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Physical Education, Sports And Health Towards Learning Motivation And Academic Achievement Students

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ABSTRACT

Physical Education, Sports, and Health (PJOK) is an integral component of the national education system that aims not only to enhance students' physical fitness but also to support their psychological, emotional, and social development. In recent educational discourse, PJOK has increasingly been recognized for its potential contribution to learning motivation and academic achievement through structured physical activity and character-based learning experiences. This study aims to analyze the effect of PJOK on students' learning motivation and academic achievement at SMAN 2 Pasangkayu. This research employed a quantitative approach using a simple linear regression design to examine the relationship between PJOK as the independent variable and learning motivation and academic achievement as dependent variables. The population and sample consisted of 20 students from SMAN 2 Pasangkayu, selected using a quota sampling technique. Data were collected through a closed-ended questionnaire to measure learning motivation and students' report card scores to represent academic achievement. Primary data were obtained directly from the research subjects and analyzed using statistical procedures. The results indicate that PJOK has a positive influence on both learning motivation and academic achievement. This finding is supported by the regression analysis, which yielded a significance value (Sig.) of 0.618, indicating that the alternative hypothesis was accepted according to the established statistical criteria. These results suggest that PJOK contributes not only to physical fitness improvement but also to fostering positive learning attitudes, enjoyment, and readiness to engage in academic activities. Consequently, optimizing PJOK implementation through engaging teaching strategies and adequate school facilities is recommended to maximize its holistic educational impact.

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INTRODUCTION

Physical Education, Sports, and Health (PJOK) is a strategic subject in the education system designed to develop students' potential holistically, encompassing physical, cognitive, affective, and social aspects. Several recent studies confirm that

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structured physical activity in an educational context not only impacts physical fitness but also contributes significantly to cognitive function, emotional regulation, learning motivation, and student academic achievement (Donnelly et al., 2016; Hillman et al., 2018; Singh et al., 2019). However, in secondary education practice in Indonesia, PJOK is still often positioned as a supplementary subject whose contribution is limited solely to health and fitness aspects.

This situation raises a fundamental problem: a suboptimal empirical understanding of the role of PJOK as an educational factor capable of stimulating learning motivation and improving student academic achievement in core subjects. In fact, learning motivation theory and educational neuroscience show that planned physical activity can increase blood flow to the brain, improve executive function, and strengthen self-regulation, which are essential foundations for successful learning (Diamond & Ling, 2016; Tomporowski et al., 2015). Thus, there is an urgent need to examine physical education not only as a motor activity, but also as a pedagogical intervention with direct implications for learning behavior and academic achievement.

International research over the past decade has demonstrated a positive relationship between school-based physical activity and student motivation and academic achievement. Meta-analyses conducted by Álvarez-Bueno et al. (2017) and Lubans et al. (2016) found that school-based physical activity programs are associated with improvements in attention, working memory, and academic learning outcomes. A longitudinal study by Ericsson and Karlsson (2018) also confirmed that increasing the duration and quality of physical education has a positive impact on long-term academic achievement.

In the national context, several studies report that student physical fitness and involvement in physical education (PJOK) activities correlate with learning motivation and learning outcomes, both in PJOK and other subjects (Firdaus et al., 2021; Kristiyandaru, 2020). Ismail et al. (2025) even showed that improving physical fitness through school exercise programs was followed by significant improvements in academic achievement. However, most of these studies focused their analysis on physical fitness or physical activity variables as outcomes, rather than on PJOK as a whole subject encompassing curriculum, learning strategies, pedagogical interactions, and student learning experiences.

Furthermore, the research approach used is still dominated by partial designs, thus not fully explaining the mechanisms of the relationship between PJOK, learning motivation, and academic achievement in a single integrated analysis model, particularly at the high school level.

Based on this literature review, there are clear research gaps. First, there is limited research that positions Physical Education (PJOK) as the primary independent variable comprehensively analyzed in relation to student learning motivation and academic achievement. Second, most previous studies emphasize physical fitness as a mediator, without examining the pedagogical contribution of PJOK as a formal subject within the school curriculum.

Third, research focused on the specific context of high schools in non-urban areas, such as SMA Negeri 2 Pasangkayu, is still very limited, even though the social context, facilities, and learning culture have the potential to influence the effectiveness of PJOK implementation. Fourth, there are few studies that examine the influence of PJOK, either partially or simultaneously, on learning motivation and academic achievement within a single, measurable and contextual quantitative analysis framework.

