

Article

Physical Education Teacher's Continuing Professional Development Affects the Physiological and Cognitive Well-Being of School-Age Children

Francesca Latino ^{1,*}, Generoso Romano ² and Francesco Tafuri ³¹ Department of Psychology and Education, Pegaso University, 80100 Naples, Italy² Department of Medical Sciences, Exercise and Wellbeing, University of Napoli Parthenope, 80100 Naples, Italy; generoso.romano@uniparthenope.it³ Heracle Lab Research in Educational Neuroscience, Niccolò Cusano University, 00100 Rome, Italy; francesco.tafuri@unicusano.it

* Correspondence: francesca.latino@unipegaso.it

Abstract: A burgeoning corpus of scholarly inquiry indicates that engagement in physical activity among children yields a plethora of advantageous outcomes, including enhanced cardiorespiratory endurance, improved academic performance, augmented cognitive functioning, as well as advancements in social and psychological well-being. Given that students participate in schooling for up to 200 days per annum, physical education (PE) possesses the potential to substantially influence the physiological and cognitive maturation of school-aged children through purposeful pedagogical practices. The notion of quality physical education (QPE), whose paramount objective is the cultivation of physical literacy, represents a critical element in the facilitation of both physiological and cognitive growth in children. Consequently, the objective of this investigation was to examine the ramifications of a continuing professional development program on educators' self-efficacy and, in turn, on their students' physical fitness and educational outcomes. The inquiry was conducted over a 32-week span during which teachers and students participated in a continuing professional development training (CPD) intervention and a physical literacy (PL) program, respectively. At both the initiation and conclusion of the intervention programs, a comprehensive series of standardized assessments were administered, including the Motorfit battery, Spirometry, Physical Education Teaching Efficacy Scale (PETES), and Amos 8–15. As a consequence, a significant Time $\times$ Group interaction effect for the Motorfit battery, Spirometry, PETES, and Amos 8–15 was identified. This finding suggests a meaningful improvement in the treatment groups ($p < 0.001$). Conversely, no notable alterations were recorded within the comparison groups. The outcomes of this research reinforce the assertion that exemplary instruction in physical education exerts a profound influence on the physiological well-being and academic achievements of students.

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1. Introduction

Regular physical activity promotes and preserves both psychological and physiological wellness [1]. A growing body of research suggests that physical activity undertaken by children produces numerous beneficial outcomes such as cardiorespiratory endurance, academic performance, cognitive efficacy, as well as social and psychological health [2]. Cardiorespiratory fitness is a crucial metric of health condition and a forecaster of longevity [3–6]. Accumulating scientific proof, indeed, reveals an inverse correlation between cardiorespiratory fitness and mortality [7]. Certain general population

investigations have identified elevated lung volumes among individuals who are physically active [8–10]; specifically, cohort studies indicate that physically active children and adolescents may possess greater lung volumes [11–13]. In addition, there exists a longstanding tradition asserting that a “healthy body engenders a healthy mind” and that physical activity can facilitate cognitive advancement in children [14–17]. Scholars have posited that regular physical activity can augment academic achievement by amplifying the flow of blood to the brain, enhancing mood, elevating cognitive acuity, and bolstering self-efficacy [18,19]. The corpus of evidence supporting such assertions is diverse, and further inquiry remains imperative. Nevertheless, prevailing studies do indicate a favorable correlation between cognitive performance and consistent physical activity, applicable to both adults and children [20,21].

To support this evidence, the contemporary directives disseminated by the World Health Organization [22] and numerous additional international and European health agencies have signified that children and adolescents aged between 5 and 17 years should partake in a minimum of 60 min of moderate to vigorous physical activity (MVPA) on a daily basis to obtain beneficial health outcomes [23,24]. Nevertheless, more than one in four adults and over 80% of children do not achieve the WHO’s suggested physical activity levels for optimal health.

Within this paradigm, PE inside school stands as the principal societal entity for the cultivation of physical and cognitive competencies and has manifested the potential to elevate the physical activity levels of youth [25–28].

Physical education teachers, in particular, have been acknowledged as pivotal actors in transformative endeavors designed to inspire children to embrace an active lifestyle and engage in increased physical activity [29]. Physical education teachers possess the capacity to furnish their pupils with motivation, confidence, competence, knowledge, and comprehension, which are imperative for attaining sufficient levels of physical activity [30]. Physical education teachers require contemporary knowledge, specialized skills, and adequate resources to optimize their influence on students’ physical activity. Professional education serves as the means to equip teachers with the requisite competencies; it has been substantiated that continuing professional development training (CPD) can favorably affect both teachers’ work engagement and students’ motivation [31]. Transformations within society compel teachers to embrace novel roles (by acquiring new skills) and to modify or relinquish certain previous ones [32]. A teacher should predominantly instigate transformations or promote learning also by attending to his/her own personal and professional advancement. Consequently, in the frame of lifelong learning, each teacher is evolving into a significant component of a “society of knowledge”, which has also been one of the fundamental objectives of European policies regarding education and training [33–35]. The perspective of lifelong learning and continuous professional development necessitates a critical mind on the part of the teacher. Moreover, it is founded on the premise that a teacher ought primarily to be “competent in practice” and capable of producing novel insights through the examination of their own actions [36].

With particular emphasis on the advancement of students’ physical activity, continuous professional development programs should encompass subjects such as physical literacy [37]. When teachers are endowed with this specialized content knowledge, pedagogical proficiencies, and competencies [38], they can exert a favorable influence on the students’ experience in physical education and, through this engagement, enhance the students’ motivation towards physical activity. Furthermore, continuous professional development interventions can benefit physical education teachers by promoting reflective practices, ensuring professional growth, and providing high-quality instruction [39].

The importance of high-quality instruction within the domain of physical education was acknowledged by the United Nations Educational, Scientific and Cultural Organization (UNESCO) through the endorsement of quality physical education policy

formulation as one of three paramount priorities for the Organization's Intergovernmental Committee (CIGEPS) and via the ratification of the International Position Statement on Physical Education by the International Council of Sport Science and Physical Education (ICSSPE) [40]. Specifically highlighted by UNESCO is the notion of meaningful physical education, the outcome of which is quality physical education (QPE), and QPE inherently requires the adoption of a physical literacy-informed and enriched pedagogical approach.

