



Predicting Physical Education Achievement: The Role of Sports Extracurricular Activity, Motivation, Discipline, and Responsibility

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ABSTRACT

Purpose of the study: This study examines the individual and joint relationships between sports extracurricular activity, learning motivation, discipline, and responsibility, and physical education achievement among eleventh-grade Science Track students at State Senior High School 1, Grobogan, Central Java, Indonesia.

Methodology: A quantitative correlational cross-sectional design was employed with 84 eleventh-grade Science Track students selected via proportionate random sampling from a population of 112. Data were collected using four validated five-point Likert-scale questionnaires and official semester report card grades. Prerequisite assumption tests and multiple linear regression analysis were conducted using IBM SPSS Statistics Version 21.0.

Main Findings: All four variables showed significant positive relationships with physical education achievement. Discipline demonstrated the strongest individual correlation ($r = 0.833$), followed by responsibility ($r = 0.796$), extracurricular activeness ($r = 0.789$), and learning motivation ($r = 0.677$). Simultaneous regression analysis confirmed that the four variables collectively explained 90.6% of achievement variance ($R^2 = 0.906$, $F(4,79) = 190.987$, $p < 0.001$), with responsibility yielding the highest effective contribution (27.6%).

Novelty/Originality of this study: This study is the first to simultaneously examine sports extracurricular activeness, learning motivation, discipline, and responsibility as combined predictors of physical education achievement among Indonesian senior high school students within a single regression model, identifying responsibility as the dominant behavioral determinant and demonstrating the collective predictive power of affective and extracurricular variables.

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1. INTRODUCTION

Physical education, sports, and health occupy a unique and irreplaceable position in the secondary education curriculum in Indonesia [1]. Unlike subjects primarily oriented toward cognitive aspects, physical education simultaneously develops students' psychomotor, affective, and cognitive domains through systematic, purposeful physical activities [2], [3]. Recent research indicates that quality physical education contributes not only to improved motor competence but also to psychosocial development, learning engagement, and broader

academic success [4]. Therefore, physical education plays a strategic role in developing healthy, active, and character-based students with optimal learning abilities.

The success of physical education learning is ultimately reflected in student achievement, which encompasses mastery of skills, knowledge acquisition, and the development of attitudes and behaviors. [5]. However, achievement in physical education does not consistently reflect student performance. In practice, teachers often encounter students with relatively similar physical abilities who achieve different learning outcomes. These differences indicate that physical education achievement is influenced not only by physical ability but also by various psychological, behavioral, and environmental factors that shape student engagement during the learning process [5]-[7]. Therefore, identifying factors that influence physical education achievement is important both for theoretical development and for designing more effective learning strategies [9], [10].

International studies have shown that success in physical education stems from the interplay among individual, social, and school-environment factors, not just students' athletic abilities [11]. The ecological model of youth sports participation explains that students' involvement in physical activities is influenced by a mix of personal factors, such as intrinsic motivation and felt competence; social factors, such as support from peers and family; and institutional factors, such as the school climate and opportunities to participate in extracurricular activities [12], [13]. Recent empirical findings also support this view, showing that students' participation in physical activities and their learning outcomes are shaped by the interaction among personal motivation, the social environment, and the learning opportunities provided by the school [14]. In the context of Indonesia, where physical education is a required subject with minimum competency standards, understanding these factors is even more important because the education system emphasizes balanced development across the cognitive, affective, and psychomotor domains [15]-[18].

One factor believed to help students do well in physical education is participation in extracurricular sports activities. Extracurricular activities give students a chance to learn outside regular class time through focused training, increased social interaction, and the ongoing development of sports skills [19]. According to guidelines from the Ministry of Education, Culture, Research, and Technology, extracurricular activities serve to develop students' skills, provide social interaction, offer recreation, and prepare them for future careers. Studies have shown that active involvement in extracurricular sports can increase practice time, broaden learning experiences, boost motivation, and positively affect students' performance in physical education classes [20], [21].

Besides school environment factors, study motivation is also an important factor in determining learning success. Learning motivation comes from within a person and starts, guides, and keeps them going in their study behavior to reach a specific goal [22]-[24]. In physical education, motivation is important because students' involvement is directly evident in their participation in physical activities during learning [25]. According to the Self-Determination Theory, motivation is divided into intrinsic and extrinsic types. Intrinsic motivation, which comes from personal interest and enjoyment in an activity, has consistently been shown to lead to higher levels of engagement and learning achievement compared to motivation driven mainly by external factors [26]-[27].

