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Learning motivation and parental attention predict physical education outcomes through physical fitness in elementary students

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ABSTRACT

This study examined direct and indirect relationships of learning motivation and parental attention with Physical Education, Sports, and Health learning outcomes through physical fitness among elementary students. A quantitative path-analysis design involved 55 students selected through purposive sampling. Data were collected using questionnaires, fitness assessments, and learning records. Learning motivation and parental attention significantly predicted physical fitness ($\beta=0.532$ and $\beta=0.383$), explaining 46.4% of its variance. Parental attention showed the strongest direct association with learning outcomes ($\beta=0.573$), followed by physical fitness ($\beta=0.266$) and learning motivation ($\beta=0.141$), collectively explaining 38.9% of outcome variance. Physical fitness mediated pathways from learning motivation ($\beta=0.142$) and parental attention ($\beta=0.102$) to learning outcomes. Physical education achievement reflects interconnected motivational, familial, and physical factors, highlighting the importance of integrated student support.



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Introduction

Physical Education, Sports, and Health is an integral component of elementary education that promotes physical, cognitive, affective, and social development through structured movement and learning experiences. Accordingly, Physical Education, Sports, and Health learning outcomes should not be understood solely as indicators of motor performance but as educational achievements encompassing students' knowledge, physical and motor competencies, participation, and ability to apply healthy-lifestyle principles. Physical fitness is particularly relevant within this context because adequate fitness may enable students to sustain participation, perform movement tasks effectively, and meet the physiological demands embedded in physical education learning and assessment. Nevertheless, much of the available evidence has examined physical fitness in relation to general cognitive or academic outcomes rather than achievement specifically within physical education. Systematic evidence generally demonstrates positive associations among physical activity, physical fitness, cognitive functioning, and academic achievement in school-aged populations, although the magnitude and consistency of these relationships vary considerably across fitness components, study designs, and outcome measures (Kolovelonis et al., 2022; Martín-Rodríguez & Madrigal-Cerezo, 2025; Haug et al., 2023; J. Wang et al., 2025).

Beyond physical capacity, learning motivation represents an important psychological resource that may shape students' engagement and achievement in Physical Education, Sports, and Health. Motivation influences students' willingness to initiate learning activities, sustain effort, persist when facing difficulties, and participate actively in movement-based tasks. These behavioral manifestations provide a plausible link between motivation and physical fitness because students who consistently engage, exert effort, and persist in physically demanding activities may have greater opportunities to develop their physical capacities. Evidence from physical education research indicates that autonomous motivation is associated with adaptive learning outcomes, continued physical activity, and positive engagement, while satisfaction of basic psychological needs can strengthen autonomous motivation and achievement-related behaviors (Rosenkranz et al., 2023; Su & Liu, 2025). Thus, learning motivation may be associated with Physical Education, Sports, and Health achievement both directly through greater engagement in the learning process and indirectly through behavioral participation related to physical competence and fitness development (Jankauskiene et al., 2022; Sun et al., 2024).

The family environment provides a complementary contextual influence on children's educational and physical development. In the present study, parental attention refers specifically to the attention children perceive from parents in relation to their learning and development, whereas the broader literature frequently conceptualizes related constructs as parental support or parental involvement. Although these constructs should not be treated as interchangeable, evidence concerning parental support and involvement provides a relevant conceptual basis for understanding how parental attention may operate through encouragement, supervision, provision of learning resources, facilitation of physical activity opportunities, and reinforcement of healthy routines. Such behaviors may influence educational achievement while simultaneously creating conditions that support children's active lifestyles and physical development. Systematic evidence identifies parental encouragement, logistical assistance, and parent-child co-participation as important components associated with children's physical activity; however, intervention findings remain heterogeneous, indicating that the mechanisms connecting family-related factors with physical behavior and educational outcomes remain insufficiently established (Lawler et al., 2022; Yang et al., 2022).