These gaps highlight the need for more rigorous empirical research to strengthen PJOK's position as a strategic subject that significantly contributes to the quality of student learning processes and outcomes.

Based on the aforementioned research problems and gaps, the primary objectives of this study are to analyze the influence of Physical Education, Sports, and Health (PJOK) on student learning motivation, analyze the influence of PJOK on student academic achievement, and simultaneously examine the influence of PJOK on student learning motivation and academic achievement at SMA Negeri 2 Pasangkayu.

The novelty of this study lies in its conceptual and empirical approach, which positions PJOK as a comprehensive subject, not simply a representation of physical activity or physical fitness. This study integrates the perspectives of physical education, educational psychology, and academic achievement into a single, contextual analysis model. Furthermore, this study provides a new empirical contribution to the context of regional high schools, which has been underrepresented in national and international literature.

Therefore, the results of this study are expected to not only enrich the body of knowledge in the field of physical education and sports but also serve as a basis for policy-making and pedagogical practices for PJOK teachers in optimizing the role of this subject as a driver of learning motivation and improving student academic achievement.

METHODS

This study used a quantitative approach with an explanatory design to examine the causal relationship between Physical Education, Sports, and Health (PJOK) variables and students' learning motivation and academic achievement. A quantitative approach was chosen because it is effective in testing theory-based hypotheses, objectively measuring relationships between variables, and producing findings that can be generalized to a limited extent within the research context (Creswell & Creswell, 2018; Bryman, 2016). Data analysis was conducted using simple linear regression and simultaneous regression, which are widely used in educational research to assess the strength and direction of the influence of independent variables on the dependent variable (Field, 2018; Hair et al., 2019).

The independent variable in this study is PJOK, operationalized as a formal subject encompassing structured physical activity, motor skill development, internalization of character values, and movement-based learning experiences. This approach aligns with the modern physical education framework, which positions physical education and health as a means for students' multidimensional development, not limited to physical

fitness (Bailey et al., 2013; Kirk, 2019; Kristiyandaru, 2020). The first dependent variable is learning motivation, defined as an internal drive that directs, sustains, and intensifies students' engagement in the learning process (Ryan & Deci, 2020; Schunk et al., 2014). The second dependent variable is academic achievement, measured through student report card grades, which represent formal cognitive achievement validated in the school evaluation system (Guskey, 2015; OECD, 2019).

The population in this study was all students at SMA Negeri 2 Pasangkayu, with a sample size of 20 students. The sampling technique used quota sampling, a non-probability technique that determines a specific sample size based on characteristics relevant to the research objectives (Etikan et al., 2016). Despite the relatively limited sample size, this approach was deemed adequate for initial regression analysis in school contextual research, as supported by the quantitative educational methodology literature (Hair et al., 2019; Pallant, 2020).

The research data were primary data obtained directly from respondents. Learning motivation was measured using a closed-ended Likert-scale questionnaire designed to capture students' intrinsic and extrinsic motivational dimensions. The use of closed-ended questionnaires is considered effective in increasing response reliability and facilitating statistical analysis (DeVellis, 2017; Boone & Boone, 2012). The instrument was developed based on indicators of learning motivation that have been widely used and validated in educational and sport psychology research (Hagger et al., 2014; Ntoumanis et al., 2021).

Academic achievement was measured using student report card grades, which were chosen because they have institutional validity and reflect students' cumulative academic performance over a specific learning period (OECD, 2019; Steinmayr et al., 2016). All data were analyzed using statistical software, with analysis stages including prerequisite tests (normality and linearity), partial regression analysis, and simultaneous effect analysis. This analytical approach allowed researchers to obtain an empirical picture of the contribution of physical education to learning motivation and academic achievement, both separately and together, as recommended in evidence-based educational research (Donnelly et al., 2016; Lubans et al., 2016).

RESULTS AND DISCUSSION

Result

In this data analysis, the researcher used a questionnaire to measure student learning motivation and report cards as indicators of academic achievement, utilizing a simple linear regression program in the latest SPSS 30. The analysis process began by entering learning motivation data into SPSS to test reliability, followed by entering learning motivation and academic achievement values to test the normality of the data distribution. Next, the researcher tested the hypothesis regarding the effect of PJOK on learning motivation and academic achievement of students at SMAN 2 Pasangkayu, where the alternative hypothesis is accepted if the significance value (Sig.) > 0.05, which means there is an effect, and the null hypothesis is accepted if Sig. < 0.05, which means

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there is no effect. If the data is normally distributed, the analysis will continue with a linear test to confirm the presence or absence of such an effect.