Learning discipline is another factor that may influence student success in physical education. Discipline refers to students' ability to comply with rules, manage time effectively, and consistently participate in learning activities [28]. In physical education learning, discipline enables students to actively participate in activities, maximize training opportunities, and develop skills gradually and sustainably [29], [30]. Therefore, students with higher levels of discipline tend to demonstrate better learning achievement than those with lower levels of discipline.

Another important factor is personal responsibility. Responsibility refers to an individual's willingness to fulfill obligations, complete tasks diligently, and accept the consequences of their actions [31]. In educational contexts, students with high levels of responsibility demonstrate stronger commitment to the learning process, greater persistence when facing difficulties, and continuous efforts to achieve learning goals without relying on external supervision. These characteristics are consistent with the concept of autonomous motivation within Self-Determination Theory; therefore, responsibility is theoretically expected to contribute positively to physical education achievement [32], [33].

Although previous studies have reported relationships among extracurricular sports participation, learning motivation, discipline, responsibility, and learning outcomes, most have examined these variables separately or combined only some of them. Consequently, limited empirical evidence explains the relative contribution of each variable when analyzed simultaneously within a single predictive model. Furthermore, studies specifically examining physical education achievement among Indonesian high school students remain limited, resulting in an insufficient understanding of the dominant factors influencing learning success in physical education.

This research gap is increasingly important to address, given the implementation of the Independent Curriculum, which emphasizes holistic student development through the integration of the cognitive, affective, and psychomotor domains [15]-[18]. Physical education teachers, schools, and policymakers require empirical evidence on the factors that most strongly influence learning achievement to develop effective learning strategies,

character-building programs, and extracurricular activities. Therefore, this research has both academic and practical significance for improving the quality of physical education learning in Indonesia.

This study was conducted at State Senior High School 1, Grobogan, Central Java, Indonesia, a public high school with an active sports extracurricular program and varying levels of student participation. The school represents a relevant educational setting for investigating how students' participation in sports extracurricular activities, motivation, discipline, and responsibility are associated with physical education achievement. Moreover, the characteristics of the school provide an appropriate context for examining the combined influence of behavioral and extracurricular factors on students' learning outcomes in physical education.

The novelty of this study lies in the integration of sports extracurricular activity, learning motivation, discipline, and responsibility into a single multiple regression model to predict physical education achievement among Indonesian senior high school students. Unlike previous studies that examined these variables separately or only in partial combinations, this study simultaneously evaluates the relative contribution of each predictor and identifies the most influential factor affecting students' achievement. Therefore, this research provides more comprehensive empirical evidence regarding the combined influence of affective and extracurricular factors on physical education achievement and offers a stronger empirical basis for developing evidence-based physical education learning strategies in Indonesia.

Based on this background, this study aims to analyze the partial and simultaneous relationships between sports extracurricular activity, learning motivation, discipline, and responsibility and physical education achievement among eleventh-grade Science Track students at State Senior High School 1, Grobogan, Central Java, Indonesia.

2. RESEARCH METHOD

2.1 Research Design

This study used a quantitative correlational design to examine the relationships between sports extracurricular participation, learning motivation, discipline, responsibility, and physical education achievement. Specifically, it investigated both the individual and combined contributions of these variables to students' achievement in physical education. A correlational design was considered appropriate because the study focused on examining naturally occurring relationships among variables without manipulating the research conditions. This approach is widely used in educational research, where student characteristics such as motivation, discipline, and responsibility cannot be experimentally manipulated or randomly assigned due to ethical and practical considerations [34], [35]. The study adopted a cross-sectional survey approach, with data collected during the first semester of the 2024/2025 academic year.

2.2 Population and Sample

This research was conducted at State Senior High School 1, Grobogan, Central Java, Indonesia. The study population included all 112 eleventh-grade students in the Natural Sciences (IPA) program in the 2024/2025 academic year. The IPA program was selected purposively because it was considered representative of a group of students with relatively homogeneous academic characteristics and high academic demands. Therefore, the relationship between active participation in extracurricular sports activities and academic achievement could be more clearly observed.