Physical fitness may therefore represent a plausible intermediate mechanism connecting psychological and family-related resources with Physical Education, Sports, and Health learning outcomes. Conceptually, motivation may encourage sustained participation and effort in physical activities, while parental attention may facilitate opportunities, encouragement, and routines that support such participation; repeated engagement may, in turn, be associated with better physical fitness. Within Physical Education, Sports, and Health, higher fitness may enable students to sustain movement, execute physical tasks, and participate more effectively in performance-based learning activities, thereby providing a potential pathway to better learning outcomes. Existing evidence supports associations between physical fitness and cognitive processes relevant to learning, including attention, executive functioning, and information processing, although the strength of these associations varies across fitness components and educational outcomes (Huhtiniemi et al., 2022; Septiantoko et al., 2024). Importantly, these findings do not establish physical fitness as a mediator by themselves, but they provide a theoretical basis for examining whether fitness represents an intermediate pathway linking psychosocial resources with Physical Education, Sports, and Health achievement (Li et al., 2025; Lin et al., 2024).

Despite growing evidence concerning these individual relationships, an important gap remains in understanding how learning motivation, parental attention, physical fitness, and Physical Education, Sports, and Health learning outcomes operate simultaneously among elementary-school students. Previous research has largely examined motivational processes in relation to engagement or achievement, parental factors in relation to physical activity or general academic outcomes, and physical fitness in relation to cognitive or academic performance. Consequently, these findings establish relevant pairwise relationships but provide limited evidence regarding whether psychological and family-related resources are associated with Physical Education, Sports, and Health achievement through a physical-fitness pathway. This limitation is particularly important in elementary education, where parental influence remains substantial and physical education requires simultaneous psychological engagement and physical participation. Furthermore, methodological heterogeneity across previous studies limits conclusions regarding the mechanisms connecting these domains. Examining these variables within an integrated structural framework may therefore clarify relationships that remain fragmented in the existing literature (J. Chen et al., 2024; Leo et al., 2022; Liu et al., 2025; Yudaparnita & Nirmayani, 2024).

The novelty of the present study therefore lies not merely in applying path analysis but in conceptually integrating psychological, family-related, and physical dimensions within a single model of Physical Education, Sports, and Health achievement among elementary-school students. Specifically, the proposed framework examines whether learning motivation and parental attention are associated with Physical Education, Sports,

and Health learning outcomes directly and whether physical fitness constitutes a plausible intervening pathway linking these factors with achievement. This approach extends previous research that has predominantly considered motivation, parental factors, and physical fitness through separate relationships by examining their simultaneous structural associations within the specific context of elementary-school physical education. Accordingly, this study aimed to examine the direct relationships of learning motivation, parental attention, and physical fitness with Physical Education, Sports, and Health learning outcomes and to estimate the indirect relationships of learning motivation and parental attention with learning outcomes through physical fitness. By adopting this framework, the study seeks to provide a more integrated explanation of how psychological, familial, and physical characteristics are associated with achievement in elementary physical education while avoiding causal assumptions that cannot be established from an observational design (Henning et al., 2022; Sevil-Serrano et al., 2022; L. Wang & Chen, 2022).

Method

This study employed a quantitative observational design with a cross-sectional approach to examine the structural relationships among learning motivation, parental attention, physical fitness, and Physical Education, Sports, and Health learning outcomes. The study was conducted at SDN 106 Pekanbaru, Tenayan Raya District, Pekanbaru, Indonesia, in October 2023. Learning motivation (X1) and parental attention (X2) were specified as exogenous variables, physical fitness (X3) as an intervening variable, and Physical Education, Sports, and Health learning outcomes (Y) as the endogenous variable. The target population comprised students enrolled at SDN 106 Pekanbaru, from whom 55 students were selected using purposive sampling. Eligibility was determined based on an age range of 10–12 years, corresponding to the age classification applied in the physical fitness assessment. The final sample consisted of 32 Grade V students and 23 Grade VI students. Given the purposive sampling procedure, relatively small sample size, and single-school setting, the estimated structural relationships were interpreted specifically within the characteristics of the study sample rather than generalized to the broader population of elementary-school students.

