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THE RELATIONSHIP BETWEEN PHYSICAL FITNESS LEVELS AND PHYSICAL EDUCATION LEARNING OUTCOMES AMONG STUDENTS

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Abstract
This study aims to examine the relationship between physical fitness levels and physical education academic performance among 10th-grade students at SMA Negeri 1 Mranggen, in response to the mixed findings of previous studies, as well as to introduce the digital version of the TKSI Stage E/F instrument, which incorporates sensory-motor components such as hand-eye coordination and visual-motor reaction time. The research design used was quantitative, descriptive-correlational, involving 70 students aged 15–16 years who were selected through simple random sampling. Physical fitness was measured using the TKSI Stage E/F test battery, consisting of six items (hand-eye coordination, hand-touch reaction, agility/vertical jump, arm muscle strength, and the Multistage Fitness Test for VO_2 max), while academic achievement was obtained from midterm exam scores through documentary analysis. The data were analyzed descriptively and tested for normality and linearity prior to hypothesis testing, using Spearman's rank correlation because the data were not normally distributed. The results of the study showed that the students' average physical fitness score was 21.64 (moderate category), while their average Physical Education (PJOK) learning outcomes were 88 (moderate category). The correlation test yielded an r value of 0.196 with $p = 0.104$ ($p > 0.05$), indicating a positive but statistically insignificant and very weak relationship between physical fitness and PJOK learning outcomes. These findings suggest that performance on the midterm exam in physical education, which emphasizes cognitive understanding of sports theory, is more influenced by factors such as teaching methods, memory, and psychological readiness than by students' physical fitness or motor-sensory abilities alone.
Keywords: Physical fitness, learning outcomes, TKSI

INTRODUCTION

As one of the subjects taught in school, physical education makes a significant contribution to the overall educational process (Aulia & Januarto, 2022). Conceptually, education is understood as a planned effort to create a learning process that enables students to learn actively while developing their potential in terms of intelligence, knowledge, and personality (UU No. 20 year 2003 about SISDIKNAS). Physical education, sports, and health not only focus on sports activities but also play a role in fostering a healthy lifestyle, strengthening discipline, and honing social skills

and cooperation among students (Syofian & Gazali, 2021). By actively engaging in physical activities during the learning process, students are expected to achieve an adequate level of fitness to participate optimally in their studies (Aprilia & Januarto, 2022). Optimal physical condition becomes increasingly important as students enter high school, given that they must adapt to a new learning environment while managing increasingly complex academic demands (Ratna Sari Wulandari, 2021). Especially during the transition phase in 10th grade, high academic pressure often leads to fatigue and reduced concentration among students during class. Thus, physical fitness not only supports athletic activities but also serves as a physiological factor that facilitates the cognitive processes involved in learning (Hidayah et al., 2025).

Although, in theory, physical fitness is considered one of the key requirements for academic success, conditions on the ground actually show a downward trend in students' physical condition. A preliminary study conducted through structured interviews with physical education teachers at SMA N 1 Mranggen revealed that approximately 35% of 10th-grade students frequently exhibited signs of early fatigue and reduced attention to movement instructions, and some even asked for permission to rest before the practical class ended, particularly during sessions held in the afternoon (Athiyyah, 2025). These findings raise an important question: Does the low level of fitness variation truly have a linear correlation with learning outcomes in physical education, or are there other factors that have a greater influence on the relationship between these two variables?

The urgency to address this issue is increasingly evident because previous studies have shown mixed results regarding the relationship between physical fitness and academic achievement. Studies conducted by (Pratama & Nurrochmah, 2023, Abduh et al., 2020) examined the relationship between physical fitness and students' academic achievement. The study sample consisted of 28 participants selected from a population of 35 using purposive sampling. Data collection was conducted using five physical fitness test instruments, while academic achievement data were obtained from midterm exam scores. Data analysis was performed using the one-sample Kolmogorov-Smirnov and Spearman's correlation tests. The results showed that the highest physical fitness test score was 24 (very good category) and the lowest was 13 (poor category), while the average student academic achievement ranged from 72.28 (lowest) to 79.92 (highest). The correlation test yielded an r value of 0.304 with a p-value of 0.005, which is smaller than $\alpha = 0.05$, indicating a significant relationship between the two variables. From these results, it was concluded that the level of physical fitness is related to students' academic performance, such that the better a person's physical fitness, the better their academic performance. This finding aligns with the results of a study (Supariyadi et al., 2022) that scientifically examined the relationship between physical fitness levels and physical education academic achievement in 2021. That study was conducted at

SMA Negeri 6 Bandar Lampung in the same year, using a correlation method with the product-moment statistic to objectively analyze 24 11th-grade students selected via random sampling. The purpose of this study was to measure the strength of the relationship between physical fitness levels and physical education academic achievement among 11th-grade students at that school. The analysis results showed a calculated r value of 0.464, which is greater than the table r value of 0.404; therefore, it can be concluded that there is a positive and significant relationship between physical fitness levels and physical education academic achievement among 11th-grade students at SMA Negeri 6 Bandar Lampung.

