

	<p>Science, Education and Innovations in the Context of Modern Problems Issue 11, Vol. 8, 2025</p>
	<p>Title of research article</p> <p>An analysis of The Correlational Relationship between Academic Achievement and Physical Ability among Middle School Students</p>
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<p>Keywords</p>	<p>Academic Achievement ; Physical Ability ; Middle School Education.</p>
<p>Abstract</p> <p>This study aims to analyze the correlational relationship between academic achievement and certain physical abilities among middle school students. We employed the descriptive method on a sample of 86 students studying in several middle schools in the Wilaya of Bordj Bou Arréridj, Algeria. The sample was intentionally selected. Three physical tests were used: the 30-meter sprint test to measure speed, the standing broad jump to measure explosive strength, and the five-step jump test (pentathlon) to measure speed-strength. Statistical data processing was conducted using arithmetic mean, standard deviation, simple and multiple linear regression, and ANOVA, via the SPSS statistical software. The results revealed a strong correlation between certain indicators of physical ability and academic achievement, which was measured through the annual average of the study sample.</p>	
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Introduction

Contemporary educational organizations propose that children's experiences in sport and physical education (PE) contribute to the mental acuity, skills, and strategies that are important for navigating challenges faced across the life span (America SoHaPE, 2014, p1). The perceived importance of PE and its contribution to children's academic success has varied considerably over the history of the modern educational system (Tomprowski Pd & okumura MS, 2011, p53). Over the past decade the focus was on academic achievement and test scores, school

administrators are constantly evaluating curricula to maximize learning opportunities. In order to decide whether to add, maintain, or cut physical activity and physical education (PE) programs in elementary and middle schools (Howie Ek & Pate RR, 2012, p161). Physical activity (PA) proponents have long argued for the necessity of school-affiliated pa, suggesting that the time spent in pa would benefit health and might contribute to academic performance (Trudeau. FO & Shephard. RJ, 2008, p2). Health and educational professionals confirm that physically active students perform better in the classroom, so incorporating physical activity during every school day is essential for numerous reasons. Physical activity has physical and mental health benefits. As physical activity is linked to lowered risks of obesity, increased cardiovascular fitness, improved health, and academic achievement. (Karen rodenroth, 2010, p17). There are many debates on the effect of physical activity on academic performance among children and adolescents, ratey & hagerman (2008) and hansen (2017) also point out the impacts of physical fitness training on non-cognitive factors, such as controlling negative mood, the improvement of concentration, and the triggering of motivation for learning new things, due to the increased level of neurotransmitters in the brain. (Yilan xu, 2021, p02), many neuroscientists believe that our minds and bodies are connected “the better your fitness level, the better your brain works” (Ratey & Hagerman, 2008, p 247).

A large number of researchers from different countries have reported that there is a positive association between the overall physical fitness level and the academic achievement of children and adolescents, one of the similar previous studies that addressed this topic is:

Blom, Lindsey c & Kolbo, Jérôme (2011) a study of associations between health-related physical fitness, academic achievement and selected academic behaviors of elementary and middle school students in the state of mississippi. The purpose of this study was to explore the relationships among these variables by using objective measures of fitness, standardized language arts and math test scores, attendance records, discipline actions, and socio-demographic information from a sample of 2,992 mississippi (usa) public school children in grades 3-8. The sample consisted of students who were mostly male (52.4%), white (52.3%), in grades 3-5 (64.2%), within a healthy weight range (54.1%), and qualified for free/reduced price lunch (63.7%). The results indicated a statistically significant positive correlation between fitness and standardized test scores in language arts and math and a statistically significant negative relationship with school absences. The relationships remained significant while controlling for gender, race, and socioeconomic status. (Blom C & Kolbo J, 2011 p 13)