Data were collected using measures corresponding to each study variable. Learning motivation and parental attention were assessed through questionnaires administered directly to the participating students, whereas physical fitness was assessed using a physical fitness test appropriate for the 10–12-year age category. Physical Education, Sports, and Health learning outcomes were obtained from existing school assessment records administered by the subject teacher and represented students' achievement in the subject, including performance-based assessments of relevant physical and motor competencies. Learning motivation, parental attention, physical fitness, and learning outcomes were subsequently coded as X1, X2, X3, and Y, respectively, according to the hypothesized structural model. To ensure methodological transparency and reproducibility, the sources and psychometric properties of the questionnaires, including the number of items, scoring procedures, validity, and reliability, as well as the specific components and scoring criteria of the physical fitness test and school-based learning assessment, should be reported based on the original instrument documentation.

Data were analyzed using IBM SPSS Statistics version 25. Descriptive statistics, including the mean, standard deviation, minimum, and maximum, were calculated to characterize the distribution of each variable. Before testing the structural relationships, statistical assumptions were examined through tests of normality and linearity, while homogeneity was additionally evaluated as reported in the original analysis. Because the proposed model consisted of regression-based structural equations, diagnostic evaluation should also consider potential multicollinearity, influential outliers, and residual behavior when the corresponding diagnostic statistics are available. Path analysis was subsequently performed using two structural equations. The first model estimated the relationships of learning motivation and parental attention with physical fitness, whereas the second model estimated the relationships of learning motivation, parental attention, and physical fitness with Physical Education, Sports, and Health learning outcomes. Accordingly, five direct paths were examined ($X1 \rightarrow X3$, $X2 \rightarrow X3$, $X1 \rightarrow Y$, $X2 \rightarrow Y$, and $X3 \rightarrow Y$), while the indirect pathways $X1 \rightarrow X3 \rightarrow Y$ and $X2 \rightarrow X3 \rightarrow Y$ were estimated to evaluate the proposed intervening role of physical fitness. Statistical significance for direct effects was established at $\alpha = .05$, and the coefficient of determination (R^2) was used to indicate the proportion of variance explained by each structural equation. Indirect effects were calculated as the product of the corresponding path coefficients ($a \times b$); because bootstrapped confidence intervals or other inferential tests of indirect effects were not available in the original analysis, these coefficients were interpreted as estimated indirect associations rather than definitive evidence of statistical mediation.

Results and Discussions

The results were organized to describe the characteristics of the study variables, verify the statistical assumptions, and examine the hypothesized direct and indirect relationships within the path model. Descriptive analysis was first conducted for learning motivation, parental attention, physical fitness, and Physical Education, Sports, and Health learning outcomes, followed by normality, homogeneity, and linearity testing. The structural analysis subsequently evaluated the extent to which learning motivation and parental attention were associated with physical fitness and whether these variables, together with physical fitness, were associated with learning outcomes. Direct, indirect, and total effects were then estimated to clarify the role of physical fitness as an intervening variable. Overall, the findings supported the proposed structural relationships and indicated that motivational, familial, and physical factors were significantly associated with students' learning outcomes.

Table 1. Descriptive Statistics of the Study Variables

Variable	N	Mean	SD	Minimum	Maximum
Learning Motivation (X1)	55	158.18	12.82	130	181
Parental Attention (X2)	55	107.76	5.94	96	119
Physical Fitness (X3)	55	16.38	2.07	12	20
PJOK Learning Outcomes (Y)	55	82.93	3.50	76	88

The descriptive analysis indicated distinct score distributions across the four study variables. Learning motivation had a mean score of 158.18 ± 12.82 , whereas parental attention averaged 107.76 ± 5.94 . Physical fitness yielded a mean score of 16.38 ± 2.07 , while PJOK learning outcomes averaged 82.93 ± 3.50 . The observed ranges were 130–181 for learning motivation, 96–119 for parental attention, 12–20 for physical fitness, and 76–88 for PJOK learning outcomes. These findings provide the empirical profile of the variables subsequently incorporated into the path model.

