



The Impact of Physical Activity and Social Support on Cognitive Ability and Motor Skills of Students

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Abstract

Physical inactivity among adolescents is a growing public health concern that may negatively affect cognitive and motor development. In Indonesia, many children and adolescents do not meet recommended physical activity levels, a situation worsened by sedentary lifestyles and increased screen time. This study aims to analyze the impact of physical activity and social support on the cognitive ability and motor skills of students. The study uses a quantitative approach with a descriptive quantitative method and an associative causal design (ex post facto). Using the stratified random sample technique, 60 students from Senior High School Bhayangkari Bandung participated in the study. Physical activity was measured using the Physical Activity Questionnaire for Adolescents (PAQ-A), social support was measured using the Social Support Scale for Exercise Behavior, cognitive ability was measured using the General Cognitive Assessment Battery (GCAB) based on a computer, and motor skills were measured using the Motorische Basiskompetenzen (MOBAK) level 2 instrument. Data were analyzed using descriptive statistics and multiple linear regression analysis. The research results show that physical activity has a positive and significant impact on cognitive and motor skills, and is the most dominant factor compared to social support. Social support also has a positive and significant impact on cognitive and motor skills, although its contribution is smaller compared to physical activity. Simultaneously, physical activity and social support significantly influence cognitive and motor skills, indicating that both factors contribute together to support the development of learners. Adequate physical activity and social support are important factors that need to be considered in efforts to improve students' cognitive and motor skills.

How to Cite

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INTRODUCTION

Physical activity is one of the important factors in a person's growth and development process, not only from the aspect of physical health (Dhuli et al., 2022). Someone who is actively engaged in physical activity tends to show more optimal brain function, better motor coordination, and readiness for daily activities (Voelcker-Rehage et al., 2016). Physical activity plays a strategic role in supporting the quality of human resource development in the aspect of health (Scatigna et al., 2019). In the context of education, cognitive abilities encompass various mental functions such as attention, memory, problem-solving, decision-making, and critical thinking skills (Thuc Duc et al., 2024). Meanwhile, motor skills are related to basic movement skills, coordination, balance, and body control, which form the foundation for learning activities, sports, and daily life activities (Newell, 2020). Both are essential aspects that are interconnected and contribute to the success of students in the formal education process.

The percentage of physical activity among Indonesians, especially children and adolescents, is still low, according to official data from Badan Pusat Statistik. Only over 37% of people aged 5 and older participated in sports during the previous week in 2024, according to BPS, while over 60% of residents did not exercise at all during that time. Also, Percentage of citizens who exercised among those aged 10 and above remained below 40% in numerous provinces. Low levels in physical activity among school-age children may have a detrimental effect on pupils' cognitive and motor skill development (Abdelkarim et al., 2017). In contemporary educational environment, sedentary lifestyles which include extended periods of sitting, excessive use of electronics, and little physical activity outside of class time have grown to be significant problems (Park et al., 2020). This pattern is further supported by changes in societal behaviors and technological advances (Rahman, 2020). There are have a lower opportunities for active mobility as a result of students being exposed to more screen-based learning and entertainment activities (Guo et al., 2021). This condition poses a risk of reducing sustainable health.

Students' development is supported in both ways by physical activity (Huang, 2024). Social support impacts students' motivation, self-esteem, and participation in academic and physical activities (Peng et al., 2025). Positive

social support can results in more active, self-assured, and cognitively and motorically developed students (Blegur et al., 2021). Social support acts as a driving factor that enhances the effects of physical activity on cognitive and motor development (Xu et al., 2024). Parents' encouragement to be active, teachers' support in physical activity-based learning, and positive interactions with peers can create a conducive learning environment for the overall development of students (Shaheen et al., 2020; Sparks et al., 2015; Wang & Abd Rahim, 2024). Therefore, physical activity and social support play a role in children's growth and development, especially within the scope of education in schools.

Schools do not only function as places for the development of cognitive knowledge, but also as educational environments responsible for the balanced development of students' physical, motor, social, and emotional aspects (Jannah et al., 2025). Thru physical education subjects, a school culture that supports movement activities and positive social interactions, students have the opportunity to develop motor skills while also stimulating cognitive functions such as concentration, problem-solving, and decision-making. School is the main social space for students to build relationships with teachers and peers (Wijayanti & Sulistiobudi, 2018), so social support within the school environment has a direct impact on students' learning motivation and engagement in both physical and academic activities (Masupah et al., 2021). Therefore, the support provided thru positive teacher feedback, cooperation among students, and opportunities for active participation in movement-based learning activities can strengthen cognitive and motor development.

