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The Influence of Physical Fitness, Nutritional Status, and Gadget Use on the Learning Outcomes of Physical Education, Sports, and Health at Elementary Student

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Abstract

Study purpose. This study aims to analyze the effect of physical fitness, nutritional status, and the use of gadgets on the learning outcomes of Physical Education, Sports, and Health in fifth grade students. This study aims to analyze the effect of physical fitness, nutritional status, and the use of gadgets on the learning outcomes of Physical Education, Sports, and Health in fifth grade students.

Materials and methods. Quantitative research with path analysis was employed to analyze these relationships. The sample comprised ok 60 student age 11-12 years female Phase C students test Fitness, selected via purposive sampling. Research instruments included the TKSI Phase C physical fitness test, nutrition assessment, and the Gadget Angket Test and Learning outcomes data analysis with Causal Modeling.

Results. The results showed that physical fitness, nutritional status, and device usage significantly influenced the learning outcomes of Physical Education, Sports, and Health. Physical fitness has the strongest direct effect ($\beta = 0.726$), followed by nutritional status ($\beta = 0.251$) and device usage ($\beta = 0.231$). In addition, the use of gadgets is proven to mediate the relationship between physical fitness and nutritional status to learning outcomes significantly ($z = 2.12$ and $z = 2.17$; $p < 0.05$).

Conclusions. The results of this study confirm that the learning outcomes of Physical Education, Sports, and Health are influenced by a combination of physical condition, nutritional health, and students' digital behavior. Therefore, Physical Education, Sport and Health learning needs to be designed holistically by considering a healthy lifestyle, nutritional intake and appropriate use of technology.

Keywords: Physical Fitness; Nutritional Status; Gadget Use; Learning Outcomes

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Introduction

Physical Education, Sports, and Health is one of the important subjects in the Merdeka Curriculum which not only focuses on improving students' motor skills, but also develops cognitive, affective, and social aspects that support a healthy and active lifestyle throughout life (Susanta, 2021). Physical education learning activities implemented in schools are conducted weekly for a minimum of two hours. Students are provided with various activities to relieve stress and provide a sense of comfort to motivate them to engage in activities that require good thinking (Mavilidi et al., 2018). In the context of elementary schools, especially for phase C students, namely grades V and VI, Physical Education, Sports and Health lessons serve as a means to foster discipline, teamwork, and awareness of the importance of physical health(Wijayanto et al., 2022). However, student learning outcomes in Physical Education, Sports, and Health subjects still show wide variations. Some students show optimal learning outcomes, while others have not achieved the basic competencies that have been set. This phenomenon raises deep questions about the factors that influence student learning achievement in Physical Education, Sports and Health subjects, especially in an era where children's lifestyles are increasingly affected by environmental and technological changes.

One of the main factors believed to significantly affect the learning outcomes of Physical Education, Sports and Health is the level of physical fitness of students (Limbo, Abegail B. Limbo-Rivera, 2024; Ortega et al., 2007). Physical fitness not only has an impact on students' physical readiness when participating in sports practice activities but also affects cognitive functions such as concentration and memory which are part of the knowledge assessment in Physical Education, Sports and Health learning (Mavilidi et al., 2018). In addition to physical fitness, nutritional status is also an internal factor that needs attention. Balanced nutritional intake is very important in the growth period of children. Children with good nutritional status generally have optimal physical and brain development, so they are able to absorb the subject matter well (Sasmarianto et al., 2023). Eating nutritious food contributes to the overall development of children's abilities (Herdina et al., 2025; Sasmarianto et al., 2023). Furthermore, the balanced nutritional intake provided by the government through the Free Nutritional Meals (MBG) program has a positive effect on children's overall enthusiasm for sports activities. Children are more enthusiastic about coming to school, and most importantly, in addition to having breakfast after physical education learning, students also receive lunch from the MBG program.