Table 2. Statistical Assumption Tests for Path Analysis

Assumption	Relationship/Variable	p-value	Criterion	Decision
Normality	Learning Motivation (X1)	0.121	> 0.05	Normal
Normality	Parental Attention (X2)	0.144	> 0.05	Normal
Normality	Physical Fitness (X3)	0.189	> 0.05	Normal
Normality	PJOK Learning Outcomes (Y)	0.067	> 0.05	Normal
Homogeneity	Y across X1	0.834	> 0.05	Homogeneous
Homogeneity	Y across X2	0.355	> 0.05	Homogeneous
Homogeneity	Y across X3	0.150	> 0.05	Homogeneous
Linearity	X1 → Y	0.573	> 0.05	Linear
Linearity	X2 → Y	0.110	> 0.05	Linear
Linearity	X3 → Y	0.386	> 0.05	Linear

The prerequisite analyses supported the application of the specified path model. All four variables satisfied the reported normality criterion, with p-values ranging from 0.067 to 0.189. The homogeneity tests were likewise non-significant, with p-values of 0.834, 0.355, and 0.150 for learning motivation, parental attention, and physical fitness, respectively. Furthermore, the reported tests of deviation from linearity supported linear relationships between each predictor and PJOK learning outcomes, as all corresponding p-values exceeded 0.05. Collectively, these results indicate that the assumptions reported in the thesis were considered satisfied before path analysis was conducted.

Table 3. Structural Models of the Relationships Among Study Variables

Structural Model	Dependent Variable	Predictors	R	R ²	Residual Coefficient*
Model 1	Physical Fitness (X3)	X1, X2	0.684	0.464	0.536
Model 2	PJOK Learning Outcomes (Y)	X1, X2, X3	0.624	0.389	0.611

*Residual coefficients are presented as reported in the source thesis.

The first structural model showed that learning motivation and parental attention jointly accounted for 46.4% of the variation in physical fitness ($R = 0.684$; $R^2 = 0.464$). The corresponding path coefficients were 0.532 for learning motivation and 0.383 for parental attention. In the second structural model, learning motivation, parental attention, and physical fitness jointly explained 38.9% of the variance in PJOK learning outcomes ($R = 0.624$; $R^2 = 0.389$). The resulting structural equation reported in the thesis was $Y = 0.141X1 + 0.573X2 + 0.266X3 + 0.611\varepsilon$. Thus, parental attention exhibited the largest direct path coefficient to PJOK learning outcomes in the final model.

Table 4. Direct Effects in the Path Analysis Model

Path	Path Coefficient (β)	Reported p-value	$\beta^2 \times 100$ (%)	Decision
Learning Motivation $\rightarrow$ PJOK Learning Outcomes	0.141	0.002	1.98	Significant
Parental Attention $\rightarrow$ PJOK Learning Outcomes	0.573	0.002	32.83	Significant
Physical Fitness $\rightarrow$ PJOK Learning Outcomes	0.266	0.004	7.07	Significant
Learning Motivation $\rightarrow$ Physical Fitness	0.532	0.002		Significant
Parental Attention $\rightarrow$ Physical Fitness	0.383	0.004		Significant

All direct paths reported in the thesis were statistically significant. Parental attention demonstrated the strongest direct association with PJOK learning outcomes ($\beta = 0.573$, $p = 0.002$), followed by physical fitness ($\beta = 0.266$, $p = 0.004$) and learning motivation ($\beta = 0.141$, $p = 0.002$). Learning motivation also showed a relatively strong path to physical fitness ($\beta = 0.532$), while parental attention was positively associated with physical fitness ($\beta = 0.383$). Based on the squared path coefficients reported in the thesis, parental attention contributed 32.83% to PJOK learning outcomes, compared with 7.07% for physical fitness and 1.98% for learning motivation.