It is at this point that this study seeks to fill the existing gap. Unlike previous studies, which generally concluded that there is a linear relationship between physical fitness at the macro level and academic achievement, this study offers a unique approach in terms of both concept and methodology. This uniqueness is reflected in the use of the digital TKSI Stage E/F instrument, which integrates motor-sensory components (hand-eye coordination and reaction time), the inclusion of a larger and statistically robust sample of 70 10th-grade students currently in an academic transition phase, more objective specifications of academic achievement variables, and the selection of SMA Negeri 1 Mranggen as the research site, which has not been studied previously. Thus, this study is able to present a more comprehensive analysis of the fitness-academic relationship compared to previous studies, while also updating and deepening the research through the application of the TKSI Stage E/F instrument published by the Ministry of Education, Culture, Research, and Technology (Lubis et al., 2025). Unlike conventional instruments, the TKSI includes motor-sensory components such as hand-eye coordination and visual-motor reaction time (hand-touch reaction). Physiologically, these two components are directly related to the brain's speed in processing information and maintaining students' concentration during the learning process.

The findings of this study are expected to contribute to the theoretical literature on the influence of motor and sensory abilities on students' academic achievement. In addition, the results of this study are also expected to be utilized by physical education teachers as a foundation for designing learning programs and interventions that are better tailored to students' physical and neuromotor fitness profiles in an objective and data-driven manner.

METHODOLOGY

This study employs a quantitative approach with a descriptive correlational design to analyze the relationship between physical fitness levels and academic achievement in Physical Education, Sports, and Health (Hulu et al., 2025). Data collection was conducted at Mranggen

State High School 1. The study population consisted of all 11th-grade students at Mranggen State High School 1 in the current academic year, totaling 231 students. From this population, a sample of 70 students aged 15–16 years was selected using simple random sampling to ensure the objectivity of the study, avoid selection bias, and provide equal opportunity for all members of the population to be selected as participants (Afiani & Qodir, 2020).

Data collection in this study involved two main instruments representing each variable (Sinaga et al., 2024). Data for the independent variable (physical fitness level) were collected using the standardized Indonesian Student Fitness Test (TKSI) Stage E/F, published by the Ministry of Education, Culture, Research, and Technology for high school students. This instrument consists of six integrated physical test items, namely: (1) the eye-hand coordination test to measure eye-hand coordination; (2) the hand-touch reaction test to measure visual-motor reaction time; (3) the T-test agility test to measure agility; (4) the vertical jump test to measure lower-body explosive power; (5) a dipping test to measure upper arm and shoulder muscle endurance; and (6) a multi-stage fitness test (MFT) to measure cardiorespiratory endurance (VO_2max). Meanwhile, data on the dependent variable (PJOK learning outcomes) were obtained through a documentary study method by collecting official Mid-Semester Exam scores from subject teachers (Trisnata et al., 2020).

All numerical data obtained were analyzed using SPSS Statistics 22 through two main stages: descriptive statistical analysis and prerequisite testing. Descriptive statistical analysis included calculating the mean, minimum, and maximum values, as well as tabulating frequency distributions for physical fitness levels and student learning outcomes (Muna et al., 2022). The next stage involved conducting a prerequisite test using the One-Sample Kolmogorov-Smirnov Normality Test to determine the direction of the statistical analysis. Since the research data was found to be not normally distributed ($p < 0.05$), hypothesis testing to examine the relationship between physical fitness levels and physical education learning outcomes proceeded using nonparametric statistical analysis, specifically the Spearman's Rank Correlation Test (Spearman's rho) at a significance level of $\alpha = 0.05$.

RESULTS

Physical Fitness

Table 1. Frequency Distribution of TKSI Test Data

Category	Score Range	Frequency	Percentage
Very Good	27-30	0	0%
Good	23-26	26	37%
Moderate	19-20	37	53%
Poor	15-18	7	10%
Very Poor	≤ 14	0	0%
	Average : 21,64	70	100%

Based on the results of the descriptive analysis of the physical fitness levels of 10th-grade students at SMA Negeri 1 Mranggen, the majority of students fell into the "Moderate" category, with 37 students (53%), followed by the "Good" category with 26 students (37%), and the "Poor" category with 7 students (10%). No students fell into the "Very Good" or "Very Poor" categories. The average physical fitness score for the students was 21.64, indicating that the students' overall physical fitness level falls within the moderate category.

Physical Education Learning Outcomes.