A total of 84 students were selected as the study sample using a proportional random sampling technique, representing approximately 75% of the total population, according to the sample size reference table from Krejcie and Morgan [36]. The inclusion criteria for this study were students who were still actively enrolled in the eleventh-grade science program and had completed all questionnaire items. All questionnaires that met the completeness criteria were included in the analysis, so no data had to be excluded. The number of samples taken from each class was determined using the proportional allocation formula as shown in Equation (1), where n_i represents the number of samples in class i , N_i represents the population in class i , N represents the total population (112 students), and n represents the number of research samples (84 students).

$$n_i = \frac{N_i}{N} \times n \quad \dots (1)$$

Applying this formula across all six Science Track classes yielded fractional values ranging from 13.50 to 14.25, which were rounded to 14 students per class to achieve the targeted total sample of 84 participants. The complete population and sample distribution by class are presented in Table 1.

Table 1. Population and Sample Distribution by Class

Class	Population (N)	Percentage (%)	Sample (n)
XI Science 1	19	16.96	14
XI Science 2	18	16.07	14
XI Science 3	19	16.96	14

Class	Population (N)	Percentage (%)	Sample (n)
XI Science 4	18	16.07	14
XI Science 5	19	16.96	14
XI Science 6	19	16.96	14
Total	112	100.00	84

As shown in Table 1, the sample was distributed as evenly as possible across all six classes, with 14 students selected from each class. Although minor differences in class size existed, the proportional allocation formula yielded values sufficiently close to warrant equal allocation, thereby simplifying random selection while maintaining adequate representation across all groups. Following proportional allocation, students within each class were randomly selected from the class attendance list, ensuring that all students had an equal probability of selection. The overall sampling procedure, from population to final sample, is illustrated in Figure 1.

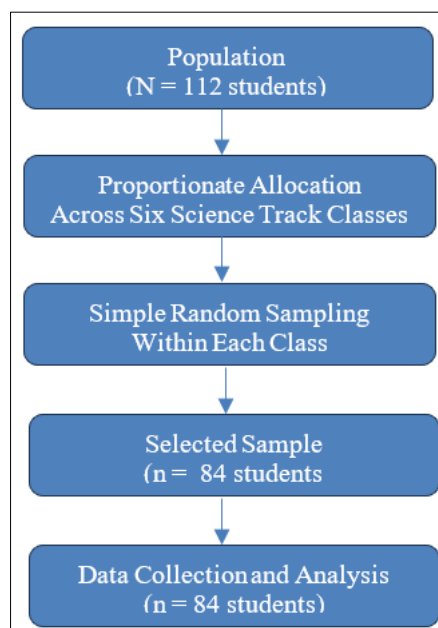


Figure 1. Sampling Procedure

As illustrated in Figure 1, the sampling procedure comprised four sequential stages: identification of the total population, proportionate allocation across six Science Track classes, simple random sampling within each class, and final selection of the study sample. This multi-stage procedure ensured that the selected sample was both statistically representative of the target population and methodologically transparent, thereby supporting the study's reproducibility.

2.3 Data Collection Technique

Research data were collected using five instruments, consisting of four Likert-scale questionnaires to measure the independent variables and semester report card grades as the dependent variable. All questionnaires used a five-level Likert scale, with a score range of 1 (strongly disagree) to 5 (strongly agree).

The Extracurricular Activity Questionnaire (X1) consisted of 18 items designed to measure the frequency of participation, level of active involvement, and quality of student participation in extracurricular sports activities. The Learning Motivation Questionnaire (X2) contained 15 items measuring intrinsic motivation, goal orientation, persistence, interest, and perceived rewards in physical education. The Discipline Questionnaire (X3) consisted of 14 items covering three dimensions: time discipline (time management and punctuality), place discipline (readiness and preparation), and normative discipline (compliance with school rules and regulations). Meanwhile, the Responsibility Questionnaire (X4) contains 14 items used to measure perseverance, tenacity, task completion, and self-regulated learning behavior. It was developed based on the personal responsibility measurement framework proposed by Ref [37].

Physical Education Learning Achievement (Y) is operationalized using students' official end-of-semester report card grades for Physical Education, Sports, and Health. These grades reflect students' achievements in the cognitive, psychomotor, and affective domains in accordance with the school curriculum, with a final score ranging from 0 to 100. A summary of all research instruments is presented in Table 2.

