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The Relationship between School Age Children's Academic Performance and Innovative Physical Education Programs

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Abstract: Currently, there is great interest in the correlation between children's physical activity and their academic performance. In this study, a pre-test/mid-test/post-test experimental strategy was used to avoid any disruption of educational activities, due to the random selection of children in each group. The experimental group was tested for eight months. We developed a methodology for innovative physical education classes and created a model of educational factors that encourage physical activity for children. The experimental group comprised 45 girls and 44 boys aged 6–7 years. The control group included 43 girls and 46 boys aged 6–7. Methods: Mathematical diagnostic progress tests were divided into two sections: tasks were allocated according to performance levels and the content as well as fields of activity and cognitive skills. The assessment of all areas of activity was based on student performance (unsatisfactory, satisfactory, basic, and advanced). Distribution of mathematical learning achievements by curriculum content: mathematical diagnosis was used to evaluate first-grade children's mathematical knowledge and skills according to the five areas of the mathematics education curriculum: numbers and calculations; phenomena, equations, and inequalities; geometry, measures, and measurements; statistics and communication; and general problem-solving skills. The differences between the pre-test and mid-test results indicated that the number of children performing at a satisfactory level decreased (p = 0.035). The differences between the pre-test and post-test advanced (p = 0.038) and basic (p = 0.018) levels were found to be increased. Applying an innovative physical education program to first graders demonstrated a higher-level mathematics program in the areas of geometry, measures, and measurements; statistics; and communication and general problem-solving skills. Based on the interface between an innovative primary school physical education program and mathematics learning achievements, a research tool was developed that can be used in a quantitative research strategy.

Keywords: innovative physical education program; academic achievement; primary education

1. Introduction

Currently, the relationship between children's physical activity and their academic performance is of considerable interest. Physical activity (PA) may be an effective strategy positively affecting academic performance, and school-based studies investigating the effect of increased PA on academic performance have steadily increased in number during the past decade [1–3].

Physical education has been a part of school curriculums for many years, but, due to childhood obesity, focus is increasing on the role that schools play in physical activity and monitoring physical fitness [4,5]. When young people engage in at least 60 min of physical activity daily, the health benefits accumulate, including strong bones and muscles, improved muscular strength and endurance, reduced risk of developing chronic diseases, improved self-esteem, and reduced stress and anxiety [6]. Recent research by Sánchez-Miguel et al. has shown that in the context of education, in order to promote adolescents' physical activity and motor activity, it is important to improve the student's self-esteem and perception of body satisfaction [7,8]. Several cross-sectional studies suggest that lower levels of PA are associated with lower levels of academic achievement among children [9]. Additionally, intervention studies provide evidence that 90 min of moderate-to-vigorous PA, per week, at school [10], in addition to 60 min of physical education per day [11] or increased after-school PA for 40 min per day [12], improves academic performance among children.

The idea that healthy children have improved learning is empirically supported and well accepted [13]. Multiple studies have confirmed that health benefits are associated with physical activity, including cardiovascular and muscular fitness, bone health, psychosocial outcomes, and cognitive and brain health [14]. Given that the brain is responsible for both mental processes and physical actions of the human body, brain health is important across the life span. In children, brain health can be measured in terms of successful development of attention, on-task behavior, memory, and academic performance in an educational setting [15]. Educational benefits of physical activity can be derived from the theory of brain-based learning. This theory, in part, suggests that moderate to vigorous physical activity stimulates the brain in a positive way [16]. In the short term, physical activity stimulates immediate chemical changes in the brain that increase attention and may enhance cognitive performance [17]. Established connections exist between brain function and educational practice; exercise is highly correlated with neurogenesis, the production of new brain cells [18], and exercise upregulates a critical compound called brain-derived neurotrophic factor [19]. In a brain-based theory, neurogenesis is correlated with improved learning and memory [16]. In recent years, educators have explored links between classroom teaching and emerging theories about how people learn. Brain research provides many possibilities for education, and there is much discussion among educational professionals about how this research should be conducted.

Consequently, the idea that PA can enhance academic ability has received particular attention in health and education [20]. Partly owing to the Lithuanian curriculum, school incentives are oriented toward standardized academic test results. There are some claims from educators that the time spent on PA detracts from academic performance, but this is refuted by scientific evidence.

