

O LETRAMENTO CORPORAL PREDIZ O DESEMPENHO ACADÊMICO EM ESTUDANTES ADOLESCENTES?

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Resumo: Há uma suposição de que fomentando o letramento corporal (LC) em jovens estudantes pode melhorar o desempenho em outras áreas do currículo. Entretanto, evidências sustentando esse relacionamento são escassas. Os objetivos deste estudo foram verificar se o LC está correlacionado ao desempenho acadêmico (DA) em estudantes adolescentes e se o LC prediz o DA. Um estudo cohort foi conduzido com 122 adolescentes. Os participantes foram avaliados na linha de base e seis meses depois. O LC foi determinado em termos do domínio psicomotor (competência motora, nível de atividade física, aptidão musculoesquelética e composição corporal). O DA foi medido em ambos os pontos no tempo e determinado usando os escores obtidos em testes padronizados. Testes de correlação de Pearson e análise de regressão entre LC e DA foram conduzidos. Não foram encontradas correlações estatisticamente significativas entre LC e DA. A análise de regressão revelou que o LC não foi preditor do DA ao longo do tempo. Portanto, esse estudo indica que LC não prediz DA em adolescentes. Independentemente, encorajamos a promoção do LC em aulas de educação física e nos demais contextos educacionais devido à sua importância para o desenvolvimento geral das crianças e adolescentes, incluindo aspectos da saúde e comportamento.

Palavras-chave: educação física; psicomotor; adolescência; escola; desempenho acadêmico.

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DOES PHYSICAL LITERACY PREDICT ACADEMIC ACHIEVEMENT IN ADOLESCENT STUDENTS?

Abstract: There is an assumption that fostering physical literacy (PL) in young students can enhance performance and achievement in other areas of the curriculum. However, evidence supporting this relationship is missing. The purposes of this study were to verify whether PL is correlated with academic achievement (AA) in adolescent students and whether PL predicts AA across time. A cohort study was conducted with 122 adolescents. Participants were assessed at baseline and 5 months later. PL was determined in terms of psychomotor domain (motor competence, physical activity level, musculoskeletal fitness and body composition). AA was measured at both time points and determined using writing, reading and math scores in standardized tests. Pearson correlations and regression analysis between PL and AA were performed. No significant correlations were found between PL and AA. Regression analysis revealed that PL did not predict AA across time. This study indicates that PL does not predict AA in adolescent students across time. Regardless, we encourage the promotion of PL in physical education classes and educational settings due its importance for general development of children and adolescents, including aspects of health and behaviour.

Key words: physical education; psychomotor; adolescence; school; academic performance.

Introdução

Physical Education (PE) is an academic discipline taught to young people in schools across the world. Overall, students have experienced PE since early school years. At middle school (6th to 9th grades), PE classes are frequently based on body movements from which adolescent students (11 to 15 years) have opportunities to engage in active play, sports and other types of structured physical activity. Regular PE classes can positively affect cognitive, affective, physical and motor domains across adolescence. In addition, PE is the only discipline able to promote physical literacy (PL) in the middle school years.

PL is a broad term whose concept encompasses cognitive (e.g. knowledge), affective (e.g. motivation) and psychomotor (e.g. physical competence) aspects which are linked to valuation and engagement in physical activity for life¹. PL is a promising concept for establishing active lifestyles habits² and it has assembled increasing attention within PE³. Recently the concept of PL has become a key educational goal of this academic discipline⁴.

Certainly PL can be an important educational purpose to be reached in PE, mainly among adolescents, period in which physical activity level declines^{5,6} and tracks into adulthood^{7,8}. Thus, developing PL at school can be considered as a matter of public health. Indeed, PL has been positioned as a determinant of health⁹ and perhaps its development through PE classes among adolescent students can help to foster a next generation with more active physically adults.

In addition, there is an assumption that fostering PL in young students can enhance performance and achievement in other areas of the curriculum¹. This link is based on reasoning that the development of PL can affect positively self-confidence and motivation in respect of learning¹. Thus, it seems reasonable to expect that elements of PL are associated with academic achievement in disciplines beyond PE. Besides of itself educational value of PL, understanding this relationship can help to foster scholar strategies based on PL with the aim to improve the overall academic performance in young students. However, evidence supporting the association between PL and academic achievement over time is missing.-

In a previous study⁴ conducted with adolescent students from United States was found that PL, in terms of psychomotor domain (i.e. physical activity level, body mass index, musculoskeletal fitness, volleyball skill), was correlated with academic achievement (i.e. reading scores). Yet it is still unclear whether PL can predict academic achievement as well as this relationship is significant among adolescents from other cultures and schools settings. Given that PL is an educational aspect, the relationship between PL and academic achievement

can vary across different cultures and school settings and therefore to understand how it occurs in students around the world can provide insight about this underexplored topic.