Francisco Javier Fonseca Del Pozo & Francisco Jesus Llorente Cantarero (2017) a study of physical fitness as an indicator of health status and its relationship to academic performance during the prepubertal period. The aim is to examine the relationship between physical fitness (pf), pa, obesity and academic performance (ap) in primary school children, via cross-sectional studies including 91 primary school students, aged 9 to 12 years, from the province of cordoba. Data was collected from april to june 2014. We measured pf using part of the eurofit fitness testing battery. The level of pa was measured as low or high pf and the level of obesity was measured using body mass index, waist circumference, percentage of fat mass, lean body mass, percentage of lean mass and basal metabolism. Ap by scores on the second quarter was based on the total average of scores of basic subjects and other subjects, including physical education. Cognitive performance was assessed by the spanish overall and factorial intelligence test, the results of ap were positively related to levels of pf. Students who achieve better pf score better in maths, ($p = 0.019$), natural sciences ($p = 0.024$), religion ($p = 0.018$) and physical education ($p < 0.001$). A direct association between maximal aerobic capacity with mathematics ($r = 0.325$, $p = 0.02$), ap ($r = 0.349$, $p = 0.001$) and cognitive performance (cp) ($r = 0.312$, $p = 0.003$) was observed. There was also a direct association of better jump tests with higher ap ($r = 0.328$, $p = 0.002$). (Francisco, JP & Francisco, JC, 2017, p 197)

Based on these established theoretical findings, the problem of the current study revolves around examining the relationship between academic achievement and some physical ability indicators among middle school students, The main research question is:

- Is there a statistically significant correlation between academic achievement and some physical ability indicators among middle school students?

This general question is further divided into the following sub-questions:

- Is there a statistically significant correlation between academic achievement and speed index among middle school students?

-Is there a statistically significant correlation between academic achievement and explosive Strength index among middle school students?

-Is there a statistically significant correlation between academic achievement and speed- Strength index among middle school students?

General Hypothesis:

-There is a statistically significant correlation between academic achievement and some physical ability indicators among middle school students.

This general hypothesis is further broken down into the following sub-hypotheses:

-There is a statistically significant correlation between academic achievement and speed index among middle school students.

- There is a statistically significant correlation between academic achievement and explosive Strengthindex among middle school students.

-There is a statistically significant correlation between academic achievement and speed- Strengthindex among middle school students.

This study aims to identify the correlation between academic achievement and some physical ability indicators (speed, explosiveStrength, speed- Strength) among middle school students, and the impact of physical ability on academic performance, which can be measured by the annual school average among middle school students.

The significance of this study lies in its attempt to uncover the nature of the relationship between physical ability levels and academic achievement, and to clarify the impact of physical activity and sports on academic performance, which can be measured by the annual school average among middle school students. Focusing on this age group, which represents adolescence (12-15 years), is essential, as it is a critical and sensitive stage marked by significant physical changes. The findings of this research could be beneficial in promoting physical fitness among adolescents in Algeria, maintaining their physical and mental health, and fostering their cognitive and academic development. The study may also offer suggestions for educational curriculum reforms to develop effective strategies for enhancing academic learning within a healthy educational environment.

Definition of key terms in the search :

Physical ability : A physiological state of well-being that reduces the risk of hypokinetic disease; a basis for participation in sports; and good health which enables one to complete the tasks of daily living. Components include cardio-respiratory endurance, muscle strength endurance, speed, flexibility, and body composition.

Academic achievement : The extent to which a student, teacher or institution has achieved their educational goals, commonly measured by examinations or continuous assessment. (joseph E. donnelly &al, 2016, p1200)

Middle School Education: Also known as intermediate education, this constitutes a general educational phase positioned between primary and secondary education. Students' progress to it from the primary level and subsequently advance to secondary education. The study duration spans four (04) years, typically covering the age bracket of 12-15 years, a phase frequently termed early adolescence.

Methodological Approaches

We conducted a pilot study on a sample of eight (20) students to test the data collection tools and assess the sample's responsiveness to them.