Table 2. Research Instrument Summary

Variable	Instrument	Items	α	Dimensions/Indicators
X ₁ Extracurricular Activeness	Questionnaire	18	0.900	Attendance frequency, active participation, engagement quality
X ₂ Learning Motivation	Questionnaire	15	0.908	Intrinsic drive, goal orientation, persistence, interest, perceived reward
X ₃ Discipline	Questionnaire	14	0.892	Temporal, spatial, normative discipline
X ₄ Responsibility	Questionnaire	14	0.906	Diligence, tenacity, task completion, and self-directed learning
Y Physical Education Achievement	Report card grades	—	—	Cognitive, psychomotor, affective domains (score 0–100)

As presented in Table 2, instrument validation was conducted using 30 pilot respondents from the same school who were excluded from the main study sample. Item validity was assessed using Pearson's product-moment correlation. Items were considered valid if the correlation coefficient exceeded the *r*-table value of 0.361 at *df* = 28 and $\alpha = 0.05$. All items across the four questionnaires met this criterion and were retained for the main study.

Instrument reliability was assessed using Cronbach's alpha coefficient. All instruments demonstrated good to excellent internal consistency, with alpha values ranging from 0.892 to 0.908, exceeding the recommended threshold of $\alpha = 0.70$, indicating high reliability across all four instruments.

2.4 Data Analysis Technique

All data were analyzed using IBM SPSS Statistics software version 21.0. The analysis was conducted in three main stages: descriptive statistics, regression assumption testing, and hypothesis testing.

Initially, descriptive statistics were computed for all research variables, including the mean, standard deviation, minimum, and maximum. This analysis aimed to provide an overview of the data's characteristics and distribution before conducting inferential analysis.

Before testing the hypotheses, the regression assumptions were assessed to ensure that the data met the requirements for multiple linear regression. The Kolmogorov–Smirnov test for residual normality indicated that the residuals were normally distributed ($K-S Z = 0.810$; $p = 0.528$). Heteroscedasticity was tested using the Glejser test, with all predictor variables having *p*-values greater than 0.05, indicating no evidence of heteroscedasticity. Next, a multicollinearity test was conducted using the Variance Inflation Factor (VIF) value. All VIF values were below 10, indicating no multicollinearity among the independent variables. The linear relationship between the predictor and dependent variables was tested using the Lagrange Multiplier Test, with a χ^2 value of 0.559 and a *p*-value > 0.05, indicating that the relationship was linear. Based on these test results, all assumptions of multiple linear regression were met.

Hypothesis testing was conducted at a significance level of $\alpha = 0.05$. The relationship between each independent variable and physical education learning achievement was analyzed using Pearson's product-moment correlation. Furthermore, the simultaneous influence of all independent variables on physical education learning achievement was analyzed using multiple linear regression.

The coefficient of determination (R^2) was used to assess the proportion of variation in physical education learning achievement explained jointly by all independent variables. Furthermore, to determine the contribution of each predictor variable, the effective contribution (SE%) and relative contribution (SR%) were calculated. The effective contribution indicates the magnitude of each predictor variable's real contribution to the total variation explained by the model. In contrast, the relative contribution represents the proportion of each predictor variable's contribution to the overall coefficient of determination (R^2).

2.5 Research Procedure

This research was conducted in four systematic stages during the odd semester of the 2024/2025 academic year. The first stage involved developing and validating the research instrument. During this stage, four Likert-scale questionnaires were developed based on established theoretical foundations and then pilot-tested with 30 respondents from the same school. These pilot-test respondents were not included in the main research sample. Pilot-test data were used to assess item validity using Pearson's Product-Moment correlation and the instrument's internal consistency using Cronbach's alpha. All items met the established validity and reliability criteria and were therefore deemed suitable for use in the main research.

The second stage was population determination and sampling. The study population was 112 11th-grade Science (IPA) students. The sample size was then determined based on the Krejcie and Morgan table. A total of 84 students were selected using proportional random sampling, distributed proportionally across the six 11th-grade Science classes, as explained in Subsection 2.2.

The third stage was data collection. Four questionnaires, which had been declared valid and reliable, were administered directly to 84 selected students, accompanied by teachers, during learning activities. This was done

to ensure a high questionnaire return rate and minimize incomplete data. Subsequently, official end-of-semester report cards for Physical Education, Sports, and Health were obtained from school administration for the same students, ensuring that the questionnaire data and academic achievement data were from the same academic period.