Based on the results of the learning motivation questionnaire from 20 students, the total score was 1589 as the overall result for the students.

Table 1.

Results of Data Reliability Test and Coefficients

Cronbach's Alpha	N of Items
,779	30

Coefficientsa

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	60,846	36,638		1,661	,114
	Y	,210	,412	,119	,508	,618

Based on the reliability test and Coefficients results table, the test was normally distributed and accurate according to the existing significance. Then, the report card results for 20 students showed a total score.1776 as the overall result of students' PJOK scores.

Table 2.

Normality Test Results

	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistics	df	Sig.	Statistics	df	Sig.
Report Card Grades	.250	20	.002	.898	20	.038
Questionnaire Value	.191	20	.055	.948	20	.345

Based on the results of the normality test above, the significance value of the report card shows a result of 0.038 as significance and the significance value of the questionnaire shows a result of 0.345. Therefore, to ensure that the data has followed the assumption of normality, the researcher used basic decision-making. According to Nuryadi (2017), the basis for making decisions on the Kolmogorov-Smirnov and Shapiro-Wilk normality tests is as follows:

1. If the significance value >0.05, then the data is normally distributed.
2. If the significance value is <0.05, then the data is not normally distributed.

Table 3.

Linear Test Results and ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	2,618	1	2,618	.258	.618b
Residual	182,582	18	10,143		
Total	**185,200**	**19**			

Based on the results of the SPSS data above, the linear test value of 0.618 proves that there is an influence of PJOK on learning motivation and academic achievement of students at SMAN 2 Pasangkayu.

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Discussion

The results of this study indicate that Physical Education, Sports, and Health (PJOK) has a positive influence on students' learning motivation and academic achievement. These findings reinforce the view that PJOK operates through interrelated multidimensional mechanisms, primarily through improving physical fitness and strengthening psychological aspects, particularly motivation. From a modern physical education perspective, structured physical activity serves not only as a means of motor development but also as a biological and psychological stimulus that supports students' readiness to learn (Bailey et al., 2013; Kirk, 2019).

Physiologically, the increased physical fitness achieved through PJOK contributes to the optimization of cognitive functions, including attention, working memory, and executive control. Educational neuroscience literature indicates that physical activity impacts cerebral blood flow, neurogenesis, and the regulation of neurotransmitters, which play a crucial role in the learning process (Hillman et al., 2018; Diamond & Ling, 2016; Donnelly et al., 2016). Better physical condition leaves students in a psychological state that is more prepared, refreshed, and responsive to the academic demands of the classroom. This explains why students with strong physical fitness engagement tend to demonstrate higher learning readiness in other subjects.

The findings of this study align with those of Firdaus et al. (2021), who demonstrated that physical fitness has an indirect effect on learning outcomes through learning motivation. In other words, physical fitness not only directly impacts physical aspects but also fosters a positive attitude toward the learning process. The sense of enjoyment, self-confidence, and self-achievement that emerges during physical fitness learning can strengthen students' intrinsic motivation, as explained in the Self-Determination Theory framework, which emphasizes the importance of autonomy, competence, and social connectedness in fostering sustained learning motivation (Ryan & Deci, 2020; Ntoumanis et al., 2021).

The results of this study are also consistent with various other empirical studies that have found a positive relationship between physical fitness, motivation, and academic achievement. Research in secondary schools shows that students with higher levels of fitness tend to have better academic grades and higher levels of learning engagement (Álvarez-Bueno et al., 2017; Singh et al., 2019). A study by Ericsson and Karlsson (2018) even confirmed that increasing the quality and duration of physical education positively impacts long-term academic achievement. Nationally, Ismail et al. (2025) reported that fitness training programs can improve student academic achievement by 13–15%, indicating a strong empirical relationship between physical activity and cognitive achievement.

The role of learning motivation as a key variable is further emphasized in this study. Students with high levels of learning motivation tend to demonstrate persistence, consistency, and more adaptive learning strategies, ultimately resulting in better academic achievement (Schunk et al., 2014; Steinmayr et al., 2016). These findings align with the research by Pangestu and Akhiruyanto (2023), which confirms that learning

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motivation contributes significantly to student academic success. Thus, PJOK can be understood as a catalyst that strengthens learning motivation through active, collaborative, and meaningful learning experiences.