There are new research studies that prove the relationship between physical activity and better academic performance [21–24]. Studies have shown that physical activity could improve cognition and academic achievement [25–27]. In general, a more in-depth understanding of how physical activity is related to children's mathematics skills in the early school years is needed. In these circumstances, the purpose of this study was to establish a link between the academic performance of primary school children and an innovative physical education program.

2. Materials and Methods

2.1. Participants

The schools used in this study were randomly selected from primary schools in Lithuania. Four schools were selected from various regions of Lithuania, typical of the Lithuanian education system, that is, the state system, operating in accordance with the description of primary, basic, and secondary education programs approved by the Lithuanian Minister of Education and Science in 2015. It should also be noted that these schools form classes without applying selection criteria; thus, it could be said that the pupils in the randomly selected classes were also randomly assigned to the experimental and control groups. A non-probabilistic exact sample was used in the study when subjects were included depending on the objectives of the study.

The study data were collected from September to May 2019 in four Lithuanian general education schools that had primary education classes. The time and place of the study, with the consent of the parents, were agreed upon in advance with the school administration. This study was approved by the research ethics committee of Kaunas University of Technology, Institute of Social Science and Humanity (Protocol No V19-1253-03).

The experimental group comprised 45 girls and 44 boys aged 6–7 years. Their mean weight and height were 23.8 ± 0.8 kg and 1.21 ± 0.14 m, respectively, for the girls, and 28.2 ± 0.5 kg and 1.35 ± 0.07 m, respectively, for the boys. The control group comprised 43 girls and 46 boys aged 6–7. Their mean weight and height were 22.5 ± 0.7 kg and 1.27 ± 0.2 m, respectively, for the girls, and 28.7 ± 0.5 kg and 1.41 ± 0.06 m, respectively, for the boys. All children attended the same school.

2.2. Instruments

2.2.1. Mathematical Diagnostic Progress Tests

The mathematical diagnostic progress tests (MDPTs) were prepared in accordance with the requirements of the General Mathematics Education Curriculum (approved by ISAK-2433, August 26th, 2008). Diagnostic progress tests are an objective way to measure skills and abilities. The MDPTs were divided into two sections: the tasks were allocated according to performance levels and the content as well as fields of activity and cognitive skills. The assessment of all areas of activity was based on student performance (unsatisfactory, satisfactory, basic, and advanced).

The advanced level of achievement was achieved by those children who scored 26–33 standard points during the study; basic was achieved by those scoring 16–25 standard points; satisfactory represented 7–15 standard points; and the unsatisfactory level was 0–6 standard points. These levels were described according to the children's main groups of operational abilities: mathematical knowledge and skills in performing standard procedures; mathematical communication; and mathematical thinking and problem solving. Based on these levels of student achievement, the effectiveness of the process of organizing student learning was assessed. The level of student achievement is a criterion for evaluating the organization of the learning process. This assessment was used to analyze, interpret, and compare the links between students' ways of organizing learning and achievement. The four levels of achievement are described as follows:

Advanced level of achievement: Knowledge and skills—the child understands all the basic mathematical concepts and performs standard mathematical procedures without errors. Communication skills—the child correctly understands the conditions of the task presented in different ways and is able to solve practical and mathematical problems in various contexts. They consistently, comprehensively, smoothly, and clearly present the solution of the task. Thinking and problem-solving skills—the child chooses an effective and rational problem-solving strategy. They can distinguish and indicate the features characteristic of objects and phenomena and determine not only their main but also their additional relations or regularities. The child draws detailed and accurate conclusions based on the correct solution to the problem.

Basic level of achievement: Knowledge and skills—the child applies the existing knowledge in new, uncomplicated situations, but the knowledge is not exhaustive. Communication skills—the child correctly understands the conditions of simple practical and mathematical content problems. The child basically presents the solution of the problem correctly, using appropriate terms and symbols, but lacks accuracy, consistency, coherence, conciseness. Thinking and problem-solving skills—the child chooses not quite rational problem-solving strategies and distinguishes and indicates not all characteristic features of objects and phenomena, determining only their main relations or regularities.

They use analysis–synthesis, but objects and phenomena are not analyzed according to all their characteristic features.