The fourth stage was data checking and statistical analysis. This process began with data completeness checks and descriptive statistical analysis, followed by tests of regression assumptions. Once all assumptions were met, Pearson Product-Moment correlation analysis and multiple linear regression were conducted in accordance with the procedures described in Section 2.4 to address the research objectives.

2.6 Ethical Considerations

This study was conducted in accordance with ethical principles governing educational research involving human participants. Before data collection, written permission was obtained from the principal of State Senior High School 1, Grobogan. All student participants were informed of the study's purpose, the voluntary nature of their participation, and their right to withdraw at any point without consequence. Participant anonymity was maintained throughout data collection, analysis, and reporting by using numerical codes rather than personal identifiers. No personally identifiable information was recorded or retained beyond the duration of the study. As this study did not involve clinical procedures, deception, or vulnerable populations beyond the standard educational research context, formal ethics committee review was not required under the applicable institutional guidelines.

3. RESULTS AND DISCUSSION

3.1 Descriptive Statistics

Descriptive statistics were calculated to provide an overview of the characteristics and distribution of all study variables. These statistics included minimum and maximum values, averages (means), and standard deviations, thus providing an initial description of students' extracurricular sports activity, learning motivation, discipline, responsibility, and physical education learning achievement. The results of the descriptive statistical analysis are presented in Table 3. The sample consisted of 84 eleventh-grade Science Track students ($N = 84$). Table 3 presents descriptive statistics for all research variables.

Table 3. Descriptive Statistics of Research Variables

Variable	N	Min	Max	Mean	SD
Extracurricular Activeness (X1)	84	37	85	60.18	10.09
Learning Motivation (X2)	84	32	71	50.32	8.27
Discipline (X3)	84	28	70	46.61	8.23
Responsibility (X4)	84	33	62	45.65	6.98
Physical Education Achievement (Y)	84	67	97	85.32	6.87

Note. SD = Standard Deviation. All scores reflect questionnaire totals except Physical Education Achievement, which represents the official report card grade.

The distribution of extracurricular activeness scores indicated that the majority of students (32.1%) scored in the 47–56 range, suggesting moderate activeness. Learning motivation was similarly distributed, with 35.7% of students scoring 48–55. Discipline scores clustered in the 37–44 range (38.1%), while responsibility centered around 39–44 (33.3%). Physical education achievement was skewed toward higher scores, with 40.5% of students scoring 85–90. These distributions suggest that while psychological-behavioral factors remain at moderate levels, physical education achievement is generally satisfactory, supporting the notion that additional factors drive variance in achievement.

3.2 Regression Assumption Test Results

The Kolmogorov–Smirnov normality test yielded $Z = 0.810$ ($p = 0.528$), confirming that unstandardized residuals from the regression model are normally distributed. The Glejser test showed all independent variables produced non-significant results ($p > 0.05$), confirming the absence of heteroscedasticity. Multicollinearity diagnostics revealed tolerance values for $X_1 = 0.478$, $X_2 = 0.616$, $X_3 = 0.399$, and $X_4 = 0.435$, with corresponding VIF values of 2.093, 1.625, 2.505, and 2.301, respectively, all well below the critical threshold of 10. The Lagrange Multiplier linearity test produced $\chi^2 = 0.559$, substantially below the critical value ($\chi^2_{\text{table}} = 106.6$ at $\alpha = 0.05$), confirming that a linear model specification is appropriate. All regression assumptions were satisfactorily met.

3.3 Individual Relationships: Pearson Correlation Results

Table 4 summarizes the results of Pearson's product-moment correlation analyses for all four individual hypotheses.

Table 4. Product-Moment Correlation Results

Variable Relationship	r	p-value	Conclusion
Extracurricular Activeness → Achievement	0.789	0.000	Positive & Significant
Learning Motivation → Achievement	0.677	0.000	Positive & Significant
Discipline → Achievement	0.833	0.000	Positive & Significant
Responsibility → Achievement	0.796	0.000	Positive & Significant
All Variables (Multiple) → Achievement	0.952	0.000	Positive & Significant

Note. All correlations are significant at $p < 0.001$ (two-tailed). $N = 84$.