Physical literacy-enhanced pedagogy possesses considerable applicability to movement contexts, culminating in a more intentional design of lesson planning that encompasses confidence cultivation through the establishment of positive challenges [41]. Therefore, children are entitled to partake in this educational opportunity in quality physical education, particularly during their primary education.

As articulated by the "National indications for the curriculum of kindergarten and the first cycle of education" issued by the Italian Ministry of Education in 2012, physical education in the initial cycle of education should promote self-awareness and the acknowledgment of one's potential in the ongoing interaction with the environment, others, and objects [42]. It contributes to the development of the students' personality through the comprehension and awareness of their own corporeal identity as well as the incessant necessity for movement as a continual dedication to one's person and well-being [43].

Numerous European physical education curricula presently incorporate assertions concerning physical literacy; nevertheless, it is equally crucial to provide effective educator training to enhance comprehensive physical literacy-oriented methodologies [44]. Moreover, in connection with the quality physical education (QPE) initiative, a newly established requirement for continuing physical education professional development (PE-CPD) is of paramount importance in cultivating exemplary practices [45]. Accordingly, physical education teachers are encouraged to participate in continuing professional development (CPD) through obligatory, structured, and regular CPD or in-service training (INSET) programs [46]. This stipulation is essential to ensure teachers' professional advancement in knowledge and skill competencies through the exchange of practical experiences and the embrace of lifelong learning, thereby providing high-quality instruction and educational experiences for students.

The Commission's Communication on achieving the European Education Area by 2025, produced in September 2020, underlines that teachers' CPD programmes are one of the key factors impacting their teaching quality. Disciplinary knowledge, pedagogical theory, and classroom practice (in-school placement) are the key elements of effective teacher training [47].

A paucity of teaching self-efficacy can frequently culminate in teachers encountering a deficiency of efficacy in their educational aspirations [48]. Self-efficacy represents a crucial component of social cognitive theory [49]. It is defined as an individual's assessment of their ability to succeed in particular situations. Their external experiences and self-perception influence an individual's self-efficacy regarding the outcomes of various events [50]. Furthermore, self-efficacy plays a significant role in shaping an individual's motivation and achievements. Several studies confirm that their teachers' sense of self-efficacy positively or negatively influences students' achievement: in classes of teachers with a high sense of self-efficacy, students' results were significantly better. In his research, Tinning [51] emphasized that the self-efficacy of physical education teachers is an essential aspect of their beliefs, which also impacts their behavior and professional practices. In following this line of reasoning, Martin and Kulinna [52] identified that physical education teachers with heightened self-efficacy demonstrated a greater ability to overcome challenges, articulate clearer intentions, and experience improved feelings of control in contrast to their peers with diminished self-efficacy.

These findings elucidated that the intervention markedly enhanced physical education teachers' self-efficacy more significantly than the control group. Martin,

McCaughtry, Hodges-Kulinna, and Cothran [53] examined the effects of continuing professional development (CPD) on physical education teachers' self-efficacy concerning the instruction of physically engaging fitness and health-promoting curricula. Participants within the CPD group articulated that they had increased efficacy in obtaining community support following the one-day workshop and that they also perceived elevated efficacy in their educational aspirations. The results are in line with Bandura's [54] posit that an individual who possesses a strong sense of self-efficacy can enhance their achievements and personal feelings of fulfillment across various dimensions of health. In other words, teachers' self-efficacy "is associated with the utilization of challenging and more strenuous pedagogical techniques, improved implementation of novel, innovative programs, superior classroom management, the application of more humanistic methodologies to regulate class dynamics, and the encouragement of students' autonomy, cognitive and physical development" [55]. Considering these findings, we maintain that effective CPD is a vital process for supporting teachers' personal growth and self-actualization, which consequently can facilitate the advancement of students in academic achievement and physical health [56].

In light of these considerations, the current study was aimed at assessing the effects of a physical education continuing professional development (PE-CPD) intervention on teachers' self-assurance and, subsequently, the effectiveness of a professional learning program devised by teachers who had previously engaged in the PE-CPD intervention, on physical and academic performance of school-aged children.

2. Materials and Methods

2.1. Study Design

This research utilized a two-arm randomized, parallel-group trial to investigate the effects of a continuing professional development (CPD) intervention on augmenting the sense of self-efficacy in physical education (PE) teachers and, consequently, on the physical and academic performance of the pupils subsequent to a quality physical education (QPE) program. The investigation persisted for a duration of 32 weeks, during which the participants were allocated randomly to either the experimental cohort or the control cohort. Subsequent to the random allocation, the researchers evaluated the initial equivalence between the cohorts, employing double-blinding to ensure that both the participants and the researchers remained uninformed regarding the group distribution. During the initial 16 weeks, the teachers belonging to the experimental cohort adhered to a PE-CPD intervention, whereas the control cohort received no intervention treatment. Thereafter, in the remaining 16-week period, the students belonging to the experimental cohort engaged in a QPE program administered by the same teachers who had previously participated in the PE-CPD intervention. The students within the control cohort continued to partake in conventional PE classes. Throughout the 32-week duration, both experimental cohorts engaged in their respective programs biweekly. The investigation was conducted from September 2023 to May 2024 in accordance with the guidelines prescribed in the Helsinki Declaration and its subsequent amendments. The study protocol was reviewed and approved by the Department of Medical Science, Exercise, and Wellbeing—University of Naples "Parthenope" (DiSMMMeB Prot. N. 88592/2024).