- This study was conducted in sixteen (11) secondary schools within the Bordj Bou Arreridj Province.
- The study took place from 02 February 2025 to 21 April 2025.
- Methodology Used: We adopted the descriptive method as it aligns with the nature of the research.

-Population and Sample of the Study: The research population comprised all middle school students in the Bordj Bou Arreridj Province. We purposefully selected a sample of eighty (86) second-year middle school students, distributed across sixteen (11) secondary schools.

-Identification and Measurement of Variables: Independent Variables (some physical ability indicators (speed, explosive Strength, speed-Strength), Dependent Variable (academic achievement) which is expressed as the annual average for the academic year.

Data Collection Tools: Three (03) validated physical tests were applied:

- The first test measured speed.
- The second test measured explosive Strength.
- The third test measured speed-Strength.

Physical Tests Administered: The 30-metre sprint test (from an approximate running start) to measure speed, standing broad jump test to measure explosive Strength, Five-step jump test (pentathlon) to measure speed-Strength.

The data collection tools were subjected to scientific validation.

- Statistical Tools: We conducted several statistical analyses using the SPSS 2020 software. The following relationships were selected: (Mean, Standard deviation, Multiple linear regression, Pearson correlation coefficient, Coefficient of determination, Adjusted coefficient of determination, and F-ANOVA).

Presentation, analysis of Results

The results were as follows:

Table (01): Regression Coefficients between the Independent Variables (speed, explosive Strength, speed-Strength) indicators and the Dependent Variable (academic achievement) among middle school students.

Variable	Unstandardized Coefficients		Standardized Coefficients	T-test	Sig	(R)	(R ²)	Adjusted (R ²)
	B	Standard Error	Beta					
Regression Intercept B_0	22,63	2,54		8,96	0,00	0,45	0,20	0,17

speed	0,62	0,19	-0,42	3,19	0,002			
explosive Strength	0,38	0,88	0,05	0,43	0,66			
Speed-Strength	-1,26	0,45	-0,28	-2,77	0,007			

Source: Prepared by the researchers based on the SPSS output, 2020.

First: Theoretical Conditions

Consistency or Logical Validity of the Regression Coefficient Values and Signs

It is observed here that the variables under study fall within the framework of identifying athletically gifted students in the field of sports training.

Referring to the multiple linear regression model obtained in the study, which illustrates the significant relationship between the independent variables (speed, explosive Strength, speed- Strength) index and the dependent variable (academic achievement) among middle school students, we derive the following equation:

$$Y = -0,02X_1 + 0,06X_2 + 3,20$$

From this model, we conclude the following:

- The constant part B_0 has a positive value and is not equal to zero (22,63).
- The slope of the regression line B_1 has a positive value (0,62).
- The slope of the regression line B_2 has a positive value (0,38).
- The slope of the regression line B_3 has a negative value (-1,26).

We note that there is no contradiction between the theoretical conditions of the phenomenon under study and the results of the regression model, which explains the effect relationship between the independent variables (speed, explosive Strength, speed-Strength) index and the dependent variable (academic achievement) among middle school students.

The Explanatory Power of the Model

The explanatory power of the regression model is judged by the adjusted coefficient of determination, found in Table (01), which demonstrates the significant relationship between the dependent variable (academic achievement) and the independent variables (speed, explosive Strength, speed-Strength) index in the study sample. The value of the adjusted coefficient of determination is estimated at (0.17), meaning that the selected study variables explain (17%) of the effect of the independent variables (speed, explosive Strength, speed-Strength) index on the dependent variable (academic achievement) for the study sample. In other words, (17%) of the variations in the dependent variable (academic achievement) are attributed to the independent variables (speed, explosive Strength, speed-Strength) index in the study sample, while (83%) are due to other factors.

These results reflect the validity of the selected study variables and their capacity to explain the results of the regression model. The statistical significance of this model is justified by the significance level, which is estimated at a probability value of (0.00). This is statistically significant and aligns with the study's hypotheses.