On the other hand, the rapid development of technology has encouraged the massive use of gadgets among children, including elementary school students. Students tend to spend more time in front of the screen, reduce physical activity, experience sleep disturbances, and even show signs of digital addiction (Nakshine et al., 2022). This condition certainly has the potential to reduce students' physical fitness levels, which will indirectly affect their Physical Education, Sports and Health learning outcomes. In today's development, gadgets play a significant role in everyone's lives, as everyone is inseparable from them, even to the point where they can live without them every day. The use of gadgets also often disrupts learning concentration, increases sedentary behavior, and affects children's psychological conditions, such as being easily tired, less focused, and lazy to do physical activities (George et al., 2023).

Various previous studies have discussed the relationship between physical fitness and Physical Education, Sports and Health learning outcomes. Shows that there is a positive correlation between students' physical endurance and the final grade of Physical Education, Sports, and Health. Meanwhile, research by (Umar, Ali., Abbas, 2018) highlights the importance of nutritional status in determining students' readiness to participate in learning, including in practical subjects such as Physical Education (Mubarok et al., 2025), Sports and Health. However, these studies are still partial and have not comprehensively integrated three

important variables, namely physical fitness, nutritional status, and device use, into a complete research framework.

Thus, there is a research gap that needs to be filled, as suggested in research on high levels of smartphone use being associated with reduced physical activity, which can lead to adverse health impacts such as increased fat mass and decreased muscle mass (Alageel et al., 2021). Research that explicitly examines the simultaneous influence of physical activity and decreased physical fitness has been mentioned in this study. This study reveals a novelty regarding the relationship between nutritional status in elementary school students, particularly at SD Negeri 73 Ogan Komering Ulu. This research is expected to provide scientific contributions in the field of sports and health education and can serve as a basis for policymaking by schools and parents in managing children's lifestyles in a healthier and more balanced way. Therefore, this research is important as part of efforts to improve the quality of physical education in elementary schools holistically and based on contextual data.in a healthier and more balanced manner. Therefore, this research is important to do as part of efforts to improve the quality of physical education in elementary schools holistically and based on contextual data.

Materials and methods

Study participants

This study uses a quantitative approach with path analysis as the main strategy in analyzing the influence between variables that have been determined (Kadir, 2010). Namely physical fitness (X1), nutritional status (X2), intensity of gadget use (Y), and learning outcomes of Physical Education, Sports and Health (Z) in Figure 1.

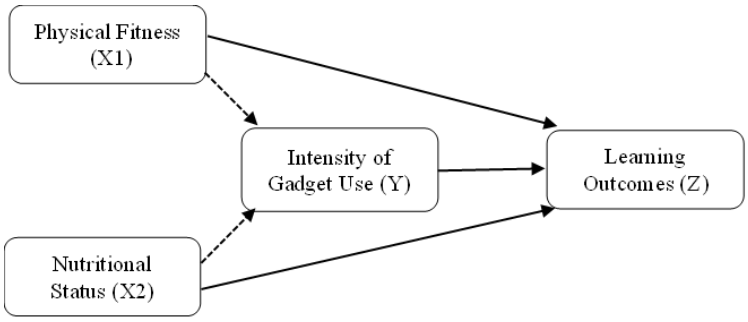

Figure 1. Conceptual Framework

This research model not only tests the direct effect between the independent and dependent variables, but also simultaneously tests the indirect effect through the mediating role of the intensity of gadget use. The path analysis approach is very relevant in this context because it allows to identify the extent to which the mediating variable strengthens or weakens the influence between physical fitness and nutritional status on Physical Education, Sports and Health learning outcomes. This research design is explanatory, because it aims to explain the complex patterns of influence between the variables under study based on theoretical models developed from previous studies (Ridder, 2017).