2.2. Procedures

This study consisted of 8 phases built as follows (Figure 1):

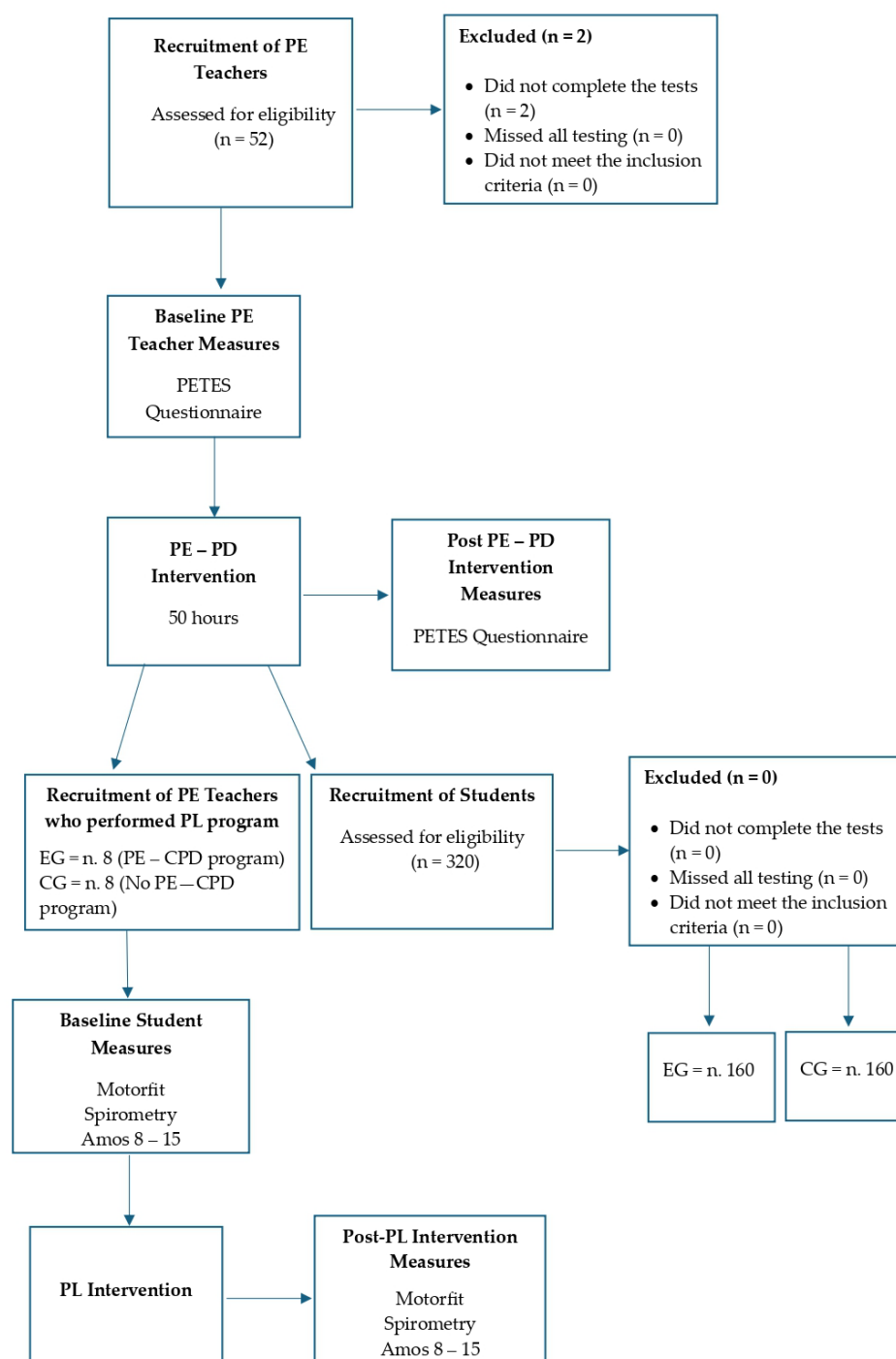


Figure 1. Study flow diagram.

Recruitment of Teachers

The recruitment procedure of teachers was conducted through the Provincial Education Office, with engagement in the examination being optional and available to all physical education teachers.

By utilizing G*Power (version 3.1.9.6), a priori power analysis was executed, indicating that a sample size of 38 would furnish sufficient statistical power ($\alpha = 0.05$, $1 - \beta = 0.80$) for discerning a moderate effect size ($f = 0.25$ or 0.4) with a correlation coefficient of $p = 0.80$, a 95% power level, and $\alpha = 0.05$, employing a within-between mixed design. To mitigate experimental attrition resulting from participant dropout, 52 individuals were

recruited. Of the 52 individuals recruited, 2 were excluded due to incomplete assessments. Teachers were aged 30 to 58 years ($M = 43.94$; $SD \pm 8.19$). Criteria for educator eligibility to participate in the physical education continuing professional development intervention included: (1) being currently employed as a full-time physical education instructor; (2) physical education instructors who had not engaged in any physical education continuing professional development in the prior three years; and (3) the ability to adhere to the intervention program outside of academic hours. The exclusion criteria included the lack of the previously mentioned prerequisites. Informed consent was secured from all participants. The researchers took measures to protect the confidentiality of all individuals engaged in the study.

Furthermore, prior to their participation in the study, participants were dispatched an electronic correspondence containing directives. Subsequently, a second electronic communication was disseminated, soliciting their presence at a briefing session wherein the trial's objectives were elucidated.

Baseline Teacher Measures

This stage involved the administration of the Physical Education Teaching Efficacy Scale (PETES) questionnaire [57]. It was executed to explore the participants' perceived level of self-efficacy. The participants completed the PETES questionnaire immediately prior to the intervention. In light of the delicate nature of these questionnaires, the respondents were made comfortable to enhance their ability to accurately express their authentic feelings. Participants were assessed individually, and each task item was clarified prior to the commencement of the participants' engagement. The assessment was conducted over a period ranging from 20 to 30 min, which included both the instructional and practice phases.

PE-PD Intervention

The PE-CPD intervention was assembled at the university and conducted by distinguished University Professors. It was predominantly scheduled in the early afternoon, specifically from 3 p.m. to 5 p.m., representing the participants' preferred timing. The ensuing delineation encompasses the content/activities of the PD initiative for each cohort:

Intervention Group: A comprehensive 50-h PE-CPD program was devised based on the PL theory over a 16-week duration within the academic year. This educational framework included four essential domains relevant to the facets of PE:

1. Teaching and Learning Domain (24 h)—an instructional workshop focused on fundamental movement (FM), teaching games for understanding (TGfU), and sport education; PE-related assignments; and the integration of information technology in physical education.
2. Student Development Domain (8 h)—a seminar elucidating the understanding of students' varied necessities alongside workshops and sharing sessions pertaining to the strategizing and organization of student development athletic endeavors.
3. School Development Domain (6 h)—exemplary dissemination of home-school collaboration regarding parent-associated educational activities and the functions of physical education and sports as augmenting factors of the educational ethos and institutional reputation.
4. Professional Relationships and Services Domain (12 h)—experiential learning through empirical investigation and institutional enlightenment aimed at facilitating the understanding of research findings and optimal methodologies.