Table 5. Direct, Indirect, and Total Effects on PJOK Learning Outcomes

Predictor	Direct Effect on Y	Path to X3	X3 $\rightarrow$ Y	Indirect Effect via X3 $\dagger$	Total Effect $\dagger$
Learning Motivation (X1)	0.141	0.532	0.266	0.142	0.283
Parental Attention (X2)	0.573	0.383	0.266	0.102	0.675

$\dagger$ Indirect effects were recalculated from the reported path coefficients using $(a \times b)$; total effects were calculated as direct effect + indirect effect.

The mediation decomposition showed that physical fitness provided an indirect pathway connecting both psychosocial predictors with PJOK learning outcomes. Based on the reported path coefficients, the indirect effect of learning motivation through physical fitness was $0.532 \times 0.266 = 0.142$, producing a total effect of approximately 0.283. For parental attention, the corresponding indirect effect was $0.383 \times 0.266 = 0.102$, resulting in a total effect of approximately 0.675. Therefore, parental attention remained the strongest overall predictor of PJOK learning outcomes, whereas learning motivation demonstrated a comparatively stronger pathway to physical fitness. These findings indicate that students' PJOK achievement was associated with both psychosocial support and physical fitness within the proposed structural framework. The simultaneous model explained 38.9% of the variance in PJOK learning outcomes.

The findings demonstrate that learning motivation, parental attention, and physical fitness are interconnected determinants of students' Physical Education, Sports, and Health (PJOK) learning outcomes. The first structural model showed that learning motivation and parental attention jointly explained 46.4% of the variance in physical fitness ($R = 0.684$; $R^2 = 0.464$), indicating that students' fitness characteristics were meaningfully associated with both individual motivational and family-related factors. In the second model, learning motivation, parental attention, and physical fitness collectively explained 38.9% of the variance in PJOK learning outcomes ($R = 0.624$; $R^2 = 0.389$). These results suggest that achievement in physical education cannot be understood solely as the product of students' physical capacities; rather, it reflects an interaction between psychological readiness, family support, and physical competence. This interpretation is consistent with evidence showing that motivation contributes to academic achievement in physical education and that supportive social environments can facilitate students' motivation and engagement in physical activity and learning (de Bruijn et al., 2022, 2023; Hosokawa et al., 2023; Moon et al., 2024).

Learning motivation demonstrated a significant direct association with PJOK learning outcomes ($\beta = 0.141$, $p = 0.002$), although its estimated direct contribution was relatively modest at 1.98%. More importantly, learning motivation was strongly associated with physical fitness ($\beta = 0.532$, $p = 0.002$), representing the largest path toward the mediating variable. When physical fitness was incorporated into the pathway, the estimated indirect effect of learning motivation on PJOK learning outcomes was $\beta = 0.142$, resulting in a total effect of approximately $\beta = 0.283$. This pattern indicates that motivation may be related to achievement not only directly but also through students' physical condition. Motivated students may be more willing to participate actively, persist during physically demanding tasks, and invest effort in developing movement competencies, thereby creating conditions conducive to better fitness and learning achievement (Cai et al., 2025; S.-C. Chen & Chen,

2021). Previous research similarly indicates that autonomous motivation is positively associated with academic achievement and intentions to remain physically active, while motivationally supportive learning environments promote more adaptive participation in physical education (An et al., 2026; Fantuzzo et al., 2004; Pavlović et al., 2023; Rokita-Jaśkow & Ellis, 2019).