The population in this study were all fifth and sixth grade students at SD Negeri 73 Ogan Komering Ulu, which is part of phase C in the Merdeka Curriculum structure. (Suriani et al., 2023) The sample selection was carried out using purposive sampling technique, which is a sampling method based on certain considerations in accordance with the research objectives (Suriani et al., 2023). Random sampling 60 sample student man and woman age 12 years. In this case, phase C students were chosen because psychologically and socially, they are at a stage of development that is very responsive to the influence of the digital

environment, including the use of gadgets. In addition, in this phase, students also begin to show stability in aspects of physical fitness and begin to experience changes in nutritional status due to changes in consumption patterns and physical activity.

Study organization

In terms of data collection techniques, each variable is measured using instruments that have been validated in various scientific literature. The physical fitness variable (X1) was measured using the Indonesian Student Fitness Test (TKSI) developed by the Ministry of Youth and Sports (Kemenpora, 2017). This instrument measures various fitness components such as muscle strength, cardiovascular endurance, agility, and speed. TKSI is proven to have high reliability and validity in the context of assessing the physical fitness of elementary school students (Aprilo et al., 2023). Meanwhile, the nutritional status variable (X2) was assessed through the Body Mass Index (BMI), which is the ratio of body weight to height. The BMI assessment refers to the WHO (2018) guidelines, which establish a classification of nutritional status based on BMI values relative to age. BMI is a credible indicator for assessing nutritional status in child health and physical education research (Sirada et al., 2023).

The variable of gadget use intensity (Y) was measured using a Likert scale questionnaire, which was designed to capture the duration and purpose of students' daily gadget use. This instrument refers to the conceptual framework from (Taufiq et al., 2019), which formulates the questionnaire items based on aspects of using digital technology for entertainment, communication, and learning. (Swami et al., 2021) reinforces the finding that excessive use of gadgets can have a negative impact on physical health and academic performance. (Aliriad et al., 2023) adds that the intensity of gadget use is an important indicator in research related to the learning habits of the digital generation. While the learning outcome variable (Z) is measured through the value of Physical Education, Sports, and Health learning outcomes, which reflects student achievement in knowledge, skills, and attitudes in accordance with the curriculum. Learning outcomes are official indicators to measure students' academic success (Joosten & Cusatis, n.d.) states that the achievement of Physical Education, Sports, and Health subject grades reflects students' theoretical understanding and motor skills in an integrated manner.

Statistical analysis

Data analysis in this study was conducted through three main stages: descriptive analysis, classical assumption test, path analysis, and Sobel test. In the first stage, descriptive analysis was used to describe the distribution and characteristics of each variable. The statistics used include mean, standard deviation, maximum and minimum values, and frequency distribution. This stage aims to determine the general description of the data before conducting inferential analysis. Furthermore, the classical assumption test was carried out to ensure that the regression model used in the study met the statistical requirements. After the classical assumption test is carried out, the next stage is multiple linear regression analysis, which is used to test the simultaneous influence of the independent variable on the dependent variable.

Path analysis was conducted to test the direct and indirect effects between variables, as well as to test whether the intensity of gadget use (Y) mediates the relationship between physical fitness and nutritional status on Physical Education, Sports and Health learning outcomes. To test the mediation effect, the Sobel test was used as a conventional statistical approach, as well as bootstrapping as a more robust non-parametric method because it does not require the assumption of normal distribution. Bootstrapping allows testing the significance of mediation by forming confidence interval estimates based on resampling the

data. All analyses were conducted using SPSS version 30 statistical software to obtain accurate and scientifically sound results.

Figure 2. Data Analysis Steps

Figure 2 the systematic steps taken in data analysis begin with: (1) collecting data from respondents in accordance with predetermined instruments and processing and cleaning data from entry errors or incomplete data, (2) descriptive analysis to obtain an overview of the characteristics of respondents and research variables, (3) classical assumption test to ensure that the regression model used is truly valid, so that the results can be trusted and used for drawing conclusions, as well as multiple linear regression analysis to map the direct effect of independent variables on the dependent variable, (4) path analysis to test the direct and indirect effects between variables, and (6) mediation test to determine the mediating role of gadget use in the relationship mechanism between variables.