Control Group (CG): Participants did not engage in the intervention treatment. To guarantee a fair opportunity for professional education-continuous professional development (PE-CPD), participants were solicited to partake in the formulated PE-CPD program subsequent to the culmination of this study.

It is important to point out that a span of 16 weeks for the PE-CPD is considered appropriate and pragmatic as it commences subsequent to the teachers' rigorous

workload during the initial term and concludes prior to the final academic evaluations [58]. Teacher participants were granted the opportunity to reflect on the PD intervention and integrate the acquired materials before they could devise strategies to execute the physical literacy initiative for the forthcoming four-month curriculum intervention period.

Post-PD Intervention Teacher Measures

After the execution of the initial 16-week intervention, teacher participants shall be solicited to re-complete the Physical Education Teaching Efficacy Scale (PETES) questionnaire. Preliminary and concluding assessments were conducted at the identical hour of the day and under the same experimental circumstances.

Recruitment of Students

Eight teachers who engaged in the PE-CPD program and their complete cohorts of learners have been randomly chosen. Additionally, eight more classes were randomly designated within the same educational institutions to represent the control group (teachers in the control group did not take part in the PE-CPD program). The average class size was twenty pupils ($M = 20$; $SD = \pm 2.44$), aggregating to three hundred and twenty pupils in the study. As a result, a cohort of three hundred and twenty students, selected as a convenient sample, was recruited with an age range of nine to ten years ($M \text{ age} = 9.57$, $SD = \pm 0.49$) from five local primary educational institutions.

Involvement in the research study was voluntary, and every pupil from the five local schools (where the selected educators are employed) was deemed qualified to participate in this inquiry. The established inclusion criteria were as follows: participants had to be proficient in completing a moderate-to-vigorous intensity aerobic exercise session, currently enrolled as students in one of the five high schools, and capable of abstaining from all physical activity outside the scope of the study protocol on testing days. Students exhibiting orthopedic or cardiological conditions that hinder their ability to engage in physical exercises were systematically excluded from the study, as were those who could not refrain from all forms of physical activity outside the parameters of the study protocol on the designated testing days.

Three hundred twenty subjects satisfied the inclusion criteria and were solicited to partake. All three hundred twenty enlisted individuals acquiesced to participate in the research study. Consequently, the ultimate sample encompassed three hundred twenty participants who completed the assessments at baseline and subsequent to the intervention. Both cohorts comprised one hundred sixty students (experimental group—EG; $n = 160$; control group—CG; $n = 160$). A priori power analysis suggested that three hundred ten participants were essential to discern a medium effect size ($f = 0.25$ or 0.4) considering a coefficient of correlation $p = 0.80$ with 95% power and $\alpha = 0.05$, employing a within-between mixed design. Additional students were engaged to address experimental mortality, which denotes the participant attrition that could undermine the research design's validity. Given the likelihood of clustered responses within existing classes, the class mean and standard deviation will serve as the basis for analysis in forthcoming inferential statistical examinations of student performance indicators.

Before the onset of the intervention, students and their guardians were gathered to articulate the elaborate treatment plan, the features of the study, a comprehensive explanation regarding the intent of the experiment, its contents, and safety considerations established by the Declaration of Helsinki.

Baseline Student Measures

Participants were advised to adhere to their regular sleep routines and refrain from engaging in intense physical activities for a duration of 48 h preceding the commencement of data collection. At first, individuals were asked to fill out a questionnaire that detailed demographic aspects, including age, gender, medical background, tobacco use, and other relevant factors. Following this, students took part in the Motorfit battery, Spirometry test, and the Amos 8–15 assessment to evaluate their physical fitness, respiratory performance, and academic success before and after the intervention. The exercise intensity of each

training session was monitored using an OMNI scale to respect exertion in the MVPA range of $5 < \text{RPE} < 8$ and to avoid possible differences between training sessions [59].

Individuals engaged in the research underwent personalized assessments, with each evaluation following a consistent sequence, taking place at the same time each day and under similar experimental settings. The same teachers who were previously engaged in the PE-CPD intervention administered the physical education program.

PL Intervention

Student participants were involved in physical education instruction provided by teacher participants. The teacher participants utilized the instructional methodologies and knowledge they had previously obtained during the continuing professional development training period in physical education.

To develop an intervention aimed at children between the ages of 9 and 10 years, based on the principle of physical literacy, we implemented a carefully designed intervention program that was specifically tailored to accommodate the logistical and temporal realities of the selected educational institutions. It was administered biweekly for a duration of 16 weeks within the standard physical education curriculum and extended for 60 min. Within the framework of this intervention, each session systematically included explicit references to all facets of physical literacy (Table 1), aligning with the established definition and conceptual framework of physical literacy [60]. Notably, it involved the physical, cognitive, emotional, and social domains. In keeping with the principles articulated by Whitehead [61], who accentuated the value of supplying a diverse selection of content to cultivate children's eagerness for partaking in physical activity, this program featured an extensive range of physical endeavors throughout the course of the intervention, as physical literacy advocates for participation in a full spectrum of physical activities and for enabling individuals to engage with their own physical potential [62]. As a result, it encompassed rule-governed games, aesthetic movements, interactions with and on apparatus, ball games, and essential forms of physical fitness [63]. Additionally, the differentiations (taxonomies) between locomotion in contrast to object control and individual in relation to team activities shaped the intervention to incorporate a wide range of movement forms and experiences. The focus of the program was primarily on terrestrial experiences, given that aquatic activities could not be performed for logistical-pragmatic and legal-qualificatory reasons.

Table 1. Physical literacy intervention.