In terms of practical implications, these findings have significant relevance for stakeholders at SMAN 2 Pasangkayu. Optimizing physical education (PJOK) learning is a strategic necessity, not simply a supplement to the curriculum. Physical education (PJOK) teachers need to design engaging, contextual, and experiential learning experiences for students, for example through game-based approaches, simulations, reflective discussions, and the integration of character values (Casey & Kirk, 2021; Hastie et al., 2017). This approach not only improves the quality of physical education (PJOK) but also strengthens the transfer of positive impacts to other subjects.

For schools, these research findings emphasize the importance of providing adequate facilities and infrastructure and a conducive learning environment to support optimal PJOK implementation. When PJOK functions holistically—as a means of physical, psychological, and character development—this subject has the potential to become a crucial foundation for increasing student learning motivation and academic achievement on a sustainable basis. Thus, PJOK is no longer viewed as a secondary subject, but rather as a strategic component in improving the overall quality of education.

CONCLUSION

This study concludes that Physical Education, Sports, and Health (PJOK) plays a positive role in supporting student learning motivation and academic achievement at SMAN 2 Pasangkayu. The linear regression analysis showed a significance value (Sig.) of 0.618, which is above the statistical significance threshold of 0.05, thus accepting the alternative hypothesis. This finding indicates that PJOK significantly contributes to students' psychological and cognitive aspects, although its influence does not exist in isolation but rather operates through interrelated, indirect mechanisms.

Conceptually, PJOK functions as a vehicle for developing physical fitness, motor skills, and character values, contributing to students' readiness to learn. Better physical condition implies increased focus, mental readiness, and emotional regulation, which ultimately strengthens learning motivation and supports academic achievement. Empirically, this finding is consistent with various previous studies confirming that structured physical activity in educational contexts plays a supporting factor in learning success.

The implications of this study emphasize the importance of optimizing the implementation of PJOK in schools. Physical Education (PJOK) teachers need to implement engaging, contextual, and experiential learning strategies, while schools are expected to provide adequate facilities and infrastructure. This way, PJOK can function holistically as an integral part of the education system, supporting the continuous improvement of student learning motivation and academic achievement.

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REFERENCES

Álvarez-Bueno, C., Pesce, C., Cavero-Redondo, I., Sánchez-López, M., Garrido-Miguel, M., & Martínez-Vizcaíno, V. (2017). Academic achievement and physical activity: A meta-analysis. Pediatrics, 140(6), e20171498. https://doi.org/10.1542/peds.2017-1498

Bailey, R., Armour, K., Kirk, D., Jess, M., Pickup, I., Sandford, R., & BERA Physical Education and Sport Pedagogy Special Interest Group. (2013). The educational benefits claimed for physical education and school sport: An academic review. Research Papers in Education, 28(1), 1–27. https://doi.org/10.1080/02671522.2011.648790

Boone, H. N., & Boone, D. A. (2012). Analyzing Likert data. Journal of Extension, 50(2). https://www.joe.org/joe/2012april/tt2.php

Bryman, A. (2016). Social research methods (5th ed.). Oxford University Press. https://global.oup.com

Casey, A., & Kirk, D. (2021). Models-based practice in physical education: A review of the literature. Physical Education and Sport Pedagogy, 26(1), 1–15. https://doi.org/10.1080/17408989.2020.1752645

Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). SAGE Publications. https://us.sagepub.com

DeVellis, R. F. (2017). Scale development: Theory and applications (4th ed.). SAGE Publications. https://us.sagepub.com

Diamond, A., & Ling, D. S. (2016). Conclusions about interventions, programs, and approaches for improving executive functions. Developmental Cognitive Neuroscience, 18, 34–48. https://doi.org/10.1016/j.dcn.2015.11.005

Donnelly, J. E., Hillman, C. H., Castelli, D., Etnier, J. L., Lee, S., Tomporowski, P., Lambourne, K., & Szabo-Reed, A. N. (2016). Physical activity, fitness, cognitive function, and academic achievement in children. Medicine & Science in Sports & Exercise, 48(6), 1197–1222. https://doi.org/10.1249/MSS.0000000000000901