Physical activity has a positive influence on children's motor skills and cognitive development. For example, a systematic review found that physical activity interventions significantly improve basic motor skills and several aspects of cognitive development in early childhood (Zeng et al., 2017). There are recommendations for further research with objective cognitive measurements to strengthen the cause-and-effect relationship between physical activity variables and children's cognition (Gao et al., 2018). Additionally, other research shows that regular physical activity is associated with improved learning abilities and cognitive function in adolescents (Haverkamp et al., 2021). The need for further studies to examine the relationship between physical activity and various cognitive aspects in school-aged groups (Bidzan-Bluma & Lipowska, 2018). Based

on these findings, accompanied by research recommendations that examine the simultaneous effects of physical activity and social support on students' cognitive and motor skills, in order to fill the gap in studies that have not yet systematically integrated these two variables in the context of formal education.

Utilization of educational potential in each region varies for students, even tho the curriculum aspect is the same because each educator has the opportunity to provide diverse contributions. This has the potential to create developmental gaps among students based on their social environment and the level of support they receive. Based on the description, it can be understood that the development of students' cognitive and motor skills cannot be separated from the role of physical activity and social support. Previous studies have generally investigated these variables separately or focused on only one developmental domain. By combining behavioral (physical activity), psychosocial (social support), cognitive, and motor dimensions in a single analytical model, this study provides a more comprehensive understanding of students' development. Therefore, the study of the influence of physical activity and social support on students' cognitive and motor skills becomes very relevant to conduct. In addition to serving as a foundation for the creation of more comprehensive, contextual, and student centered of learning strategies and educational policies, this study is anticipated to offer an empirical picture of the degree to which social support and physical activity aid in the development of students' cognitive and motor skills.

METHOD

Research uses a quantitative approach because the data collected is numerical and analyzed using statistical techniques to test the relationships and influences between variables objectively and measurably (Creswell, 2017). Quantitative approach was chosen so that the research results can provide generalizability based on empirical evidence obtained from the research subjects. Research method used is descriptive quantitative (Creswell, 2017), which aims to describe the level of physical activity, social support, cognitive ability, and motor skills of students based on data obtained in the field. This descriptive method provides a factual and systematic depiction of the characteristics of each research variable in accordance with the actual conditions of the students.

Research design used is a causal associati-

ve design (ex post facto) with regression analysis (Cohen et al., 2002). This design is used to test the influence of physical activity and social support on students' cognitive and motor skills without any treatment or manipulation of variables by the researcher. Research was conducted by observing phenomena that have occurred naturally, and then statistically analyzing the cause-and-effect relationships. Thru this design, the influence of the independent variables of physical activity and social support can be analyzed both partially and simultaneously on the dependent variables of cognitive ability and motor skills of the students. Analysis results are expected to show the contribution of each independent variable as well as the strength of its influence in supporting the cognitive and motor development of the students.

Population of this study consists of students from Senior High School Bhayangkari Bandung, specifically from grades X, XI, and XII, totaling 354. These students were selected as the population because they represent the full range of adolescent developmental stages within the school context, allowing for comprehensive analysis across different grade levels. Stratified random sampling, which divides the population according to grade levels and then takes equal number of samples from each stratum, is the sampling approach utilized. Twenty students are chosen at random from each of the grade levels X, XI, and XII, for a total of 60 study participants. Technique is used to ensure balanced representation across grade levels and to obtain a proportional picture of the physical activity, social support, cognitive abilities, and motor skills of high school students. All participants are adolescents aged 15–18 years, corresponding to early to late adolescence, and are actively engaged in formal learning activities at school.

First instrument used, adopting the Physical Activity Questionnaire for Adolescents (PAQ-A) developed by (Rahayu et al., 2022), is used to measure the physical activity levels of students over the past 7 days. This instrument is self-reported and assesses students' physical activity habits in various contexts, such as leisure time, physical education classes, break times, after school, evenings, and weekends. PAQ-A instrument covers several domains of physical activity, namely leisure time physical activity, physical activity during physical education classes, physical activity during break times, physical activity after school, physical activity in the evening, physical activity on weekends, an overview of physical activity over the past seven days, and a daily recap of physical activity. All domains are measured

using a five-point Likert scale, with a score of 1 indicating very low or inactive physical activity, a score of 2 indicating low, a score of 3 indicating moderate, a score of 4 indicating high, and a score of 5 indicating very high.