Parental attention emerged as the strongest direct predictor of PJOK learning outcomes, with a standardized path coefficient of $\beta = 0.573$ ($p = 0.002$) and an estimated direct contribution of 32.83%. Parental attention was also significantly associated with physical fitness ($\beta = 0.383$, $p = 0.004$). Based on the reported path coefficients, its indirect effect through physical fitness was approximately $\beta = 0.102$, producing an estimated total effect of $\beta = 0.675$. The magnitude of these relationships indicates that the family environment may constitute an important contextual resource for students' achievement in physical education. Parents can potentially support children's learning through encouragement, supervision, provision of opportunities for physical activity, and reinforcement of healthy and active routines. This interpretation is supported by research showing that family support positively predicts engagement in physical education and that parental support may facilitate children's participation through both tangible assistance and psychological encouragement (H.-J. Chen et al., 2025; Griffin et al., 2025). Evidence from broader educational research likewise indicates that parental involvement is positively associated with students' academic performance (Cripps & Zyromski, 2009; Idris et al., 2026; Kim et al., 2024; Pollastri et al., 2013).

Physical fitness itself showed a significant direct association with PJOK learning outcomes ($\beta = 0.266$, $p = 0.004$), corresponding to an estimated direct contribution of 7.07%. Although this coefficient was smaller than the direct effect of parental attention, physical fitness occupied an important position in the structural model because it was associated with learning outcomes while simultaneously receiving paths from learning motivation ($\beta = 0.532$) and parental attention ($\beta = 0.383$). Thus, physical fitness appears to function as a potential mechanism linking students' psychological and family resources with achievement in physical education. Students with better fitness may be more capable of sustaining participation, performing motor tasks, and meeting the physical demands embedded in PJOK assessment. Previous evidence among primary-school children has demonstrated meaningful links among physical fitness, physical activity, healthy lifestyle characteristics, and academic achievement, while longitudinal evidence further suggests that parental characteristics and parental physical activity can be associated with the development of children's physical fitness (Baudinet et al., 2023; Y. Chen et al., 2023; Graham et al., 2016; Love et al., 2016).

Taken together, the findings support an integrated interpretation in which PJOK learning outcomes are associated with individual, family, and physical factors rather than with a single determinant. Parental attention displayed the largest estimated total association with learning outcomes ($\beta = 0.675$), followed by learning motivation ($\beta = 0.283$), while physical fitness retained an independent direct association with achievement ($\beta = 0.266$). Moreover, the indirect pathways through physical fitness were approximately $\beta = 0.142$ for learning motivation and $\beta = 0.102$ for parental attention, suggesting that physical fitness may represent one pathway through which psychological and family resources are connected with PJOK achievement. From an educational perspective, these findings imply that efforts to improve physical education outcomes should integrate motivationally supportive teaching, meaningful parental involvement, and systematic opportunities for developing students' physical fitness rather than addressing these dimensions separately. Nevertheless, because the present study used an observational path-analytic design with a relatively limited sample, these coefficients should be interpreted as structural associations rather than definitive causal effects, and future research should verify the proposed mediation pathways using larger samples, longitudinal designs, and bootstrapped indirect-effect confidence intervals (Barker et al., 2026; Lucas-Thompson et al., 2020; Rahimi & Oh, 2024; Vornberger et al., 2026).

Conclusions

This study concludes that learning motivation, parental attention, and physical fitness play important roles in supporting students' Physical Education, Sports, and Health learning outcomes. Learning motivation and parental attention contribute to the development of students' physical fitness, while all three factors are associated with better learning outcomes. Physical fitness also serves as an important pathway through which learning motivation and parental attention are related to students' achievement. Among these factors, parental attention emerges as a particularly important component, emphasizing the essential role of family support in students' educational and physical development. Overall, the findings demonstrate that successful learning in Physical Education, Sports, and Health requires an integrated approach that combines strong learning motivation, meaningful parental involvement, and adequate physical fitness. Therefore, collaboration among

students, parents, teachers, and schools is essential for creating learning conditions that support students' physical development and educational achievement.

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