Discipline demonstrated the strongest individual association with physical education achievement ($r = 0.833$), followed by responsibility ($r = 0.796$), extracurricular activeness ($r = 0.789$), and learning motivation ($r = 0.677$). All relationships are positive and highly significant, fully supporting Hypotheses 1 through 4.

3.4 Simultaneous Relationships: Multiple Regression Results

Table 5 presents the multiple regression coefficients and effective contributions of each predictor variable.

Table 5. Multiple Regression Analysis Results

Predictor	B	Std. Error	Beta (β)	Effective Contribution
(Constant)	36.369	1.868	—	—
Extracurricular Activeness (X1)	0.176	0.034	0.258	20.4%
Learning Motivation (X2)	0.236	0.036	0.284	19.2%
Discipline (X3)	0.235	0.046	0.282	23.5%
Responsibility (X4)	0.341	0.051	0.346	27.6%
Total $R^2 = 0.906$; $F = 190.987$; $p < 0.001$				90.6%

Note. Dependent variable: Physical Education Achievement (Y). $R = 0.952$; $R^2 = 0.906$; Adjusted $R^2 = 0.902$; $F(4,79) = 190.987$; $p < 0.001$.

The multiple correlation coefficient $R = 0.952$ indicates an exceptionally strong combined relationship between the four predictors and physical education achievement. The coefficient of determination, $R^2 = 0.906$, indicates that the four variables collectively explain 90.6% of the variance in physical education achievement, with only 9.4% attributable to factors outside this model. The overall model was statistically significant ($F(4,79) = 190.987$, $p < 0.001$). The regression equation is:

$$Y = 36.369 + 0.176X_1 + 0.236X_2 + 0.235X_3 + 0.341X_4 \dots (2)$$

All regression coefficients are positive and statistically significant (all $p < 0.001$). Responsibility demonstrated the largest standardized coefficient ($\beta = 0.346$) and highest effective contribution (27.6%), followed by discipline ($\beta = 0.282$; 23.5%), extracurricular activeness ($\beta = 0.258$; 20.4%), and learning motivation ($\beta = 0.284$; 19.2%).

3.5 Extracurricular Activeness and Physical Education Achievement

The significant positive relationship between extracurricular sports activity and physical education achievement ($r = 0.789$) reinforces previous research findings regarding the benefits of co-curricular sports involvement on academic achievement and psychomotor skill development. Participation in extracurricular activities provides students with additional practice time, allowing them to strengthen their mastery of movement skills learned in physical education classes while improving their tactical understanding of specific sports. These results align with Mogonea's view that extracurricular activities are not merely a complement to the formal curriculum but are an essential component contributing to the development of competencies targeted for assessment in physical education [38].

From a sports pedagogy perspective, the significant effective contribution of extracurricular activities, at 20.4%, underscores the importance of schools developing structured and diverse extracurricular sports programs. Sustained student involvement in sports through extracurricular activities reflects the application of the principle of deliberate practice, which entails directed, continuous practice to improve skill mastery. This principle is one of the main factors that support the improvement of sports skills and contribute to physical education learning achievement [39], [40]. Therefore, schools need to view extracurricular sports activities not only as a means of recreation or interest development but also as a pedagogically complementary part of physical education.

3.6 Learning Motivation and Physical Education Achievement

The significant positive relationship between learning motivation and physical education achievement ($r = 0.677$), although lower than the relationship between discipline and responsibility and learning achievement,

aligns with the predictions of Self-Determination Theory, which states that the quality of motivation influences the quality of student engagement in the learning process, which ultimately impacts learning outcomes. Students with high intrinsic motivation for physical activity tend to be more enthusiastic about practicing, able to persist in the face of difficulties in mastering skills, and more open to receiving feedback to improve their abilities. These behaviors contribute directly to better achievement in physical education [41], [42].

The effective contribution of learning motivation, at 19.2%, is relatively lower than that of discipline and responsibility, indicating that, in this study, motivation was measured as a relatively persistent characteristic (trait) rather than a situational condition (state). In addition, students with a high level of discipline can still achieve good learning outcomes even when their motivation is moderate, because this is supported by consistent learning habits and effort [43], [44]. However, motivation remains the primary mechanism encouraging students to learn. Therefore, various efforts that focus on increasing autonomous motivation, such as the implementation of autonomy-supportive teaching and the creation of a mastery-oriented learning climate, have been proven effective in increasing student engagement and learning achievement in the context of physical education [45].

