Thrust captures repeated whole-body strength-endurance capacity, and PACER reflects cardiorespiratory endurance. Comprehensive fitness assessment is important because physical fitness is multidimensional rather than represented by a single performance characteristic (Hasanuddin et al., 2022; Mustafa, 2022). Field-based testing is particularly appropriate in educational environments because it permits feasible assessment of relatively large student groups while maintaining standardized procedures (Krochmal et al., 2021). Cardiorespiratory fitness measured through PACER-type protocols is especially relevant because aerobic fitness is an important health-related indicator during childhood and adolescence (Lang et al., 2018; Scott et al., 2019).

Nevertheless, the moderate magnitude of $r = 0.436$ is theoretically important. It demonstrates that physical fitness is associated with, but does not independently determine, PJOK academic achievement. The approximate R^2 of 0.190 indicates that substantial variation remains beyond physical fitness. Educational achievement is shaped by interacting factors such as learning motivation, nutritional status, teaching quality, parental support, socioeconomic circumstances, sleep, habitual physical activity, and the school learning environment (Ana & Sartika, 2021; Nur Hidayah et al., 2023; Angelia et al., 2023; Mappaompo & Sudirman, 2023). Therefore, the present relationship should not be interpreted causally, particularly because the ex post facto correlational design does not establish temporal or experimental causation.

From a practical perspective, these findings support strengthening structured physical activity and fitness-development opportunities within schools. Regular, developmentally appropriate physical activity can contribute to adolescent fitness without compromising academic learning (Donnelly et al., 2016; Bull et al., 2020). PJOK teachers may therefore use standardized fitness assessments not merely for grading but as diagnostic information for designing differentiated activities targeting cardiorespiratory endurance, muscular endurance, flexibility, and overall movement capacity. Schools should simultaneously promote active lifestyles, adequate sports facilities, healthy nutrition, and supportive learning environments. Overall, the findings reinforce physical fitness as a meaningful component of educational development while demonstrating that optimal PJOK achievement requires an integrated approach addressing students' physical, cognitive, psychological, and environmental determinants.

CONCLUSION

This study concludes that the physical fitness level of eleventh-grade students at Palopo State High School No. 3 was generally in the moderate category, whereas their academic achievement in Physical Education, Sports, and Health (PJOK) was predominantly high. The mean physical fitness score was 2.9638 ± 0.84489 , with 45.0% of students classified in the fair category, 22.5% in the good category, 25.0% in the poor category, and 7.5% in the very poor category. No students reached the excellent fitness category. In contrast, PJOK academic achievement showed a mean score of 92.23 ± 2.869 , with 62.5% of students categorized as excellent and 37.5% as good.

Inferential analysis demonstrated a positive and statistically significant relationship between physical fitness and PJOK academic achievement ($r = 0.436$, $p = 0.005$). The magnitude of the correlation indicates a moderate association, while the coefficient of determination of approximately 19.0% suggests that physical fitness represents one meaningful factor associated with students' PJOK achievement. However, because the study employed an ex post facto correlational design, the findings should not be interpreted as evidence of a direct causal effect.

These results emphasize the educational relevance of maintaining and improving students' physical fitness. Schools and PJOK teachers are therefore encouraged to provide structured and regular physical activity, fitness monitoring, sports participation opportunities, and healthy lifestyle education. Such programs should be integrated with motivational, nutritional, and instructional support because academic achievement is influenced by multiple interacting factors. Future studies should involve larger samples, additional schools, and multivariable analyses to clarify the relative contribution of physical fitness alongside other determinants of PJOK learning outcomes.

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