The purposes of this study were to verify whether PL is correlated with academic achievement in adolescent students and to assess whether PL predicts academic achievement across time.

Materials and methods

Participants and study design

A longitudinal study was conducted with 122 adolescent students (57.4% girls) aged between 12 and 14 years old. Demographic information is described in Table 1. They were followed during 5 months within a school year in whose period measurements were performed at two time points: June and November. All participants were recruited from an Elementary School located at Rio de Janeiro city, where they had regular PE classes during 150 min/week. Inclusion criteria consisted of adolescent students old enrolled in middle school with regular participation in physical education classes. Exclusion criteria consisted of presence of any intellectual disabilities as well as history of injury or disease that could affect motor performance. Ethical approval for this study was obtained from the University Ethics Committee. Parent consent and adolescent assent were provided.

PL was determined in terms of psychomotor domain from the following variables: motor competence (i.e. gross motor skills test), self-reported physical activity and health-related physical fitness (i.e. musculoskeletal fitness and body composition). These measurements were performed by a single expert assessor at time point 1 of this study. Self-reported physical activity was assessed using a questionnaire administered within the classroom. Body composition, motor competence e musculoskeletal fitness tests were administered in a school gymnasium during the school day and lasted approximately 30 min per participant. Standardized regional tests assessing writing, reading and math skills at semester 2 (June) and 4 (November) were used to determine academic achievement.

Body composition (i.e. body fat mass) was determined using the sum of skinfolds. Triceps and gastrocnemius skinfold thickness were measured using a skin caliper. The mean values were converted to percent (%) body fat using the Slaughter equation¹⁰. Further, body mass was measured to the nearest 0.1 kg using an electronic scale with participants wearing their school uniform. Standing height was measured while unshod with a stadiometer to the nearest 0.1 cm.

Physical activity level was determined using a translated and cross-culturally adapted version (Internal consistency, Cronbach's $\alpha = 0.85-0.87$; test-retest reliability with a time interval of 1 day, Intra-class Correlation Coefficient [ICC] = 0.90)¹¹ of the Physical Activity Questionnaire for Older Children (PAQ-C)¹² into the language of the participants. The PAQ-C is a self-administered 7-day recall instrument, appropriate for elementary school-aged children approximately between 8-14-years old who are currently in the school system and have recess as a regular part of their school week. The summary score from the PAQ-C is the average of the sum of the 9 item questions, each scored on a 5-point scale.

Motor competence was assessed with the KTK by a single trained assessor. The KTK is a reliable and valid instrument¹³ for middle school-aged children and consists of four test items: (1) walking backwards along balance beams of decreasing width; (2) one-legged hopping over an obstacle, formed by an increasing pile of pillows; (3) two-legged jumping sideways across a wooden slat for 15 s as quickly as possible; and (4) moving sideways on wooden boards lasting 20 s as many times as possible. All four scores were gender – and age-adjusted. The motor coordination level for each participant was derived from the sum of the four age-adjusted scores obtained in the tests

Musculoskeletal fitness was determined using a sit-up test¹⁴. Initially, the subject was in supine position, knees at 90°, arms crossed over the chest, and feet held by the sole by the appraiser. With the verbal command to start, the chronometer was triggered and the subject flexed their trunk until they could touch the thighs with the elbows. Then the participant returned to the initial position. For each correct execution, one score was attributed. The movements were repeated as many times as possible during 60s.

Academic achievement was determined using scores acquired in standardized regional tests. The average of writing, reading, and mathematics grades of students were used to assign academic achievement scores among participants. These tests are administrated periodically in that school system, and the grades used in data analysis were those obtained from students at time point 1 – together PL measurements – and 5 months later at time point 2. Academic achievement scores could vary from 0 to 10, with an interval of 0.1.

Data analysis

Descriptive statistics were determined for all variables. The Kolmogorov–Smirnov test confirmed acceptable normality of the data distribution. Pearson correlation coefficients were used to examine bivariate relationships between academic achievement and PL elements (motor

competence, physical activity level, musculoskeletal fitness and body composition) measured at time point 1. Univariate analysis of variance was used to check whether PL elements (predictors) measured at time point 1 predict academic achievement (outcome) at time point 2, adjusting for age and sex. A significance level of 5% ($\alpha = 0.05$) was adopted in all statistical tests. Data analysis was executed using IBM SPSS software version 22.0.