Second instrument used in this study adopts the Social Support Scale for Exercise Behavior developed by (Noroozi et al., 2011). This instrument is used to measure the social support received from family and friends in relation to exercise or physical activity behavior. The Social Support Scale for Exercise Behavior consists of several domains of social support, namely friend support, family participation and involvement, and family reward and punishment. All domains are measured using a five-point Likert scale in the form of a rating scale, which describes the frequency of social support received by the respondents. The measurement scale used consists of a score of 1 indicating never, a score of 2 indicating rarely, a score of 3 indicating sometimes, a score of 4 indicating often, and a score of 5 indicating very often.

Third instrument regarding cognitive abilities in this study refers to the General Cognitive Assessment Battery (GCAB) by Cognifit™, which is an online neuropsychological tool lasting approximately 40 minutes, designed to accurately evaluate various abilities and assess cognitive well-being. By using online cognitive tasks that have been clinically and scientifically validated (Öztürk et al., 2022). Cognitive ability test instrument using the Cognifit application includes five main domains of cognitive function, namely attention, memory, coordination, perception, and reasoning. These five domains are measured through 21 cognitive aspects assessed using computer-based neuropsychological tasks. Cognitive ability scores are obtained within a range of 0–800 points, which are then interpreted into four categories in **Table 1**.

Table 1. Cognitive Ability Score Interpretation

Score Range	Category	Description
0 – 200	Below Average	Indicates below-average cognitive ability
200 – 400	Low Average	Indicates low cognitive ability but still within the average range
400 – 600	High Average	Indicates high cognitive ability within the average range
600 – 800	Above Average	Indicates above-average cognitive ability

Fourth instrument on motor skills adopts from MOBAK (Motorische Basiskompetenzen) developed by (Herrmann et al., 2015). MOBAK instrument is a measurement tool used to assess basic motor competence. The MOBAK instrument evaluates basic motor skills grouped into two main domains, namely locomotion and object control. The locomotion domain includes basic movement skills such as balancing, rolling, jumping, and sidestepping, while the object control domain encompasses skills in controlling objects such as throwing, catching, bouncing, and dribbling a ball. Assessment is conducted through direct practical tests using a performance-based scale system. Each item is assessed using a basic scale of 0–1 (fail–pass) which is then converted into a score of 0–2 based on the number of successful attempts. This instrument has two levels of difficulty (Level 1 and Level 2), with the analysis focused on Level 2. The maximum total score is 16 points, consisting of 8 points for the locomotion domain and 8 points for the object control domain, where a higher score indicates better motor skills, while a lower score indicates the need for basic motor skill development.

RESULTS AND DISCUSSION

Descriptive statistics of the research variables, sample characteristics, and test results on the impact of social support and physical activity on cognitive and motor skills have been included in the study's findings. An overview of the respondents' profiles by age and gender is given by the sample characteristics. The general trends and data distribution for every variable under study are described using descriptive statistics of the research variables. The influence test results are then shown to illustrate how social support and physical exercise, each partially and simultaneously, relate to and contribute to cognitive and motor abilities.

Description of the respondents who took part in this survey is given by the sample characteristics. The age and gender of the respondents are among the characteristics that have been examined.

Table 2. Sample Characteristics (Gender and Age)

Characteristic	Category	Frequency (n)	Percentage
Gender	Female	26	43,3
	Male	34	56,7
	Total	60	100

	15	4	6,7
	16	15	25
Age (years)	17	23	38,3
	18	18	30
Total	60	100	

Descriptive statistics on the elements of the data on motor skills (Y2), social support (X2), cognitive ability (Y1), and physical activity (X1) for each variable. The sample size, mean, standard deviation, minimum, and maximum values are all part of these statistics.

Table 3. Descriptive Statistics of Variables

Variables	N	Mean	SD	Min.	Max.
X1 (Physical Activity)	60	32,75	5,114	25	40
X2 (Social Support)	60	71,72	7,307	58	86
Y1 (Cognitive Ability)	60	9.588,55	380,073	8.607	10.725
Y2 (Motor Skills)	60	10.658,87	811,232	9.488	12.640

Table 3 shows that there are 60 respondents for all of variables, and all data is full with no missing information. The physical activity variable (X1) has an average value of 32.75 with a standard deviation of 5.114, indicating that the respondents' level of physical activity falls into the moderate category with a relatively homogeneous data distribution. The social support variable (X2) shows an average value of 71.72 and a standard deviation of 7.307, indicating that respondents generally receive quite good social support. The cognitive ability variable (Y1), with an average value of 9,588.55 and a standard deviation of 380.073, indicates that respondents' cognitive abilities are at a relatively good level with data variation still within reasonable limits. The motor ability variable (Y2) has an average value of 10,658.87 with a standard deviation of 811.232, indicating that respondents' motor abilities are in the good category, although with greater data variation compared to cognitive abilities.