3.7 Discipline and Responsibility as Key Determinants

The study results showed that discipline had the strongest bivariate correlation with physical education learning achievement ($r = 0.833$), while responsibility made the largest effective contribution in the multiple linear regression model, at 27.6%. This finding indicates that behavioral characteristics related to self-regulation are the most dominant factors influencing physical education learning achievement in this study sample. These results align with the contemporary educational psychology perspective, which positions self-regulation as a metacognitive factor that directs, controls, and maintains goal-oriented learning behavior in various learning contexts.

The substantial contribution of responsibility relative to other predictor variables in the regression model has important theoretical implications. Unlike motivation, which can change according to the conditions or situations faced by students, responsibility is a relatively persistent tendency as a form of individual commitment to their learning obligations [48], [49]. Students who have internalized the value of responsibility tend to complete assignments consistently, attend lessons well-prepared, and continue striving for their best effort even as their motivation levels may change over time. This consistency of behavior allows for the accumulation of mastery of skills, increased understanding of knowledge, and continuous learning experiences, which are ultimately reflected in higher physical education learning achievements [50], [51].

3.8 Simultaneous Contribution and Model Implications

The results of the multiple linear regression analysis indicate that the developed model has very high explanatory power. Active participation in extracurricular sports activities, learning motivation, discipline, and responsibility collectively explained 90.6% of the variation in physical education learning achievement ($R^2 = 0.906$). This finding indicates that psychological factors, behavior, and involvement in extracurricular activities are very important predictors of student achievement in the educational context studied [52], [53]. Although this coefficient of determination is relatively high compared to results generally found in social science research, its interpretation requires consideration of the characteristics of the sample and the research environment. All respondents came from the same grade level and school, thus having relatively uniform learning experiences and behavioral patterns. The 9.4% of the variation in learning achievement that could not be explained by the model is suspected to be influenced by other factors not analyzed in this study, such as teacher competence, quality of learning, availability of sports facilities, family socioeconomic conditions, and peer influence.

From a theoretical perspective, the results of this study support the view that physical education learning achievement is influenced by the interaction between motivational factors, behavior, and student participation. Previous studies generally examined extracurricular activity, motivation, discipline, and responsibility as independent factors in explaining learning success. The novelty of this study lies in integrating sports extracurricular activity, learning motivation, discipline, and responsibility into a single predictive model of physical education achievement among Indonesian senior high school students. Unlike previous studies that investigated these variables separately or in limited combinations, this study simultaneously examines their relative contributions and identifies the strongest predictor of learning achievement. Therefore, this study contributes a more comprehensive empirical framework for understanding the combined influence of affective, behavioral, and extracurricular factors on physical education achievement [52]-[54].

In practical terms, the results of this study have important implications for various stakeholders in physical education. Schools can use the resulting predictive model to design programs that improve learning achievement by strengthening extracurricular sports activities, implementing learning strategies that increase motivation to learn, fostering a culture of discipline, and developing character that emphasizes student responsibility. Given that responsibility is the most significant predictor of physical education achievement, various educational interventions should focus on building personal accountability, commitment to completing tasks, the ability to independently monitor one's learning, and a readiness to accept the consequences of each action

[55]-[58]. These efforts not only support the improvement of motor skills but also strengthen the affective and behavioral aspects, which are crucial for successful physical education learning.

This research also provides an international perspective through collaboration with researchers from Indonesia, Turkey, and Mexico, representing physical education traditions from Southeast Asia, Eurasia, and Latin America. Although the empirical data were obtained entirely from the Indonesian educational context, the research team's diverse academic backgrounds provide a broader theoretical perspective for interpreting the results. The relationship between extracurricular activity, learning motivation, discipline, responsibility, and physical education achievement in this study is also consistent with research findings from various countries, indicating that these variables are relevant predictors across diverse educational contexts. However, cross-national comparative research is needed to test whether the strength of the relationship and the underlying mechanisms remain consistent across different educational systems and cultures.