Table 2. Mid-Semester Examination Score Data

Category	Score Range	Frequency	Percentage
Very Good	93-96	11	15,71%
Good	91-92	12	17,14%
Moderate	85-90	34	48,57%
Poor	79-84	8	11,43%
Very Poor	73-78	5	7,14%
	Average : 88	70	100%

Based on midterm exam data from 70 students, the class average score was 88, with the majority of students falling into the "Satisfactory" category, namely 34 students (48.57%). The high-achieving group consisted of 12 students (17.14%) in the Good category and 11 students (15.71%) in the Very Good category. Meanwhile, low performance was experienced by only 8 students (11.43%) in the "Poor" category and 5 students (7.14%) in the "Very Poor" category.

Overall, these results indicate that the majority of students were able to master the exam material well.

Table 3. One-sample Kolmogorov-Smirnov

		Physical Fitness	Learning Outcomes
N		70	70
Normal Parameters[a,b]	Mean	21.6429	87.9571
	Std. Deviation	2.43189	4.99981
Most Extreme Differences	Absolute	.130	.181
	Positive	.090	.099
	Negative	-.130	-.181
Test Statistic		.130	.181
Asymp. Sig. (2-tailed)		.005[c]	.000[c]

Based on the results of the one-sample Alamogordo-Smirnov normality test, the significance value for the physical fitness variable was 0.005, while the learning outcomes variable had a significance value of 0.000. Since both significance values were less than 0.05 ($p < 0.05$), the research data were considered not to be normally distributed. Therefore, the hypothesis analysis was continued using a non-parametric statistical test, namely the Spearman's Rank Correlation Test.

DISCUSSION

Essentially, physical fitness requires functional harmony between the body's physiological systems and motor capabilities so that students can perform various physical activities efficiently without experiencing excessive fatigue (Rezza et al., 2020). The ability to coordinate movements, maintain cardiorespiratory endurance, and optimize muscle strength serves as a crucial foundation for every individual in meeting the demands of daily activities (Syofian & Gazali, 2021). This becomes increasingly relevant at the high school level, where good physical fitness is an essential physiological prerequisite for students to remain physically prepared amid a demanding academic schedule and school activities. Therefore, students' physical readiness can no longer be measured solely by conventional macro-level aspects such as muscle strength; it must also (Afiani & Qodir, 2020). Into account more complex motor-sensory aspects that govern movement efficiency and the body's response to stimuli.

To achieve optimal learning performance, students require support in more specific areas of physical fitness, such as hand-eye coordination and visual-motor reaction speed (Rahmayani et al., 2019). Theoretically, these two motor-sensory abilities play a major role in accelerating the brain's processing of visual information and maintaining students' concentration when receiving instructions in class (Kapti & Winarno, 2022). With good coordination and reaction times, students are expected to be more adept at performing motor tasks on the field while still being able to maintain mental focus when learning in the classroom. Based on these considerations, the integration of motor-sensory aspects into modern fitness assessment tools is positioned as a key indicator for evaluating the extent to which students' physical capacity supports their cognitive readiness to optimally absorb course material (Hidayat, 2023).

However, when this theoretical concept was empirically tested in this study, the results of the data analysis actually showed that the level of physical fitness, as measured by the TKSI instrument, did not correlate significantly with students' physical education learning outcomes. This positive correlation, albeit with a very weak relationship, suggests that fluctuations in students' academic performance on midterm exams are not directly determined by their physical fitness or motor-sensory capacity. This finding differs from the patterns observed in previous studies published in the Stamina Journal, such as those by (Wahyudi, 2019) and (Rahmayani et al., 2019) which reported a linear contribution or direct relationship between physical fitness and students' academic performance. This means that the actual conditions in the field indicate that variations in physical fitness levels among students at SMA Negeri 1 Mranggen have their own contextual characteristics; therefore, physical fitness cannot be considered the sole determining factor influencing variations in their written exam scores at school.

Upon further analysis, the absence of a statistically significant relationship indicates that learning outcomes in Physical Education and Health (PJOK), as measured by the midterm exam, tend to emphasize cognitive dimensions such as understanding sports theory and game rules and are thus distinct from purely psychomotor aspects (Haq & Prasetiyo, 2025). This explains why students with moderate levels of physical fitness can still achieve high academic performance, as they are supported by conceptual readiness, good memory, and strong intrinsic motivation when taking written exams. Furthermore, the effectiveness of teachers' instructional methods in the classroom and students' psychological readiness leading up to exams appear to have a far greater influence on learning outcomes than their physical condition alone (Satria Armanjaya, 2023). In conclusion, physical fitness and academic performance on the midterm exam have been shown to be two distinct domains of competence that develop separately and do not limit one another in the context of physical education in schools (Siti Aisyah, 2022).

CONCLUSION

Relationship Between Variables: There was no significant relationship between physical fitness levels and academic performance in Physical Education, Sports, and Health (PJOK) among 10th-grade students at SMA Negeri 1 Mranggen ($p = 0.104 > 0.05$). The correlation coefficient of 0.196 indicates a positive relationship but with very low strength, meaning that students' midterm exam scores are not directly influenced by their physical fitness levels.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this research.

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