Satisfactory level of achievement: Knowledge and skills—the learner repeats some knowledge, but the level of knowledge comprehension is superficial. They apply the basic standard procedures defined in the curriculum. Communication skills—the child understands the conditions of the simplest tasks correctly and tries to convey the main ideas and the solution of the problem. There is insufficient understanding of the purpose of communication, mathematical concepts, and symbols. Thinking and problem-solving skills—the child chooses not entirely rational problem-solving strategies but combines several algorithms in standard situations. They correctly solve the problem and explain the solution of the problem and the results obtained but do not provide a final answer or draw a final conclusion. The child recognizes and examines only individual details of the research question without linking them, does not see regularities and connections, does not substantiate with logical reasoning, and does not argue or interpret.

Unsatisfactory level of achievement: The child does not achieve a satisfactory level of achievement in any of the mathematical activity ability groups.

These levels of children's learning achievements were analyzed in the study according to the criteria of learning organization efficiency, that is, ways of starting the lesson, ways of presenting new material, ways of knowledge assessment and skills formation, and organization of feedback. In other words, the study used a statistical criterion to determine whether the level of child achievement depends on the ways in which learning is organized.

2.2.2. Distribution of Mathematical Learning Achievements by Curriculum Content

Mathematical diagnosis evaluates first-grade children's mathematical knowledge and skills according to the five areas of the mathematics education curriculum:

1. Numbers and calculations;
2. Phenomena, equations, and inequalities;
3. Geometry, measures, and measurements;
4. Statistics;
5. Communication and general problem-solving skills.

The learning achievements listed in the General Programs (Basic curriculum for primary education, 2016) in the field of geometry, measures, and measurement are incorporated into the diagnostic assessment program and described in the curriculum content. There are seven possible MDPT tasks [28].

2.3. *Procedure*

In this study, a pre-test/mid-test/post-test experimental strategy was used to avoid any disruption of educational activities, due to the random selection of children in each group. The experimental group was tested for eight months. We developed the methodology for innovative physical education classes and created a model of educational factors that encourage physical activity for children. The relationships between the children's physical activities at school and learning achievements were determined. Physical education lessons, according to the lesson schedule, always took place before mathematics lessons.

We also prepared the methodical material for innovative physical education classes [29]. The methodology was based on the dynamic exercise, intense motor skills repetition, differentiation, seating and parking reduction, physical activity distribution in the classroom (DIDSFA) model [29,30] (Table 1).

Table 1. Dynamic exercise, intense motor skills repetition, differentiation, seating and parking reduction, physical activity distribution in the classroom (DIDSFA) model—increasing active learning time in primary physical education.

Dynamic exercise	Aerobic capacity and/or muscle strength training. Exercise can be any activity that enhances physical fitness. Exercise that gives you more energy, endurance, or stamina is often called aerobic exercise [29].
Intense motor skills repetition	Reducing/eliminating queues so that children are not waiting their turn; having small-sided games or group work such as 3 vs. 3 (which increases the amount of times children have to develop/apply their skills—this helps to eliminate children being on the periphery of, or excluded from, a game/activity); and increasing the amount of equipment available to the children and/or increasing the number of stations.
Differentiation	All children should be set tasks that are appropriate to their physical, cognitive, and social development, which enables them to engage in active learning time. Teachers should ensure that they are familiar with the space, task, equipment, and people (STEP) framework for effective differentiation of activities [31].
Seating and parking reduction	When a teacher is providing feedback or questioning learners, often they do not need to stop the whole class; instead they can just target and stop a group of learners or an individual child. Engaging children in an activity as soon as possible at the start of the lesson through concise questioning and feedback. Ensuring equipment is ready, organized, and accessible at the start of and throughout the lesson [30].
Physical activity distribution in the classroom	This principle is based on teachers encouraging children's in-class physical activity through positive praise. Examples of the promotion of in-class physical activity includes "great team work, keep moving, and looking for space" [30].