Second: Mathematical Conditions

Table (02): Analysis of Variance (ANOVA) for the Independent Variables (speed, explosive Strength, speed-Strength) indicators and the Dependent Variable (academic achievement) among middle school students.

Source	Sum of Squares	Degrees of Freedom	Mean Squares	F Value	Sig Value
Regression	92,70	3	30,90	6,83	0,000
Error	375,41	83	4,52		
Total	468,12	86			

Source: Prepared by researchers based on SPSS output, 2020.

The purpose of calculating the ANOVA table is to analyse the total sum of squares of the dependent variable (SST), the sum of squares due to regression (SSR), and the sum of squares for the error (SSE).

Additionally, the key indicator for the quality of the regression model is the coefficient of determination (R^2), calculated as follows:

$$R^2 = \frac{\text{Sum of Squares for Regression (SSR)}}{\text{Total Sum of Squares (SST)}} = \frac{92,70}{468,12} = 0,20$$

Explanatory Power of the Model

The square root of the coefficient of determination equals the correlation coefficient $\sqrt{R^2} = r$. By substituting the values, we find $r = \sqrt{0,20} = 0,45$. These results align with the outcomes shown in Table (02) and indicate that (45%) of the total variance in the dependent variable is explained by the linear relationship in the regression model between the dependent variable (academic achievement) and the independent variables (speed, explosive Strength, speed-Strength) index in the study sample. This result justifies the adjusted coefficient of determination obtained in Table (02).

Overall Significance of the Model

From Table (02), it is clear that the calculated F-value is (6,83), and the P-value is (0,00), which is less than the significance level of (0,05). This means that at least one of the regression coefficients differs from zero and is statistically significant.

Partial Significance of the Model

In the previous step, we concluded that at least one of the regression coefficients differs from zero. To determine which of these coefficients is significant, we conduct a partial significance test for the model using the T-test.

From the results in Table (01), we find:

-The constant B_0 (22,63) with a probability value of (0,00), which is less than (0,05), indicating that the constant in the regression model is significant.

-The slope of the regression line B_1 for the speed index among the study sample is (0,62) with a probability value of (0,002), which is less than (0,05). Therefore, we conclude that the slope for speed in the regression model is significant.

-The slope of the regression line B_2 for the explosive Strength index among the study sample is (0,38) with a probability value of (0,66), which is bigger than (0,05). Thus, we conclude that the slope for explosive Strength in the regression model is not significant.

- The slope of the regression line B_3 for the speed-Strength index among the study sample is (-1,26) with a probability value of (0,007), which is less than (0,05). Therefore, we conclude that the slope for speed-Strength in the regression model is significant.

Discussion

The obtained results indicate a significant relationship between the independent variables, physical ability indicators (speed, explosive Strength, speed-Strength), and the dependent variable, academic achievement, among middle school students. Changes in the independent variables, (speed, explosive Strength, speed-Strength) indicators, have a noticeable impact on the dependent variable, academic achievement, among the study sample. The statistical model shows that (17%) of the effects on the dependent variable, academic achievement, can be attributed to the independent variables, (speed, explosive Strength, speed-Strength) indicators, among the sample participants, while (83%) is due to other factors. Additionally, (39%) of the total variance in the residuals is explained by the linear correlation of the regression model between academic achievement (dependent variable) and (speed, explosive Strength, speed-Strength) indicators (independent variables) among the study sample. This result highlights the strong correlation between academic achievement and (speed, explosive Strength, speed-Strength) indicators, which equals (0,39) with a probability value (P-value) of (0,00), less than (0,05), making it statistically significant.