ACTIVITIES							
TIME 60 min/biweekly	Cooperative activities	Ball games	Coordination games and exploratory tasks	Physical exercises and leisurely pursuits involving pairs or teams	Dancing	Exercises designed to improve lateralization, control, as well as overall and segmental coordination	Creative activities
General objective	Team building	Object control	Exercise designed to acquire proficiency in spatial awareness	Exercise structured to foster unity, mutual support within the group, and confidence in others	Engagement in rhythmic tasks and games accompanied by music	Different Exercises designed to improve lateralization, control, as well as overall and segmental coordination	Utilization of the body for conveying, expressing, and portraying both real and imaginary scenarios

Physical domain	Game arrangements fostering collaboration and expectation	Throw, catch, shoot within different individual exercises, team games	Individual and group arrangements concentrating on static strength and fostering group balance	Game preparations testing personal and group skills	Aesthetic and rhythmic movements	Small team games emphasizing the spectrum of motions encompassing running, throwing, pushing	Mixed games and exercises
Cognitive domain	Strategy; Planning; Collaborative advancement and functioning with partnership methodologies	Understanding regarding fundamental competencies for ball control	Building up a repertoire of fundamental acrobatic modalities, delineating “physical activity”	Comprehending the physical fitness	Awareness concerning the diversity of movement; formulating dances in alignment with the rhythm	Introduction to understand diverse competencies to engage in physical activity	Reflection about the program
Psychological domain	Concentrating on accomplishments with the entire group	Personal growth and confidence	Focus on courage, self-perception, and confidence	Cultivating tenacity.	Enjoyment; self-expression	Enjoyment; individual experiences	Personal experiences, emotions, and sentiments;
Social domain	Communication; respect; address collective obstacles	Engaging in diverse manners collaboratively and in opposition to one another	Fostering communication, cooperation, and integrity	Foster and uplift others, interpersonal connections	Group choreography (communication and collaboration)	Respect; communication	Communication; relationships

The physical literacy intervention consisted of a preparatory phase lasting 10 min, succeeded by a primary session lasting 40 min, and concluding with a recovery phase of 10 min. During the central session, a series of activities were conducted with the objective of improving engagement, motivation, and enjoyment. Clearly, the fitness regimen was designed to be enjoyable and appealing, with the objective of promoting a thorough understanding of one’s own potential.

The control group participated in standard curricular physical education sessions that encompassed activities (primarily team sports) intentionally chosen by the teachers.

Post-PE Intervention Student Measures

Subsequent to the 16-week educational intervention, student participants were solicited to re-administer the Motorfit battery, Spirometry, Heart Rate Recovery, and Amos 8–15 questionnaire. The students underwent individual evaluations and executed each assessment in a uniform sequence, at an identical time of day, and under analogous experimental conditions.

2.3. Measures

2.3.1. Motor Tests

The assessment meticulously examined six subtests that are integrated within the Motorfit battery [64]. The activities comprise: (1) motorfit Locomotor (conducting forward leaps on a single foot (SAP1); executing lateral galloping (GL); completing forward hopping strides on one foot (SAP2). (2) motorfit object (propelling a ball with one hand (LP); capturing a ball with hands (RP); striking a ball with a tennis racket (CP).

They were selected due to their straightforward and efficient implementation, requiring minimal equipment.

2.3.2. Spirometry

Spirometry represents a widely employed pulmonary function test (PFT) that quantifies the volume of air expelled forcefully after a deep inhalation. The spirometric evaluations carried out comprised Forced Expiratory Volume in 1 Second (FEV1), the percentage of Forced Expiratory Volume in 1 Second % Predicted (FEV1%), along with Forced Vital Capacity (FVC). A portable electronic spirometer (Vyntus Spiro, Vyaire Medical GmbH, Hoechberg, Germany), designed specifically for physiological assessments, was employed. The assessments were conducted in a controlled laboratory environment. Participants adhered to the experimental protocol, and any concerns were suitably addressed. In accordance with the protocols delineated by the American Thoracic Society [65], participants engaged in forced inhalation and exhalation maneuvers while seated, with their nasal passages obstructed. Each participant performed a maximal inhalation followed by a forceful exhalation through the tube of the spirometer's mouthpiece until all air was expelled. Each participant undertook a minimum of three trials, with the most successful attempt chosen for further analysis. Verbal encouragement was utilized to stimulate the participants' optimal inhalation and exhalation efforts. The procedure reached its conclusion with the individual undertaking a maximal inhalation.

2.3.3. Heart Rate Recovery (HRR)

Heart Rate Recovery (HRR) signifies an evaluation of the cardiovascular system's ability to return to its baseline resting rhythm following the termination of physical activity. This metric denotes the difference between the peak heart rate attained during exercise and the heart rate recorded shortly after cessation. Following the completion of the Queen's College step test, HRR was computed as described in the study conducted by Castro-Piñero [66]. The experimental design included the implementation of bench stepping as a sub-maximal exercise modality specifically tailored for male subjects in accordance with the prescribed protocol. Before the commencement of the assessment, participants received instructions to partake in a preparatory phase lasting 5 to 7 min, which included activities designed to improve lower limb flexibility and promote brisk walking [67]. A conventional wooden bench with a height of 16.25 inches was selected to implement the test protocol. The time-related dimensions of the assessment were meticulously tracked using a stopwatch. Moreover, a Metronome was utilized to guarantee a consistent stepping cadence established at 96 beats per minute, equating to 24 complete steps for male participants. Subsequent to a brief demonstration, all participants partook in the step test uninterrupted for a period of three minutes. At the conclusion of the test protocol, individuals sustained an erect posture, and their carotid pulse rate was measured exactly 60 s after exercise using the pulse-pen device (Diatecne, Milan, Italy). The assessment of HRR was thereafter standardized in beats per minute for meticulous analysis.

2.3.4. Physical Education Teaching Efficacy Scale (PETES)

Humphries et al. [68] designed a Physical Education Teaching Efficacy Scale (PETES) to analyze physical education teachers' individual teaching efficacy. PETES consists of 35 items that represent seven different dimensions. The seven efficacy dimensions of the PETES encompass efficacy related to content knowledge (5 items), application of scientific knowledge in the teaching of physical education (4 items), accommodating differences in skill levels (5 items), teaching students with special needs (5 items), pedagogical practices (6 items), implementation of assessment (5 items), and integration of technology (5 items). Respondents engage with the instrument by utilizing a 10-point Likert scale (1 = Disagree/Cannot perform and 10 = Agree/Highly confident I can perform). Representative items encompassed: (a) I possess extensive fitness knowledge and am able to convey it effectively; and (b) I can inspire my students to respect and collaborate with one another.