An innovative physical education program was designed to promote high levels of physical activity, teach movement skills, and be enjoyable. The recommended frequency of physical education classes was three days per week. A typical DIDSFA model lesson lasted 30 min and had two parts: health–fitness activities (15 min) and skill–fitness activities (15 min). Ten health-related activity units included aerobic dance, aerobic games, walking/jogging, and jump rope. Progression was developed by modifying the intensity, duration, and complexity of the activities. Although the main focus was on developing cardiovascular endurance, brief activities to develop abdominal and upper body strength and movement skills were included. To enhance motivation, children self-assessed and recorded their own fitness levels monthly. Four sport units that developed skill-related fitness were included (basketball, football, gymnastics, and athletics) and healthy lifestyle and unconventional physical activity were additionally introduced. These sports and games had the potential for promoting cardiovascular fitness and generalization to the child's community (e.g., fun relays) (Table 2). During the study, physical education lessons were taught through innovation, that is, a physical education training textbook consisting of two interrelated parts: a) a textbook and b) children notes. Textbooks were dominated by logical tasks, self-assessment, and exercises of spatial perception and self-development. The methodological tools presented innovative methods of working with textbooks. Vaquero-Solís et al. found that mixed methodologies in their interventions are implemented on new strategies that have a greater effect on the participants [32]. Twice per month, the usual methodology was applied, during which the transition from theory to practice was gradual. During the first lesson of the month, the material in the textbook was examined, future plans and tasks for the month were introduced, and the theory was established during practical sessions. During the theoretical lessons, the children also had the opportunity to move around, using the physical activities provided in the textbook. During the last lesson of the month, the tasks presented in the textbook were performed; the activities of the month were repeated, remembered, summarized, and evaluated; and the tasks of children's notes were performed. Girls and boys from the control group attended unmodified physical education lessons.

Table 2. Innovative physical education program.

	Lesson Topic	Areas of Activity for the Physical Education Lesson
Month 1	Working with a textbook and notes Arrangement, basic initial hand and leg positions Honest behavior Proper breathing over time	Movement skills Healthy lifestyle Sport units (athletics)
Month 2	Working with a textbook and notes Ball school. I pass the ball to a friend. I am learning to pass the ball accurately Running is the king of movement. Running: Relay Proper posture	Sport units (basketball) Sport units (athletics) Healthy lifestyle
Month 3	Working with a textbook and notes Jumps on both feet. Spider and turn Animal gymnastics Let's jump by jumping. Shuttle running 3×10 m	Movement skills Unconventional physical activity Sport units (athletics)
Month 4	Working with a textbook and notes Long jump We learn to kick and drive a soccer ball, to drive a soccer ball in a straight and winding line	Sport units (athletics) Sport units (football)
Month 5	Working with a textbook and notes We learn to kick a soccer ball into the goal The basics of gymnastics: exercises with gymnastic balls. Muscle stretching. We try to keep the balance	Sport units (football) Unconventional physical activity
Month 6	Working with a textbook and notes Basics of gymnastics means, tools, correct posture. Jumps with rope Basic steps of aerobics Fun relays	Sport units (gymnastics) Unconventional physical activity Movement skills
Month 7	Working with a textbook and notes We learn to drive, pass, and catch a basketball by working in pairs, to drive a basketball in a straight and winding line Obstacle course	Sport units (basketball) Movement skills
Month 8	Working with a textbook and notes We throw the ball We work together to overcome obstacles We play football We learn to orientate. Project. Sport event.	Sport units (athletics) Healthy lifestyle Sport units (football) Movement skills

2.4. Data Analysis

Descriptive statistics are reported for all measured variables as mean ± SD. The effect size of the Mann–Whitney U-test was calculated using the equation $r = Z/\sqrt{N}$, in which Z is the z-score and N is the total number of the sample (small, 0.1; medium, 0.3; large, 0.5). Statistical significance was defined as $p \leq 0.05$ for all analyses. Analyses were conducted using SPSS 23 software (SPSS Inc., Chicago, IL, USA).

3. Results

3.1. Mathematical Diagnostic Progress Tests

An analysis of the results of the pre-test of the mathematical diagnostic progress tests (MDPTs) shows that, across the seven possible MDPTs tasks, the male and female seven-year-old children achieved satisfactory results (pretest control group, CG, 6.45; experimental group, EG, 6.38; $p = 0.054$) and basic results (pretest CG 6.18; EG 5.43; $p = 0.032$). Fewer children qualified for the advanced level (pretest CG 1.08; EG 1.04; $p = 0.051$) (Figure 1). Results were evaluated between experimental and control groups.