Multiple linear regression analysis was conducted to determine the effect of physical activity (X1) and social support (X2) on cognitive ability (Y1) in **Table 3** and **Table 4**. Multiple linear regression analysis was conducted to determine the effect of physical activity (X1) and social support (X2) on motor skills (Y2) in **Table 4** and **Table 5**.

Based on **Table 4**, the partial test results show that variable X1 (physical activity) has a regression coefficient value of $B = 46.866$, with a t-value of 6.813 and a significance level of 0.000 ($p < 0.05$). The standardized beta coefficient value of $\beta = 0.631$ indicates that physical activity has a positive and significant effect on cognitive ability. This shows that the higher the level of physical activity performed, the more an individual's cognitive ability tends to increase. With the highest beta value, physical activity is the most dominant variable in influencing cognitive ability. In **Table 4**, the partial test results on variable X2 (social support) show a regression coefficient value of $B = 18.321$, with a t-value of 3.805 and a significance level of 0.000 ($p < 0.05$). Based to the standardized beta value of $\beta = 0.352$, social support significantly and favorably affects cognitive performance. This indicates that, although the contribution is less than that of physical activity, people's cognitive abilities tend to improve the more social support they receive, whether from peers, family, or the environment. With a level of significance of 0.000 ($p < 0.05$), the simultaneous test results in **Table 5** display a F value of 29.885. This suggests that social support and physical exercise together significantly affect cognitive function.

Table 4. Multiple Linear Regression Test of Physical Activity and Social Support on Cognitive Ability

Variable Y	Variable X	B	Std. Error	Beta	t	Sig.	Description
Cognitive Ability	(Constant)	6739,73	417,938		16,126	0,000	Significant constant
	PA	46,866	6,879	0,631	6,813	0,000	Positive and significant
	SP	18,321	4,815	0,352	3,805	0,000	Positive and significant

Note: PA: Physical Activity. SP: Social Support

Table 5. ANOVA Test on Physical Activity and Social Support on Cognitive Ability

Variable	Sum of Squares	df	Mean Square	F	Sig.	Sig.
Cognitive Ability	4.362.533,47	2	2.181.266,735	29,885	0,000	Description Model is significant
	4.160.357,37	57	72.988,726			
	8.522.890,85	59				

Table 6. Multiple Linear Regression Test of Physical Activity and Social Support on Motor Skills

Variable Y	Variable X	B	Std. Error	Beta	t	Sig.	Description
Motor Skills	(Constant)	4360,105	888,169		4,909	0,000	Significant constant
	PA	96,796	14,618	0,610	6,621	0,000	Positive and significant
	SP	43,626	10,232	0,393	4,264	0,000	Positive and significant

Table 7. ANOVA Test Results of Physical Activity and Social Support on Motor Skills

Variable	Sum of Squares	df	Mean Square	F	Sig.	Description
	20.038,942,351	2	10.019,471,17	30,40	0,000	
Motor Skills	18.788,796,582	57	329,628,01			Model is significant
	38.827,738,933	59	10.019,471,17			

Variable X1 (physical activity) has a regression coefficient value of $B = 96.796$, a t-value of 6.621, and a significance level of 0.000 ($p < 0.05$), based to the partial test findings based on Table 6. The standardized beta coefficient value of $\beta = 0.610$ suggests that motor abilities are positively and significantly impacted by physical activity. This show that a person's motor abilities tend to get better the more physical activity they engage in. Physical activity is the most important factor affecting motor skills, with the highest beta value. With a t-value of 4.264 and a significance level of 0.000 ($p < 0.05$), the partial test results for variable X2 (social support) in Table 6 show a regression coefficient value of $B = 43.626$. According to the standardized beta coefficient value of $\beta = 0.393$, social support significantly and favorably affects motor skills. This implies that, although it makes a smaller contribution than physical activity, people's motor abilities tend to increase the more social support they receive from peers, family, or the environment. The combined test findings, as shown in **Table 7**, indicate a F value of 30.40 at a significance level of 0.000 ($p < 0.05$). That indicates that physical activity and social support together have a significant impact on motor skills.

This study aims to analyze the influence of physical activity and social support on cognitive and motor skills. The results of the multiple linear regression analysis show that both independent variables have a significant role, both partially and simultaneously, in influencing the cognitive and motor skills of the respondents.