Results

The results of this study indicate a significant influence between physical fitness, nutritional status, and the use of gadgets on the learning outcomes of Physical Education, Sports, and Health in grade V students of SD Negeri 73 Ogan Komering Ulu. Based on descriptive analysis of 60 students, the average physical fitness score is 16.92 (SD = 1.92), indicating that most students are in the moderate to good category. The nutritional status of most students was classified as thin (81.7%), with an average body mass index score of 1.23 (IMT category), while the average score of gadget use was 40.62 (SD = 3.21), indicating a fairly high intensity. Nevertheless, the average score of Physical Education, Sports and Health learning outcomes reached 83.00 (SD = 3.89), which is above the Minimum Completion Criteria.

Table 1. Descriptive Statistics of Research Variables

	N	Minimum	Maximum	Means	Std. Deviation
Physical Fitness (X1)	60	11,00	20,00	16,9167	1,92479
Nutritional Status (X2)	60	1,00	3,00	1,2333	,53256
Gadget Usage (Y)	60	34,00	47,00	40,6167	3,20535
Learning Outcomes (Z)	60	77,00	90,00	83,0000	3,89263

N (according to the list)	valid	60

Based on Table 1 the results of descriptive statistical analysis of the four main variables in this research , some preliminary conclusions can be drawn regarding the general characteristics of the respondent data who became the subject of the research, namely students in grades V and VI of SD Negeri 73 Ogan Komering Ulu, South Sumatra.

The normality test results using the Kolmogorov-Smirnov method show a significance value of 0.200 (p> 0.05), which means that the regression model residuals are normally distributed. This finding is supported by a histogram shaped like a bell curve and a P-P Plot which shows the distribution of residual points along the diagonal line. The histogram of the research results shows that the residuals are distributed with a shape resembling a normal bell curve. Most of the residual values are clustered around the zero point, indicating that most of the model predictions are not far from the actual values. The histogram appears symmetrical and does not show extreme skewness. The mean residual value is 3.61E-15 (close to zero) and the standard deviation is 0.974, reinforcing the impression that the residuals are normally distributed in Figure 3 and 4.

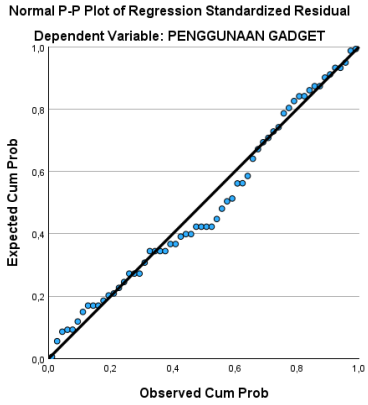

Figure 3. Normal P - P Plot of Regression Standardized Residuals of Digital Usage

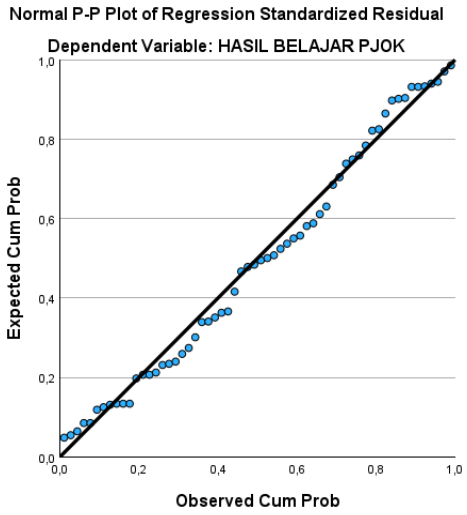

Figure 4. Normal P - P Plot of Regression Standardized Residuals of Learning Outcomes

Visual analysis of the Normal P-P Plot of Regression Standardized Residual shows that the residual points spread along the diagonal line consistently and do not show extreme

pattern deviations. This indicates that the residuals are distributed close to normal, even though the data for each variable is not statistically normal. Thus, the assumption of residual normality is met, and the regression analysis used in this study remains valid and appropriate for use in hypothesis testing and conclusion drawing in Figure 5 and 6.