Humphries and associates (2012) documented an internal consistency ranging from 0.77 to 0.94 and a test–retest reliability spanning from 0.63 to 0.88.

2.3.5. Amos 8–15

The Amos 8–15 [69] represents an assessment battery specifically designed for the Italian cultural context. It is designed to evaluate both the academic competencies and the motivational aspects of students ranging from 8 to 15 years of age. It allows for the recognition of learners' weaknesses and strengths to launch targeted initiatives focused on advancing effective study techniques and motivational approaches related to the learning process. The evaluation suite consists of a variety of objective assessments and questionnaires that prompt students to analyze their learning approaches, deployment of study tactics, self-conceptions as learners, and incidental attributions regarding both successful and unsuccessful occurrences. Particularly, it entails a Study Approach Questionnaire (QAS), a Study Strategies Questionnaire (QS1 and QS2), a Beliefs Questionnaire (QC1I, QC2F, QC3O), an Attributions Questionnaire (QCA), and Objective Study Evaluations.

The administrator may elect to implement all of them, select certain specific evaluations, or utilize merely one. In this investigation, the authors chose to employ the Study Approach Questionnaire (QAS) and the objective study evaluations.

Study Approach Questionnaire (QAS): The Study Approach Questionnaire operates as a fundamental tool that evaluates the different aspects of the student's study methodology. The instrument comprises 49 items organized into 7 distinct categories (7 items per category, with 5 affirmative and 2 negative responses, except for the Anxiety Category, which contains 2 affirmative and 5 negative responses). These classifications include: 1. Motivation; 2. Organization; 3. Didactic Material Development; 4. Study Flexibility; 5. Concentration; 6. Anxiety; 7. Attitude Towards School. The response scale utilizes a 3-point "Likert-type" format, extending from 1 (disagree) to 3 (strongly agree).

Objective Study Tests: It serves as an evaluative tool that enables the assessment of the pupil's capacity to understand and retain information. This evaluation requires the analysis of a text for a period of 30 min, with each participant engaging independently. Participants may adopt their traditional study methodologies. At the conclusion of the study period, a 15-min intermission is provided. Thereafter, participants perform three varied assessments: (1) selection of titles; (2) open-ended inquiries; and (3) true/false inquiries. The summation of the scores garnered from each evaluation delineates the overall final score.

2.4. Statistical Analysis

Statistical evaluations were conducted employing IBM SPSS (version 25.0 developed by IBM in Armonk, NY, USA). The data were expressed through group mean (M) values accompanied by standard deviations (SD). Assessment of normality assumptions was conducted utilizing the Kolmogorov–Smirnov test, whereas the evaluation of homogeneity of variances was carried out through the Levene test. Evaluation of group disparities at baseline was performed utilizing an independent sample *t*-test. The influence of the exercise program on dependent variables was assessed through a two-way ANOVA (group (experimental/control) × time (pre/post-intervention)) involving repeated measures on the temporal axis. When significant 'Group × Time' interactions were observed, paired *t*-tests were performed to reveal significant differences. The effect size of the notable 'Time × Group' interaction was evaluated using the partial eta squared (η^2_p) statistic, with classifications indicating small ($\eta^2_p < 0.06$), medium ($0.06 \leq \eta^2_p < 0.14$), and large ($\eta^2_p \geq 0.14$). Additionally, Cohen's *d* [70] was utilized for the determination of effect sizes in pairwise comparisons, with categorizations of small ($0.20 \leq d < 0.50$), moderate ($0.50 \leq d < 0.79$), and large ($d \geq 0.80$). Statistical significance was determined at $p < 0.05$.

3. Results

Each participant was subjected to the stipulated therapeutic conditions, and there were no reports of injuries from participants during the trial's duration. Participants in the research did not reveal any notable differences in terms of age, gender, anthropometric measures, psychological evaluations, or socioeconomic conditions ($p > 0.05$) (Table 2). Data results for all dependent variables are exhibited in Tables 3 and 4.

Table 2. Characteristic of participants.

Variable	EG (n = 160)	CG (n = 160)
	Mean $\pm$ SD	Mean $\pm$ SD
Age (y)	9.55 $\pm$ 0.49	9.60 $\pm$ 0.49
Height (cm)	137.41 $\pm$ 6.44	138.27 $\pm$ 6.86
Weight (kg)	33.81 $\pm$ 6.00	34.14 $\pm$ 6.49
Sex, n (%)		
Male	71 (44.38%)	79 (49.38%)
Female	89 (55.63%)	81 (50.63%)

Table 3. Changes in students' physical fitness and academic achievement after interventions.

	Students Experimental Group (n = 160)			Students Control Group (n = 160)		
	Baseline	Post-Test	Δ	Baseline	Post-Test	Δ
Motorfit						
Motorfit Locomotor	8.74 (1.18)	9.60 (1.04) +*	0.86 (0.87)	8.91 (1.67)	8.73 (1.63)	−0.18 (0.55)
Motorfit Object	8.19 (0.90)	9.51 (0.99) +*	1.32 (0.91)	9.38 (1.18)	8.98 (1.26)	−0.39 (0.62)
HRR	29.97 (0.97)	20.27 (1.06) +*	−5.70 (1.72)	26.60 (1.69)	25.36 (1.81)	−1.23 (0.65)
FEV 1	1.87 (0.17)	2.08 (0.37) +*	0.21 (0.22)	1.84 (0.08)	1.81 (0.08)	−0.02 (0.90)
FEV 1 (%)	86.38 (0.63)	88.85 (2.09) +*	2.46 (1.68)	86.02 (1.05)	85.81 (0.90)	−0.21 (0.90)
FVC	3.98 (0.66)	5.21 (0.16) +*	1.22 (0.72)	4.03 (0.63)	4.03 (0.57)	0.00 (0.36)
Amos 8–15—QAS Questionnaire						
Motivation	13.46 (1.51)	15.08 (1.75) +*	1.61 (0.91)	13.95 (2.13)	12.63 (1.87)	−1.32 (1.11)
Organization	14.65 (1.44)	17.01 (1.61) +*	2.35 (1.29)	14.65 (2.40)	13.41 (2.06)	−1.23 (0.88)
Didactic material development	14.73 (1.44)	14.48 (1.60)	−0.25 (0.72)	14.23 (1.38)	13.24 (1.39)	−0.98 (1.03)
Study flexibility	15.46 (1.44)	17.21 (1.53) +*	1.75 (0.82)	15.52 (1.40)	13.90 (1.77)	−1.62 (1.01)
Concentration	16.61 (1.73)	17.91 (1.58) +*	1.30 (0.80)	16.95 (1.82)	15.46 (1.95)	−1.48 (1.04)
Anxiety	17.17 (1.26)	15.20 (1.36) +*	−1.96 (1.18)	15.58 (2.31)	16.48 (1.92)	0.89 (1.14)
Attitude towards school	15.30 (2.04)	15.11 (2.12)	−0.18 (0.51)	16.16 (1.68)	14.62 (1.83)	−1.53 (0.75)
Amos 8–15—Objective Study Tests	17.96 (2.367)	21.20 (2.93) +*	3.23 (2.05)	18.50 (2.55)	16.39 (2.70)	−2.11 (0.88)