In the Indonesian context, the results indicate that active participation in extracurricular sports activities, learning motivation, discipline, and responsibility contribute significantly to physical education achievement in secondary school students. This finding aligns with the direction of national education policy, which increasingly emphasizes strengthening character education, active student involvement, and holistic learning experiences through both intracurricular and extracurricular activities [59], [60]. From a Turkish perspective, the results of this study further emphasize the importance of intrinsic motivation and active student involvement in physical education learning, as explained in Self-Determination Theory, which places autonomy, competence, and connectedness as the foundation for sustained learning engagement [61], [62]. Meanwhile, the Mexican perspective emphasizes the importance of social responsibility and participation in physical activity, reflecting the focus of physical education in Latin America on social development, community engagement, and the formation of healthy lifestyles through school-based sports activities [63]. Overall, these findings suggest that the contributions of extracurricular activity, learning motivation, discipline, and responsibility to physical education achievement have potential applicability across various educational settings, although further empirical evidence from cross-cultural research is needed.

Several limitations of this study should be considered when interpreting the results. First, the use of a correlational design with a cross-sectional approach means that the relationships found only indicate associations between variables and cannot yet be used to infer causal relationships. Second, this study was conducted at only one high school in Grobogan Regency, so the results cannot necessarily be generalized to other regions, school types, or educational contexts. Third, some variables were measured using self-report questionnaires, so there is still the possibility of social desirability bias, limited recall of experiences (recall bias), and common method bias, which can affect the strength of the relationships between variables. Fourth, the study sample comprised only 11th-grade science students with relatively high academic characteristics, so their levels of motivation, discipline, and responsibility may differ from those of other student groups. Therefore, further research is recommended to use a longitudinal design, involve more schools with more diverse student characteristics, utilize more objective behavioral indicators, and conduct cross-cultural comparative research to gain a stronger understanding of causal relationships and increase the external validity of the research findings.

4. CONCLUSION

The results of the study showed that activity in extracurricular sports activities, learning motivation, discipline, and responsibility each had a positive and significant relationship with physical education achievement among grade XI students in the Natural Sciences (IPA) program at State Senior High School 1, Grobogan. Among the four variables, discipline and responsibility were the strongest individual predictors, with correlation coefficients of $r = 0.833$ and $r = 0.796$, respectively. Simultaneously, the model explained 90.6% of the variation in physical education learning achievement ($R = 0.952$; $F(4,79) = 190.987$; $p < 0.001$), with the regression equation $Y = 36.369 + 0.176X_1 + 0.236X_2 + 0.235X_3 + 0.341X_4$. Based on the effective contribution analysis, responsibility contributed the most (27.6%), followed by discipline (23.5%), extracurricular sports activity (20.4%), and learning motivation (19.2%).

The findings of this study have important theoretical and practical implications. Theoretically, this study enriches the study of factors influencing physical education learning achievement by demonstrating that behavioral and self-regulation aspects, particularly responsibility and discipline, have stronger predictive power than learning motivation and extracurricular activity when all variables are analyzed simultaneously in a single regression model. These findings also provide empirical support for the importance of integrating affective and behavioral aspects into the conceptual framework of physical education learning achievement and expand the literature on self-regulation in the context of physical education.

Practically, physical education teachers are advised to implement learning strategies that support student autonomy (autonomy-supportive teaching) and are mastery-oriented (mastery-oriented instruction) to enhance students' intrinsic motivation. Furthermore, schools need to consistently build and cultivate a culture of discipline across physical education, classroom instruction, and extracurricular sports activities. Character education

programs also need to pay greater attention to the development of personal responsibility, as it has been shown to be a behavioral predictor that contributes most significantly to achievement in physical education. Furthermore, schools are expected to continue developing diverse, structured extracurricular sports programs to support and complement physical education. It is recommended that future research use a longitudinal design, involve more schools, and employ a mixed-methods approach to more comprehensively understand the mechanisms by which behavioral and affective factors influence physical education learning achievement across various educational contexts.

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AUTHOR CONTRIBUTIONS

Conceptualization, I.D.F. and S.; Methodology, I.D.F., S., and B.Y.; Software, I.D.F.; Validation, S., B.Y., and C.M.S.A.; Formal Analysis, I.D.F. and B.Y.; Investigation, I.D.F. and S.; Resources, S. and B.Y.; Data Curation, I.D.F.; Writing – Original Draft Preparation, I.D.F. and S.; Writing – Review & Editing, B.Y. and C.M.S.A.; Visualization, I.D.F.; Supervision, B.Y. and C.M.S.A.; Project Administration, I.D.F. All authors have read and agreed to the published version of the manuscript.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

Not applicable.

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