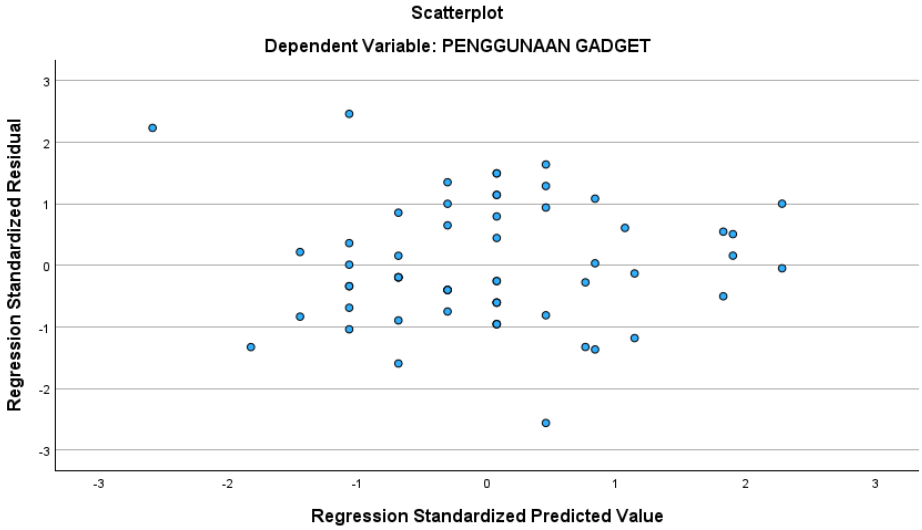

Figure 5. Scatterplot of Digital Usage

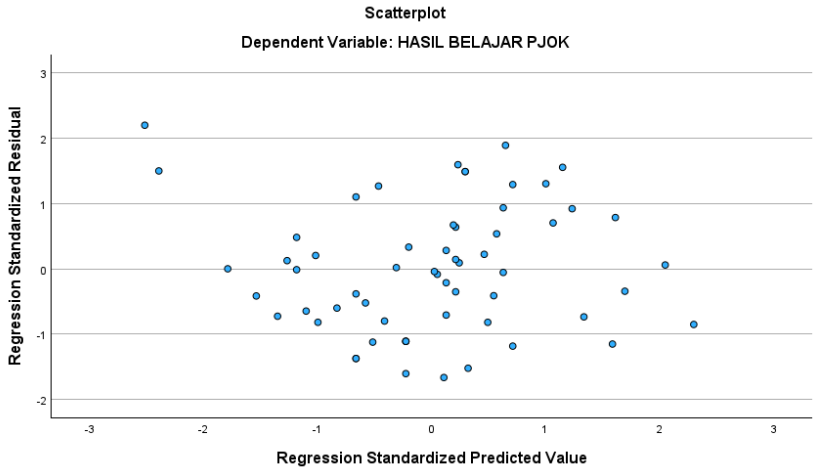

Figure 6. Scatterplot of Learning Outcomes

Based on visual analysis of the residual scatterplot structure of model 2, there is no particular systematic or funnel-shaped pattern, either conical or widened. The distribution of residual points looks random around the zero line, which indicates that the residual variance is constant at all levels of predictor values in Table 2.

Table 2. Descriptive Statistics of Research Variables

Model Summary [b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,482[a]	,232	,206	2,85697

a. Predictors: (Constant), Nutritional Status (X1), Physical Fitness (X2)

b. Dependent Variable: Gadget Use (Y)

The results of the regression analysis show that the model has an Adjusted R Square value of 0.206, which means that about 20.6% of the variation in the use of gadgets can be explained by physical fitness and nutritional status in Table 3.