Note: values are presented as mean ($\pm$ SD); Δ : pre- to post-training changes; + significant "Group $\times$ Time" interaction: a significant effect of the intervention ($p < 0.001$). * Significantly different from pre-test ($p < 0.001$); FEV1: Forced Expiratory Volume in 1 s; FEV1 (%): Forced Expiratory Volume in 1 Second % Predicted; FVC: Forced Vital Capacity.

Table 4. Changes in teachers' self-efficacy after interventions.

	Student Experimental Group (n = 50)			Teachers Control Group (n = 50)		
	Baseline	Post-Test	Δ	Baseline	Post-Test	Δ
PETES						
content knowledge	16.40 (1.15)	22.28 (2.54) +*	5.88 (1.50)	18.96 (1.05)	15.80 (2.82)	−3.16 (2.01)

applying scientific knowledge in teaching PE	21.00 (1.44)	29.28 (3.45) †*	8.28 (2.38)	24.84 (1.14)	20.70 (4.82)	−4.96 (5.95)
accommodating skill level differences	18.96 (1.05)	26.96 (3.24) †*	8.00 (2.29)	18.96 (1.05)	16.88 (3.11)	−2.08 (3.17)
teaching students with special needs	27.60 (1.52)	37.52 (4.12) †*	9.92 (2.95)	28.32 (1.97)	26.84 (3.36)	−1.48 (2.64)
instruction	37.04 (1.51)	43.28 (3.88) †*	6.24 (2.40)	38.84 (1.37)	38.04 (2.00)	−0.80 (1.70)
using assessment	12.68 (1.02)	18.56 (2.06) †*	5.88 (1.23)	15.60 (1.04)	14.52 (1.98)	−1.08 (1.80)
using technology	41.48 (1.29)	43.52 (2.46) †*	2.04 (1.39)	43.52 (1.08)	38.96 (8.35)	−4.56 (8.30)

Note: values are presented as mean ($\pm$ SD); Δ : pre- to post-training changes; † Significant “Group $\times$ Time” interaction: a significant effect of the intervention ($p < 0.001$). * Significantly different from pre-test ($p < 0.001$).

Motor Tests

Statistical analysis revealed a significant “Time $\times$ Group” interaction for Motorfit Locomotor ($F_{1,318} = 160.46$, $p < 0.001$, $\eta^2_p = 0.83$, large effect size) and Motorfit Object ($F_{1,318} = 384.81$, $p < 0.001$, $\eta^2_p = 0.94$, large effect size). Post hoc analysis revealed a positive for Motorfit Locomotor ($t = 6.75$, $p < 0.001$, $d = 0.79$, large effect size) and Motorfit Object ($t = 7.16$, $p < 0.001$, $d = 0.81$, large effect size) in the intervention group. No significant changes were found for the control group ($p > 0.05$).

Spirometry Test

A two-factor repeated measures ANOVA found a significant “Time $\times$ Group” interaction for the FEV 1 ($F_{1,318} = 168.48$, $p < 0.001$, $\eta^2_p = 0.84$, large effect size), FEV 1 (%) ($F_{1,318} = 312.29$, $p < 0.001$, $\eta^2_p = 0.89$, large effect size); and FVC test ($F_{1,318} = 359.25$, $p < 0.001$, $\eta^2_p = 0.83$, large effect size). The post hoc analysis revealed a significant improvement in the score for FEV 1 ($t = 8.37$, $p < 0.001$, $d = 1.68$, large effect size), FEV 1 (%) ($t = 10.57$, $p < 0.001$, $d = 0.89$, large effect size), and FVC ($t = 13.88$, $p < 0.001$, $d = 0.87$, large effect size) in the intervention group. No significant changes were found for the control group ($p > 0.05$).

HRR Test

A two-factor repeated measures ANOVA found a significant “Time $\times$ Group” interaction for the HRR test ($F_{1,318} = 933.35$, $p < 0.001$, $\eta^2_p = 0.85$, large effect size). The post-hoc analysis revealed a significant improvement in the score for the HRR test ($t = -23.98$, $p < 0.001$, $d = 1.34$, large effect size) in the intervention group. No significant changes were found for the control group ($p > 0.05$).

Study Approach Questionnaire—QAS

A substantial “Time $\times$ Group” interaction was obtained for Motivation ($F_{1,318} = 659.06$, $p < 0.001$, $\eta^2_p = 0.87$, large effect size), Organization ($F_{1,318} = 843.17$, $p < 0.001$, $\eta^2_p = 0.82$, large effect size), Study flexibility ($F_{1,318} = 1067.32$, $p < 0.001$, $\eta^2_p = 0.87$, large effect size), Concentration ($F_{1,318} = 712.14$, $p < 0.001$, $\eta^2_p = 0.89$, large effect size), and Anxiety ($F_{1,318} = 482.48$, $p < 0.001$, $\eta^2_p = 0.86$, large effect size). When the post hoc analysis was performed, it showed that the experimental group reached an important increase in Motivation ($t = 22.22$, $p < 0.001$, $d = 1.75$, large effect size), Organization ($t = 23.10$, $p < 0.001$, $d = 1.82$, large effect size), Study flexibility ($t = 26.85$, $p < 0.001$, $d = 2.12$, large effect size), and Concentration ($t = 20.37$, $p < 0.001$, $d = 1.61$, large effect size). In addition, a significant decrease in Anxiety score was obtained by the EG ($t = -21.03$, $p < 0.001$, $d = 1.66$, large effect size). Lastly, no significant “Time $\times$ Group” interactions were reached in didactic material development and attitude towards school ($p > 0.05$). The control group did not report any significant changes ($p > 0.05$).