Results

Descriptive statistics of age, body weight, height, body composition (i.e. body fat percentage), motor competence, physical activity and musculoskeletal fitness from all participants ($n=122$) are provided in Table 1. Writing, reading and math scores assessed at time points 1 and 2 are displayed in Figure 1.

No significant correlations were found between PL and academic achievement assessed at time points 1 (Table 2). In addition, regression analysis revealed that PL elements did not predict academic achievement across time (Table 3).

Table 1 - Descriptive statistics of all participants ($n=122$), including demographic information and PL elements.

	Boys ($n=52$)	Girls ($n=70$)
Age	13.8 $\pm$ 0.6	13.8 $\pm$ 0.7
(years)	CI: 13.7 – 13.8	CI: 13.6 – 14.0
Body Weight	49.5 $\pm$ 11.9	54.6 $\pm$ 15.2
(kg)	CI: 46.1 – 52.8	CI: 51.0 – 58.3
Height	1.61 $\pm$ 0.1	1.59 $\pm$ 0.08
(m)	CI: 1.58 – 1.64	CI: 1.57 – 1.61
body fat	16.0 $\pm$ 7.1	28.1 $\pm$ 10.7
(%)	CI: 14.0 – 18.0	CI: 25.5 – 30.6
Motor Competence	95.4 $\pm$ 15.9	76.3 $\pm$ 20.9
	CI: 91.0 – 99.8	CI: 71.3 – 81.3
Physical Activity	3.0 $\pm$ 0.8	2.3 $\pm$ 0.7
	CI: 2.8 – 3.2	CI: 2.1 – 2.4
Musculoskeletal Fitness	33.3 $\pm$ 9.2	19.9 $\pm$ 9.5
	CI: 30.8 – 35.9	CI: 17.6 – 22.2

Note. Data are provided as mean $\pm$ SD with 95% confidence interval (CI).

Table 2 - Pearson correlation coefficients (*r*) between PL elements and academic achievement (average of writing, reading and math scores).

	Academic Achievement (time point 1)
Motor competence	$r = 0.069$ ($p=0.447$)
Physical Activity	$r = -0,150$ ($p=0.100$)
Musculoskeletal Fitness	$r =0.037$ ($p=0.685$)
Body composition	$r =0.104$ ($p=0.255$)

Table 3 - Regression analysis considering PL elements as predictors and academic achievement as the outcome.

Parameter	B	95% CI		p-value
		Lower	Upper	
Motor Competence	0.006	-0.013	0.025	0.515
Fitness	0.032	-0.003	0.068	0.075
Physical Activity	-0,218	-0.602	0.166	0.263
%body fat	0.024	-0.013	0.061	0.196
Age	-0.045	-0.444	0.355	0.825
Sex	-0.369	-1.095	0.356	0.315

$R^2=0.062$; CI = Confidence Interval.