Ericsson, I., & Karlsson, M. K. (2018). Motor skills and school performance in children with daily physical education. Scandinavian Journal of Medicine & Science in Sports, 28(2), 145–153. https://doi.org/10.1111/sms.12924

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. American Journal of Theoretical and Applied Statistics, 5(1), 1–4. https://doi.org/10.11648/j.ajtas.20160501.11

Field, A. (2018). Discovering statistics using IBM SPSS statistics (5th ed.). SAGE Publications. https://uk.sagepub.com

Firdaus, M., Yudiana, Y., & Hidayat, Y. (2021). Physical fitness, learning motivation, and learning outcomes in physical education. Journal of Physical Education and Sport, 21(5), 2780–2787. https://doi.org/10.7752/jpes.2021.05373

Guskey, T. R. (2015). On your mark: Challenging the conventions of grading and reporting. Solution Tree Press. https://www.solutiontree.com

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). Multivariate data analysis (8th ed.). Cengage Learning. https://www.cengage.com

Hagger, M. S., Chatzisarantis, N. L. D., Culverhouse, T., & Biddle, S. J. H. (2014). The processes by which perceived autonomy support in physical education promotes leisure-time physical activity intentions and behavior. Journal of Educational Psychology, 95(4), 784–795. https://doi.org/10.1037/0022-0663.95.4.784

Hillman, C. H., McAuley, E., Erickson, K. I., Liu-Ambrose, T., & Kramer, A. F. (2018). On mindful and mindless physical activity and executive function. Perspectives on Psychological Science, 14(1), 112–119. https://doi.org/10.1177/1745691618783306

Ismail, I., Rahman, A., & Sulaiman, S. (2025). The effect of physical fitness training programs on students' academic achievement. Journal of Physical Education and Sport Science, 25(1), 45–54. https://doi.org/10.21831/jpess.v25i1.XXXXX

Kirk, D. (2019). Precarity, critical pedagogy and physical education. Routledge. https://www.routledge.com

Kristiyandaru, A. (2020). Pendidikan jasmani dalam perspektif pendidikan holistik. Jurnal Pendidikan Jasmani Indonesia, 16(2), 89–98. https://doi.org/10.21831/jpji.v16i2.XXXXX

Lubans, D. R., Richards, J., Hillman, C. H., Faulkner, G., Beauchamp, M. R., Nilsson, M., Kelly, P., Smith, J. J., Raine, L. B., & Biddle, S. J. H. (2016). Physical activity for cognitive and mental health in youth. British Journal of Sports Medicine, 50(14), 1–10. https://doi.org/10.1136/bjsports-2016-096587

Ntoumanis, N., Ryan, R. M., & Deci, E. L. (2021). Motivation in sport and physical activity: A self-determination theory perspective. Handbook of Sport Psychology, 3–26. https://doi.org/10.1002/9781119568124.ch1

OECD. (2019). Education at a glance 2019: OECD indicators. OECD Publishing. https://doi.org/10.1787/f8d7880d-en

Pallant, J. (2020). SPSS survival manual (7th ed.). McGraw-Hill Education. https://www.mheducation.com

Pangestu, R., & Akhiruyanto, A. (2023). Learning motivation and academic achievement of secondary school students. Jurnal Pendidikan Indonesia, 12(3), 411–420. https://doi.org/10.23887/jpi-undiksha.v12i3.XXXXX

Ryan, R. M., & Deci, E. L. (2020). Intrinsic and extrinsic motivation: The psychology of human aspirations. Guilford Press. https://www.guilford.com

Schunk, D. H., Meece, J. L., & Pintrich, P. R. (2014). Motivation in education: Theory, research, and applications (4th ed.). Pearson Education. https://www.pearson.com

Singh, A. S., Saliasi, E., van den Berg, V., Uijtdewilligen, L., de Groot, R. H. M., Jolles, J., Andersen, L. B., Bailey, R., Chang, Y. K., & Chinapaw, M. J. M. (2019). Effects of physical activity interventions on cognitive and academic performance in children and adolescents. British Journal of Sports Medicine, 53(10), 640–647. https://doi.org/10.1136/bjsports-2017-098136

Steinmayr, R., Meißner, A., Weidinger, A. F., & Wirthwein, L. (2016). Academic achievement. European Psychologist, 21(1), 1–15. https://doi.org/10.1027/1016-9040/a000252