Table 3. Indirect Coefficient Value

Coefficient [a]					
	Unstandardized Coefficient		Standardized Coefficient		
Model	B	Std. Error	Beta	t	Sig.
(Constant)	27,929	3,515		7,945	<,001
Physical fitness (X1)	,587	,194	,353	3,019	,004
Nutritional Status (X2)	2,234	,703	,371	3,178	,002

a. Dependent Variable: Gadget Use (Y)

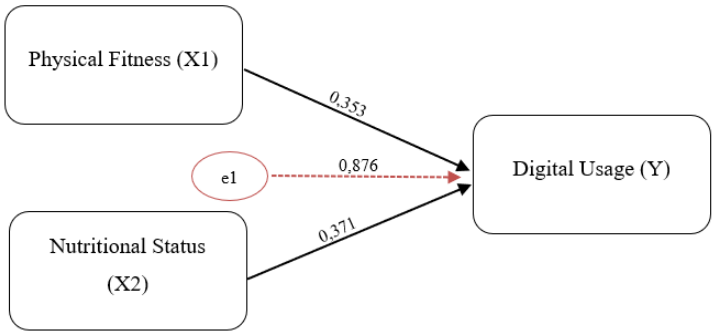

Figure 7. Structure Model 1 path analysis X1, X2 and Y

Figure 7 partially, the physical fitness variable has a regression coefficient β = 0.587, with a t-value of 3.019 and a significance p-value of 0.004, which indicates that physical fitness has a significant effect on the use of devices with a magnitude of 0.353. This means that the better the students' fitness level, the lower (or more controlled) their tendency to use devices, or vice versa, depending on the context of use. Meanwhile, nutritional status has a coefficient β = 2.234, with a t-value of 3.178 and a p-value of 0.002, which also shows a significant influence on gadget use with a magnitude of 0.37. This indicates that students with better nutritional status tend to have different gadget usage habits than students with lower nutritional status in Table 4.

Table 4. Summary of Direct Model

Model Summary [b]				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,863[a]	,744	,730	2,02086

a. Predictors: (Constant), Physical Fitness (X1), Nutritional Status (X2), Gadget Use (Y)

b. Dependent Variable: Physical Education, Sports and Health Learning Outcomes (Z)

The multiple regression results on the direct path model show the relationship between exogenous and endogenous variables. The summary model shows the Adjusted R^2 coefficient of determination of 0.730, meaning that 73% of the variation in Physical Education, Sports and Health learning outcomes can be explained by the three independent variables, while the remaining 27% is explained by other variables outside this model in Table 5.

Table 5. Direct Coefficient Value

Coefficient [a]					
	Unstandardized Coefficient		Standardized Coefficient		
Model	B	Std. Error	Beta	T	Sig.
(Constant)	44,528	3,610		12,336	<,001
Physical Fitness (X1)	1,468	,148	,726	9,907	<,001
Nutritional Status (X2)	1,834	,539	,251	3,399	,001
Gadget Usage (Z)	,280	,094	,231	2,990	,004

Dependent Variable: Physical Education, Sports, and Health Learning Outcomes (Z)

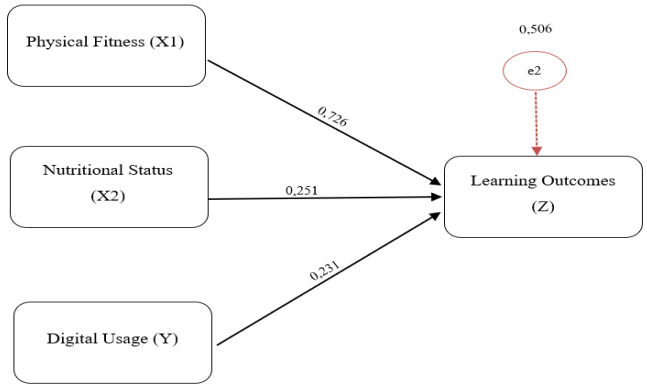

Figure 8. Model Structure 2 path analysis X1, X2, Y and Z

Figure 8 Path analysis showed that physical fitness (X1) had a significant direct effect on learning outcomes. The three variables explained 73% of the variance in Physical Education, Sports and Health learning outcomes (Adjusted R^2 = 0.730), indicating that the model is very strong in predicting the dependent variable in Table 6.