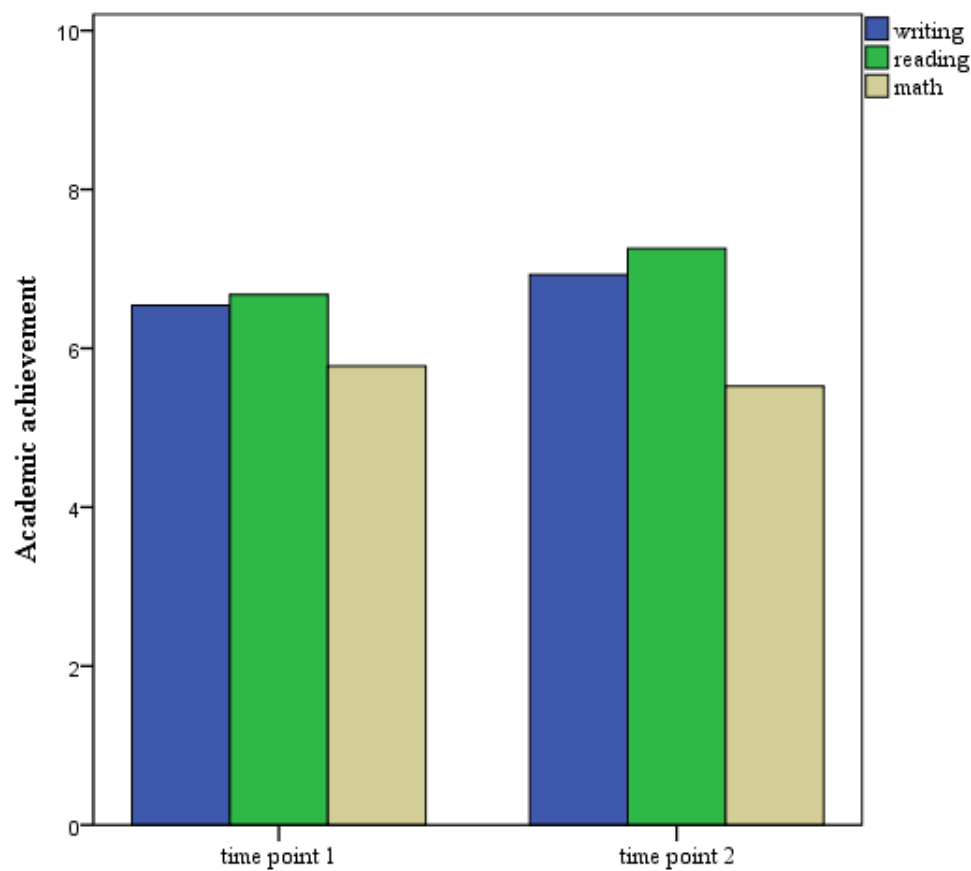


Figure 1 - Writing, reading and math scores measured at time points 1 and 2.

Discussion

The purposes of this study were to verify whether PL, in terms of psychomotor domain (i.e. motor competence, physical activity level, body composition and musculoskeletal fitness) is correlated with academic achievement in adolescent students and to assess whether PL elements are significant predictors in this relationship across time. Our findings indicated no significant relationships between PL elements and academic achievement across time. Perhaps a follow-up longer than 5 months is needed to confirm hypothesized relationships between PL and academic achievement across adolescence.

PL is an emergent concept whose definition has been broadly discussed in the academic field. Despite advancements in theoretical debate in the last years, there is not still a consensus regarding its conceptualization. A recent systematic review about definitions of PL confirmed that current literature contains different representations of the PL construct¹⁵. Given the lack of clarity regarding conceptual aspects across studies, it has been suggested that new research approaching PL must use clear definitions^{15,16}. This was a concern of this study and therefore we clearly adopted a ‘Whiteheadian’ definition. In addition, PL was delimited to psychomotor domain.

To our knowledge, only one previous follow-up study⁴ examined the relationship between PL – in terms of psychomotor domain – and academic achievement in young students. Gu et al.⁴ also conducted a 5-month follow-up research and found that academic achievement in reading is positively correlated with physical activity, cardiorespiratory fitness and sport-specific skills in American adolescents. In addition, they found negative relationship between body mass index and academic achievement, but no significant relationships between other PL elements (i.e. motor competence scores) and math or reading scores. Our results are partially divergent of these previous findings, given that our study found no significant relationships between PL and academic achievement in Brazilian adolescents. The divergence across results can be explained due to cross-cultural differences between United States and Brazil. One difference regards how PE classes are operationalised across schools in terms of curriculum, teacher training and students’ past experiences. Therefore, comparison between studies from different cultures is difficult. On the other hand, the aligned results (i.e. no significant relationships) can be due to short follow-up time conducted by studies. Regardless, our findings did not support the hypothesis that PL correlates with academic achievement in young students.

Despite scarcity of empirical studies assessing the importance of PL for academic achievement in young students, the association between some PL elements and academic

achievement have been separately addressed in previous investigations. There is evidence indicating that physical activity¹⁷, physical fitness¹⁸, weight status¹⁹ and motor coordination²⁰ are associated with academic achievement in young students. However, the results presented in the literature are inconsistent^{21,22} and therefore this emergent field of investigation remains fertile for future research.

The inconsistent results reported in related studies suggest more uncertainties than conclusions regarding the relationship between PL and academic achievement. Furthermore, time spent with activities related to PL does not have a negative impact on children's academic performance²³. Conversely, such activities have a positive influence on several aspects of health^{21,24}. PL itself is important for health, engagement in physical activity and human development. Therefore, the promotion of PL must be encouraged across schools and PE classes around the world regardless of its impact on other areas of the curriculum.

Conclusion

This study found no significant relationships between PL and academic achievement in adolescent students. Therefore, our study indicates that PL does not predict academic achievement in Brazilian adolescents across time. Independently of null results, we encourage the promotion of PL in PE classes and educational settings due its importance for general development of children and adolescents, including aspects of health and behaviour.

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