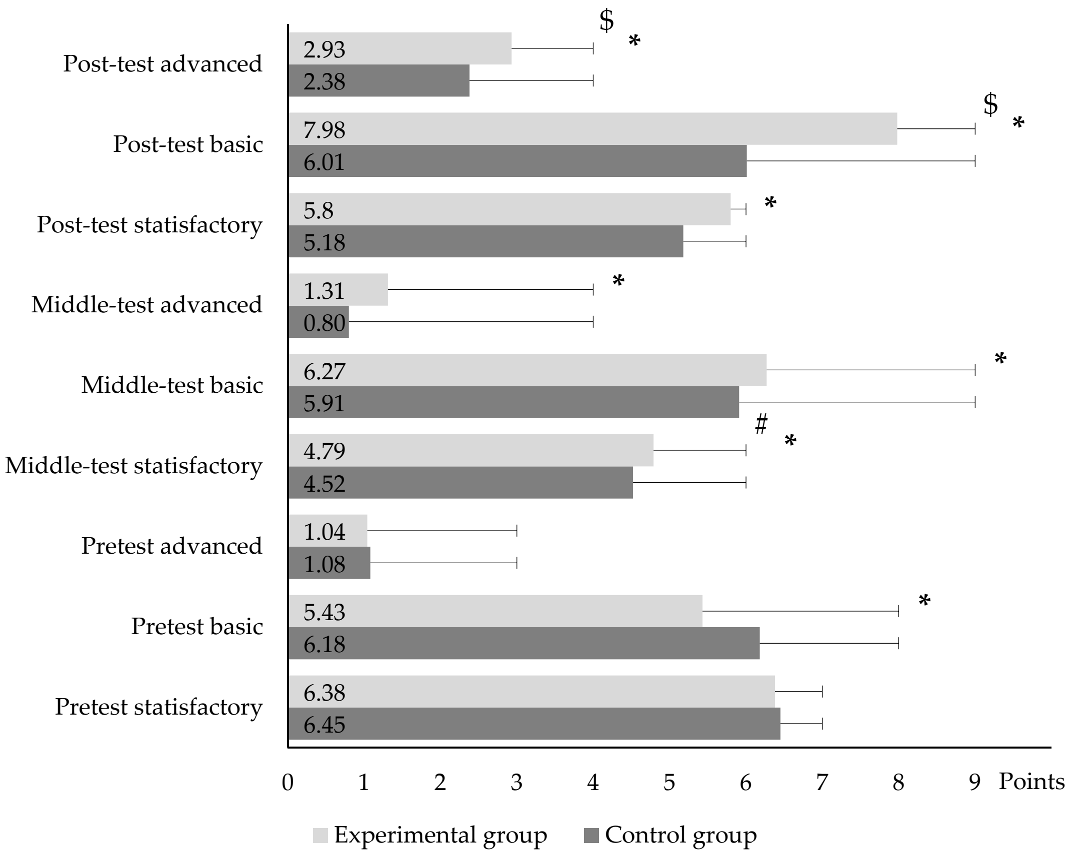

Figure 1. Mathematical diagnostic progress tests. *—$p \leq 0.05$, difference between the experimental and the control groups. #—$p \leq 0.05$, differences between the pre-test and middle-test satisfactory level. $—$p \leq 0.05$, differences between the pre-test and post-test advanced and basic levels.

The analysis of the middle-test results (results are observed between groups) showed the smallest number of children performing at an advanced level (middle-test CG 0.80; EG 1.31; $p = 0.014$). Most children who completed the tests performed to basic and satisfactory levels. Accordingly, CG and EG group achievement levels were satisfactory (middle-test CG 4.52; EG 4.79; $p = 0.044$) and basic (CG 5.91; EG 6.27; $p = 0.038$). The differences between the pre-test and middle-test results indicate that the number of children performing at a satisfactory level decreased ($p = 0.035$) (Figure 1).

An analysis of the results of the MDPTs showed that, across the seven possible tasks, both male and female seven-year-old children achieved satisfactory results (results are observed between groups) (post-test CG 5.18; EG 5.80; $p = 0.045$), basic results (post-test CG 6.01; EG 7.98; $p = 0.022$), and advanced results (post-test CG 2.38; EG 2.93; $p = 0.037$). The differences between the pre-test and post-test advanced ($p = 0.038$) and basic ($p = 0.018$) levels were found to be increased (Figure 1).