Table 6. Categories of variable influence relationships

Path coefficient	Power/Influence
0,05 - 0,09	Weak
0,10 - 0,29	Medium
≥ 0,30	Strong

The results of hypothesis testing for path analysis can be seen from the direct and indirect in Table 7.

Table 7. Categories of variable influence relationships

Influence	Direct	Indirect	Total	Description
X1→ Y	0,353		0,353	Strong
X2→ Y	0,371		0,371	Strong
X1→ Z		0,353 x 0,231 = 0,081	0,081	Weak
X2→ Z		0,371 x 0,231 = 0,086	0,086	Weak
Y→ Z	0,231		0,231	Medium

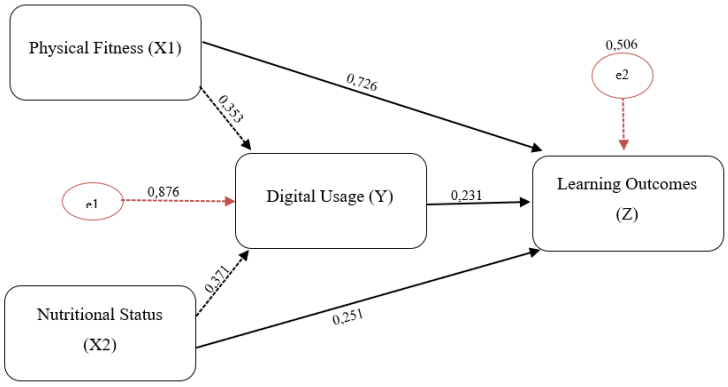

Figure 9. Complete structure of path analysis X1, X2, Y and Z

Figure 9 Path analysis results show that physical fitness (X1) and nutritional status (X2) have a strong direct effect on digital usage (Y). This effect is categorized as "strong" based on the standard value of regression coefficients.Then, digital usage (Y) has a direct effect on learning outcomes (Z), which is categorized as moderate. The direct effect of X1 and X2 on Z is only 0.081 and 0.086, respectively, through the indirect paths of X1 → Y → Z and X2 → Y → Z. However, these indirect effects are still significant. Nevertheless, this indirect effect remains statistically significant based on the Sobel test results, which show z values of 2.12 (X1 → Y → Z) and 2.17 (X2 → Y → Z), with $p < 0.05$. Thus, it can be concluded that digital usage partially mediates the relationship between physical fitness and nutritional status on student learning outcomes.

Theoretically, this finding reinforces the view that learning success in the digital era does not only depend on cognitive or motivational factors alone, but is also influenced by students' physical readiness and nutritional health which ultimately determine how effectively they can utilize digital technology in the learning process. Good physical fitness and nutritional status not only have a direct influence on learning outcomes, but also increase the efficiency of using digital devices as learning aids, which in turn has a positive impact on students' academic achievement. The implications of these findings point to the need for a holistic approach to supporting student learning outcomes, by integrating interventions to improve students' physical health and nutrition along with improving digital literacy and technology utilization in learning.

Discussion

The results of this study show that physical fitness, nutritional status and device use have a significant impact on students' Physical Education, Sports and Health learning outcomes, both directly and indirectly through mediation. In general, the results of this study support the view that students' physical aspects and digital behaviors significantly contribute to their learning outcomes (Mubarok et al., 2025), especially in the context of physical

education based on motor activities and hands-on interactions. The finding that physical fitness is the strongest factor directly affecting learning outcomes in Physical Education, Sport and Health is in line with previous studies that place physical readiness as a key prerequisite in movement-based learning. (Wiersma & Sherman, 2008) theoretically states that optimal physical fitness allows students to participate in sports activities with greater vigor, endurance, and skill. This is reinforced by the results of research Ennis (2017) which shows that students with high fitness levels tend to have higher motivation and concentration in participating in Physical Education, Sports and Health lessons (Mubarok et al., 2025; Sasmarianto et al., 2023). These results confirm that physical readiness not only supports performative aspects but also improves students' cognitive aspects in absorbing theoretical material for physical education, sports and health.