Physical activity has been proven to have a positive and significant impact on cognitive abilities. These findings indicate that individuals with higher levels of physical activity tend to have better cognitive abilities. Physical activity plays a role in increasing blood flow to the brain (Małkiewicz et al., 2019), stimulating the central nervous system (Mahalakshmi et al., 2020), and supporting neuroplasticity processes that contribute to the enhancement of cognitive functions such as attention, memory, and problem-solving abilities (Latino & Tafuri, 2024; Muyassar et al., 2025). Cognitive ability are positively and significantly impacted by social support as well. In addition to promoting learning and cognitive de-

velopment, strong social support, whether from peers, family, or the environment can lead to a more stable psychological state (Gomez, 2022). Social support enhance self-confidence, motivation, and stress levels, all of which have a good impact on cognitive ability (La Fleur & Salthouse, 2017; Lubis & Fazira, 2022; Pillemer & Holtzer, 2016). However, compared to physical activity, social support has a smaller good impact on cognitive ability, suggesting that physical activity's physiological and biological components play a larger role in this situation. Cognitive ability to performance is significantly impacted by both social support and physical activity. This suggests that psychosocial as well as physical aspects affect cognitive ability (Binh & Nghi, 2025; Garc'ia et al., 2022), which is why a holistic approach is crucial in attempts to improve individual cognitive ability.

Motor skills are positively and significantly good impacted by physical activity. These results support the idea that ability directly trains the neuromuscular system, enhancing motor control, strength, balance, and synchronization of movements (Almeida et al., 2021). Regular activity helps people improve their motor skills, which maximizes their motor talents (Iriani & Salman, 2024). It has also been demonstrated that social support significantly and favorably affects motor skills, albeit to a lesser extent than physical activity. People who receive social support are more likely to be physically active, participate in regular physical activities, and feel more secure and confident when doing a variety of motor tasks (Laird et al., 2018). People can will have in physical activities more actively when they live in a supportive social environment, which eventually affects the development of motor skills (Mancini et al., 2016). In combination, social support and physical activity have a big impact on motor abilities. According to this, physical and social environmental factors both have an impact on motor abilities (Mancini et al., 2016), therefore both must be taken into account at the same time when developing motor skills.

Findings of this study indicate about physical activity and social support are two important factors that together contribute to the development individual cognitive abilities and motor skills. Physical activity provides direct stimulation to the biological and neuromotor systems (Buzescu et al., 2020), while social support acts as an environmental factor that creates supportive psychological and social conditions (French et al., 2018). Although both were analyzed as standalone variables, the research results indicate

that each plays a significant role in explaining the variation in cognitive and motor skills. In the context of education and adolescent development, the results of this study indicate that the improvement of cognitive and motor skills is not only related to physical aspects but is also influenced by supportive social environmental conditions. Physical activities integrated into daily activities, especially in education, particularly in physical education, have the potential to provide benefits such as improved physical fitness as well as the development of cognitive functions and motor skills (Mumtazza et al., 2024). Social support from teachers, peers, and family plays a role in creating a conducive atmosphere for individual involvement in physical activities (Darmanto et al., 2024). Thus, the results of this study affirm that the development of cognitive and motor skills is influenced by the simultaneous contribution of physical and psychosocial factors.

CONCLUSION

Cognitive abilities are positively and significantly impacted by physical activity. This suggests that an individual's cognitive abilities tend to improve in proportion to their level of physical activity. Additionally, it has been shown that physical activity has positive and substantial impacts on motor ability, suggesting that regular participation in physical activities helps to improve motor control, coordination, and movement skills. Social support also has a good and considerable impact on cognitive ability. The growth of psychological conditions that promote the growth of cognitive ability is influenced by positive social support from peers, family, and the environment. Furthermore, social support has a favorable impact on motor abilities, suggesting that a supportive social environment can motivate people to engage in many kinds of motor activities and be more active. It has been demonstrated that social support and physical activity have a major impact on cognitive abilities and motor skills. Both results confirm that both physical and psychosocial elements simultaneously contribute to the development of cognitive and motor skills; hence, efforts to improve individual talents must balance both components.

Further modifying of mediating factors, such as motivation, self-efficacy, emotional regulation, sleep quality, or nutritional status, need to be included in future studies to better understand the mechanisms underlying the connections between social support, physical activity, and cognitive and motor skills. In order to examine

changes in cognitive and motor development over time and to support causal interpretations, longitudinal or experimental study methodologies are also recommended. Furthermore, broadening participant characteristics to include a range of age groups, educational attainment levels, and sociocultural backgrounds might improve the findings' generalizability. While incorporating qualitative methods were able to give deeper insights into people's experiences and the social contexts that influence these developmental outcomes, future research may also look into particular forms and intensities of physical activity to determine the best strategies for enhancing cognitive and motor skills.

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