3.2. Distribution of Mathematical Learning Achievements According to Curriculum Content

Table 3 presents the results of the descriptive data of participants by learning achievements with respect to curriculum. Results are summarized as follows. Numbers and calculations: pre-test CG and EG (p = 0.065), middle test CG and EG (p = 0.046), post-test CG and EG (p = 0.030). Phenomena, equations, and inequalities: pre-test CG and EG (p = 0.051), middle test CG and EG (p = 0.103), post-test CG and EG (p = 0.025). Geometry, measures, and measurements: pre-test CG and EG (p = 0.051), middle test CG and EG (p = 0.015), post-test CG and EG (p = 0.048). Statistics: pre-test CG and EG (p = 0.092), middle test CG and EG (p = 0.025), post-test CG and EG (p = 0.025). Communication and general problem-solving skills: pre-test CG and EG (p = 0.082); middle test CG and EG (p = 0.040), post-test CG and EG (p = 0.022) (Table 3).

Table 3. Distribution of mathematical learning achievements according to curriculum content.

Test	Control Group	Experimental Group	p Level	Observed Power	Effect Size
Pre-test					
Numbers and calculations	7.61 (1.52)	7.531 (1.39)	0.065	0.588	-
Phenomena, equations, and inequalities	0.81 (0.25)	0.79 (0.11)	0.051	0.691	-
Geometry, measures, and measurements	3.61 (0.32)	3.65 (0.28)	0.051	0.688	-
Statistics	0.63 (0.91)	0.61 (0.88)	0.092	0.361	-
Communication and general problem-solving skills	1.20 (2.68)	1.19 (2.54)	0.083	0.552	-
Middle-test					
Numbers and calculations	**5.78 (3.43)**	**5.89 (3.18)**	0.046	0.978	**0.14**
Phenomena, equations, and inequalities	1.35 (0.61)	1.35 (0.61)	0.103	0.278	-
Geometry, measures, and measurements	**2.09 (1.51)**	**3.12 (0.67)**	0.015	1.00	**0.66**
Statistics	**1.35 (0.69)**	**1.11 (0.93)**	0.025	0.991	**0.50**
Communication and general problem-solving skills	**1.16 (0.83)**	**0.81 (1.25)**	0.040	0.926	**0.19**
Post-test					
Numbers and calculations	**6.09 (1.90)**	**7.05 (0.97)**	0.030	0.975	**0.31**
Phenomena, equations, and inequalities	**1.58 (0.12)**	**1.86 (0.04)**	0.025	0.979	**0.27**
Geometry, measures, and measurements	**4.46 (1.63)**	**4.66 (1.53)**	0.048	0.967	**0.11**
Statistics	**0.55 (0.45)**	**0.84 (0.36)**	0.025	0.981	**0.27**
Communication and general problem-solving skills	**0.83 (1.17)**	**1.45 (0.76)**	0.022	0.992	**0.21**

Mathematical learning achievements; significant values are highlighted in bold. Effect size for nonparametric test: r (small, 0.1; medium, 0.3; large, 0.5) for group differences.

4. Discussion

The objectives of this research are to evaluate a one-year educational strategy aimed at helping teachers increase children's active learning time during physical education classes and to find a connection between the academic performance of primary school children and innovative physical education lessons. Our results indicate that the intervention was effective. Children in the intervention group demonstrated superior skills in mathematics, including geometry, measures, and measurements; statistics; and communication and general problem-solving skills.

It is seen that from early childhood to adolescence children's physical activity levels decrease [33,34]. Sevil et al. emphasizes the importance of increasing students' physical activity in order to enhance their intrinsic motivation [35]. During their first two decades of life, a child spends a considerable amount of time in school [36]. Some of the ways for children to be active at school are classroom-based physical activities. Physical activity could be incorporated into class time. This could be done by adding short bursts of physical activity and integrating physical activity into lessons [37].

Current findings suggest the use of cognitive engaging activities to enhance children's attention at school [38]. However, the quality of the physical activity intervention might also play an important role [39]. Physically active lessons might either have a positive effect or no effect on academic-related outcomes, as was shown in a review of research studies [40].