Therefore, the study hypothesis is confirmed, indicating a statistically significant correlation between academic achievement and some physical ability indicators (speed, explosive Strength, speed-Strength) among middle school students. This suggests that (speed, explosive Strength, speed-Strength) indicators have a positive effect on academic achievement, meaning that academic achievement is influenced by the levels of physical fitness (speed, explosive Strength, speed-Strength). In other words, as an individual's physical fitness increase, his academic level increased, and vice versa. The systematic review in Joseph E. Donnelly & al (2016) study found evidence suggesting an associations among PA, fitness, cognition, and academic achievement. Improvements in executive function are frequently associated with acute bouts of activity and fitness. Improvements in academic achievement are also found with acute activity. (Joseph E & al, 2016, p1216). The study by D. N. Ardoy & al (2014), conducted on pubescent children in Murcia, Spain, confirmed that increasing the frequency and intensity of physical education sessions positively impacts academic achievement in mathematics and language. (D. N. Ardoy & al, 2014, p52).

Our current study's results align with those of Francisco Javier Fonseca & al (2017), which found a positive correlation between academic progress programs and physical fitness levels. It was established that students with better physical fitness levels achieved higher scores in mathematics, natural sciences, religion, and physical education. (Francisco. J & al, 2017, p201). Our study's results also align with the findings of Blom, Lindsey C & al (2011) which indicated a statistically significant positive correlation between fitness and standardized test scores in Language Arts and Math and a statistically significant negative relationship with school absences. The relationships remained significant while controlling for gender, race, and socioeconomic status. Given that students who were more fit had higher test scores and fewer absences. (Blom. C & al, 2011, p19). Our study also concurs with the findings of Redouane & Fateh (2021), which showed a strong correlation between academic performance and physical fitness components (speed, strength, endurance) among middle school students. The researchers asserted that students with higher capacities in speed, strength, and endurance tend to achieve better academically. (Redouane & Fateh, 2021, p349). According to Ronald W. Bass & al (2013), muscular strength and aerobic endurance are strongly correlated with academic achievement, though to a lesser extent than aerobic fitness stability. This emphasizes the importance of programs that promote physical fitness, such as physical education, due to their significant role in academic domains. (Ronald. W & al, 2013, p835). The study by Laura Redondo & Vicente Javier (2022) revealed a strong relationship between academic achievement and VO_2 max, diastolic blood pressure, and sleep disorders caused by breathing issues. The study indicated that high-achieving students had higher VO_2 max values, lower diastolic blood pressure, and reduced levels of sleep disorders due to respiratory problems. Conversely, the low-achieving group exhibited significantly higher levels of diastolic blood pressure and sleep disturbances, along with much lower VO_2 max scores. (Laura & Vicente, 2022, p04).

Youssef & Saïd (2015) confirmed that students enjoying good health and possessing essential physical fitness components are better equipped to handle the various challenges of daily and academic life. Health and fitness positively impact intelligence and mental capabilities, all contributing to strong academic achievement. (Youssef & Saïd, 2015, p193). Practicing sports has been associated with mental health, as increased self-esteem can be

observed in those who regularly engage in physical activities (Berchtold NC & al, 2005, p860), Regular exercise may also reduce stress, anxiety, and depression—all factors that can influence academic success. (Ekeland E & al, 2005, p49).

Conclusion

Based on the results of this study conducted on middle school students aged between 12 and 15, we conclude that there is a strong correlation between academic achievement and the level of physical ability among students. Academic performance is influenced by the level of physical fitness – the better a student's physical fitness, the higher their academic achievement. In other words, when an individual or student possesses good physical fitness, their functional abilities improve, supporting self-regulation and behavioral control, which positively affects the cognitive and psychological variables linked to academic achievement. This contributes to improving academic learning levels among middle school students. Therefore, the researchers recommend that decision-makers, school principals, physical education teachers, and administrators adhere to guidelines that ensure the moderate and regular practice of physical activities to improve students' physical fitness, thereby enhancing their physical health and academic learning effectiveness. We also suggest that researchers expand this study through new research and select samples from various educational regions to generalize the findings.

Conflict of Interest

The authors declare no conflict of interest. All observations, interpretations, and recommendations presented in this article are based on professional experience and research conducted independently.

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