Meanwhile, nutritional status, which also contributes significantly to learning outcomes, underscores the importance of nutritional intake in supporting students' physiological and mental functions. Children with good nutritional status generally have sufficient energy to actively participate in learning activities, as well as higher learning focus and endurance. This is supported by the findings of (Abiola & Ph, 2022), which states that balanced nutrition influences the development of the central nervous system, which in turn directly impacts concentration and information processing in school-age children. However, some previous studies provide contradictory results. (Pratama & Winarno, 2022) for example, in an urban context found that nutritional status is not always the main determinant of Physical Education, Sports and Health learning outcomes, because students are still able to achieve even though they are categorized as malnourished. This difference indicates contextual variables such as eating culture, physical activity levels, and learning approaches that differ between urban and semi-rural areas.

What is interesting in this study is the role of gadget use as a significant mediating variable. On the one hand, high gadget usage scores do not necessarily have a negative impact on learning outcomes. In fact, in certain contexts, gadgets become learning aids that support students' understanding of Physical Education, Sports and Health materials through access to educational videos, physical exercise applications, or interactive quizzes. This finding is in line with the results of research (Widodo et al., 2020) which states that gadgets have great potential in increasing interest in learning if directed for educational purposes. However, the other side of the literature also reveals the risks of uncontrolled gadget use (Latif, Abdul., Fitri, Nila Lailatul & Fatin, 2025) emphasizes that excessive use of gadgets can cause sleep disturbances, decreased physical activity, and even decreased academic achievement. The fact that most students in this study still showed high learning outcomes despite the high intensity of gadget use could be explained by other factors such as good digital literacy, parental guidance, or innovative learning methods.

Looking at these findings, it can be concluded that the learning outcomes of Physical Education, Sports and Health are not determined by one factor alone, but rather the result of the interaction between physical readiness, health conditions and students' digital learning behavior (Susanto et al., 2023). All three influence each other and form a unique learning dynamic, especially in the context of elementary schools in the digital era. Therefore, effective Physical Education, Sport and Health learning must be designed holistically by considering the physical, nutritional and technological dimensions. The findings also indicate that an integrative approach is needed in formulating physical education policies, especially at the primary school level, to be more responsive to the changing lifestyles and learning patterns of today's students.

Conclusions

This study concludes that physical fitness, nutritional status, and gadget usage collectively exert a significant influence on the learning outcomes of Physical Education, Sports, and Health among fifth-grade students at SD Negeri 73 Ogan Komering Ulu. Among these variables, physical fitness emerges as the most dominant factor, both directly and indirectly impacting academic performance. Students with higher levels of physical fitness tend to be more active, engaged, and capable of participating effectively in learning activities.

Nutritional status also demonstrates a notable effect, as a well-balanced diet contributes to students' physical stability and cognitive focus. Furthermore, gadget usage functions not only as an independent predictor of learning outcomes but also as a mediating variable that links physical fitness and nutritional status to academic achievement. While often associated with learning distractions, gadgets when utilized purposefully can enhance the comprehension of Physical Education content through interactive and visual media.

Therefore, effective teaching of Physical Education, Sports, and Health in the digital age necessitates a holistic approach that integrates physical preparedness, nutritional well-being, and digital literacy. Collaboration among educators, parents, and policymakers is essential to foster a supportive, healthy, and adaptive learning environment that enables students to achieve optimal and sustainable educational outcomes.

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Conflict of interest

The authors declare that there is no conflict of interest in the implementation of this research. All data collection, analysis, and conclusion processes were conducted independently, without any intervention or influence from any party that could bias the results of the study. This research purely aims to develop science in the field of physical education and is not funded by institutions or parties that have commercial interests in the results of the research.

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