The one-year education strategy was chosen in our research, which had a positive effect due to the appropriate duration of the intervention. No difference between groups has been found in most studies following intervention periods less than one year as national standardized tests were used to measure outcomes [41,42], although significant improvement was found in standardized test scores following one year [43]. Amado et al. after an intervention program found that adapting exercises to the pupils' level by balancing the difficulty and capacity would give positive feedback, providing objectives and feedback regarding the process and not the result, by acknowledging pupils' efforts and/or improvements [44]. Classroom-based physical activity might have a positive effect on academic achievement, in addition to cognitive function and classroom behavior. Effects on academic achievement might depend on the type of assessment tool that was used to measure academic achievement, as well as the duration of intervention [37].

Research has shown that an intensive exercise program for overweight children has a positive effect on mathematics performance and planning skills and increases activity in the prefrontal cortex, which plays an important role in cognitive control [12]. Physically active academic lessons have been shown to improve the academic performance of third-grade children [45]. The educational benefits of physical activity can be derived from brain-based learning theory. This theory suggests that moderate-to-vigorous physical activity positively stimulates the brain [16]. It has been seen that cognitive function could be enhanced by cognitively engaging physical activity better than by non-cognitively engaging physical activity, such as in repetitive exercise [46]. Van Dusen et al. [47] found that cardiovascular fitness has the strongest direct correlation with academic performance, with a standardized mean difference of 0.34 (0.32–0.35) for boys in mathematics and 0.33 (0.31–0.35) for girls in mathematics. Consequently, task behavior could be improved by breaking up lessons with physical activity [34]. Based on the performance improvement of the experimental group in all content and activity areas, we can state that children in the innovative physical education curriculum demonstrated superior mathematical ability. Positive outcomes of integrating physical education and mathematics are commonly observed in both activities [48]. Donnelly and colleagues found improved academic performance in all reported outcome measures (i.e., the composite scores of reading, spelling, and mathematics) when comparing children who received daily bouts of moderate to vigorous PA during academic lessons for 3 years (up to 90 min/week) with children who followed the regular curriculum [10]. Ericsson [49] found higher grades in literacy and mathematics in children who participated in a 45 min PE session each school day and optional modified motor training of 60 min per week for 3 years than in children following the regular PE curriculum at 1- and 2-year follow-up.

Classroom-based physical activity could positively make an impact on academic-related outcomes, including cognitive function, academic achievement, and classroom behavior [37]. Meta-analyses, conducted by Fedewa and Ahn [50], show that physical activity is directly related to academic performance, with a particularly strong improvement in mathematics in the performance data. In contrast to longitudinal studies, low physical activity and obesity in children are negatively associated with mathematical performance [51]. Gable et al. [52] found similar results when they tested 6250 children between the ages of five and 10 with dummy scores and found that both girls and boys who were overweight scored lower in mathematics compared to physically active peers. Participation in an exergaming-based intervention (2 × 15 min, three times per week) in a study by Gao et al. [53] resulted in higher mathematics grades in fourth-grade children compared with a group receiving unstructured recess. Patnode et al. [54] assessed children's grade averages and found that physically active children demonstrated higher academic achievement than children with low levels of physical activity. However, Resaland et al. [39] found no significant intervention effect on mathematics, reading, or English in 10-year-old children. Analyses of the subgroup who performed worse at baseline for numeracy showed significant beneficial effects of the intervention. The seven-month intervention consisted of physically active lessons, active breaks between lessons, and active homework.

Academic-related outcomes improved participation in classroom-based physical activity programs, as can be seen in most studies [31]. The results of our study showed that primary school children who participated in innovative physical education lessons demonstrated superior skills in mathematics, including geometry, measures, and measurements; statistics; and communication and general problem-solving skills.

5. Conclusions

Our conclusions show that applying an innovative physical education program to first graders demonstrated a higher level math program in the areas of geometry, measurements, and measurements; statistics; and communication and general problem-solving skills. Based on the interface between the primary school innovative physical education program and mathematics learning achievements, a research tool was developed that can be used in a quantitative research strategy.

This study complements new scientific literature, which reveals that innovative physical education programs can help to achieve the goal of enhancing cognitive activation and thus facilitate the learning process promoted by schools. Participation in physical activity can improve children's academic performance and act as a mechanism that addresses educational deficiencies. Importantly, in this study, we showed the effects of a school's innovative physical education program, rather than the impact of physical activity on academic achievement in general. Although this study and many others have shown a positive impact of innovative physical education programs on children's academic achievements, social policy is a field of health and education institutions.

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