Objective Study Tests

The results of a two-factor repeated measure ANOVA showed meaningful “Time $\times$ Group” interaction for Objective Study Tests ($F_{1,318} = 918.28$, $p < 0.001$, $\eta^2_p = 0.85$, large effect size). Carrying out the post hoc analysis, it was found that EG significantly increased the score for Objective Study Tests ($t = 19.96$, $p < 0.001$, $d = 1.57$, large effect size). The control group did not report any significant changes ($p > 0.05$).

Physical Education Teaching Efficacy Scale—PETES

The results of a two-factor repeated measure ANOVA showed meaningful “Time $\times$ Group” interaction for all the seven variables. Specifically, content knowledge ($F_{1,48} = 322.58, p < 0.001, \eta^2_p = 0.87$, large effect size); applying scientific knowledge in teaching PE ($F_{1,48} = 138.29, p < 0.001, \eta^2_p = 0.84$, large effect size); accommodating skill level differences ($F_{1,48} = 165.73, p < 0.001, \eta^2_p = 0.87$, large effect size); teaching students with special needs differences ($F_{1,48} = 206.24, p < 0.001, \eta^2_p = 0.81$, large effect size); instruction ($F_{1,48} = 142.58, p < 0.001, \eta^2_p = 0.84$, large effect size); using assessment ($F_{1,48} = 253.88, p < 0.001, \eta^2_p = 0.84$, large effect size); using technology ($F_{1,48} = 15.36, p < 0.001, \eta^2_p = 0.83$, large effect size). When the post hoc analysis was performed, it showed that the experimental group reached an important increase in the Self-efficacy test: content knowledge ($t = 19.48, p < 0.001, d = 3.89$, large effect size); applying scientific knowledge in teaching PE ($t = 17.32, p < 0.001, d = 3.46$, large effect size); accommodating skill level differences ($t = 17.345, p < 0.001, d = 3.49$, large effect size); teaching students with special needs differences ($t = 16.77, p < 0.001, d = 3.35$, large effect size); instruction ($t = 12.98, p < 0.001, d = 2.59$, large effect size); using assessment ($t = 23.79, p < 0.001, d = 4.75$, large effect size); using technology ($t = 7.29, p < 0.001, d = 1.45$, large effect size). The control group did not report any significant changes ($p > 0.05$).

Pearson's r

Correlation coefficients (Pearson's r) were calculated to detect relationships between increased teacher self-efficacy and improved physiological and cognitive parameters in students. Statistically significant correlations between the variables were highlighted (Figure 2).

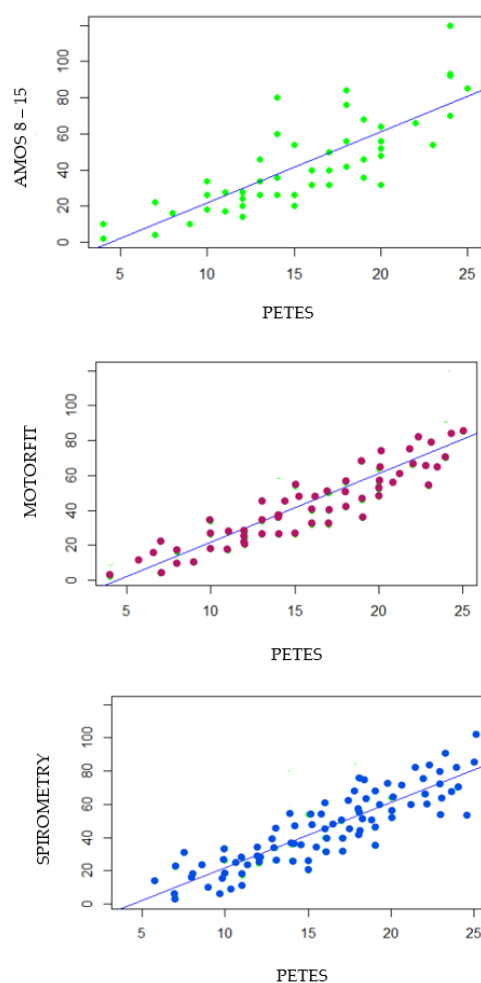


Figure 2. Correlation between the variables under study.

4. Discussion

The aim of this research was to evaluate the impact of a physical education continuing professional development (PE-CPD) initiative on the self-efficacy of educators and, subsequently, the efficacy of a professional learning program developed by instructors who had previously participated in the PE-CPD intervention, on physical and academic performance of the students.

In the framework of this analysis, the findings indicate that the continuing professional development intervention in physical education was successful in fostering educators' advancement in knowledge and skill competencies, especially in enhancing the perceived sense of self-efficacy. Moreover, when educator participants implemented the pedagogical methodologies and content they had previously internalized during the PE-CPD intervention phase in designing physical education lessons, it resulted in enhanced physical fitness and academic achievements for students. These findings indicate that high-quality physical education is vital to mediating between teachers' self-efficacy and students' physical and academic outcomes.

A primary finding of the present investigation was the notable enhancement in educators' self-efficacy perceptions following the PE-CPD intervention. In fact, the experimental cohort illustrated improvement in all seven parameters of PETES. Such a finding aligns with earlier studies, suggesting that continuous professional development positively correlates with teacher self-efficacy [70–72]. Although some teachers consider participation in CPD as simply a formality, most teachers are motivated by the intention to advance their capabilities [73,74]. During participation in collaborative initiatives, mentors and peers generally disseminate their own pedagogical insights, and the reciprocal sharing of vicarious experiences may enhance individuals' self-efficacy [75]. Engaging in revitalizing activities could contribute to the elevation of teachers' proficiency as well as their efficacy regarding advanced technical and general self-efficacy [76]. When teachers integrate the knowledge and skills obtained from CPD (e.g., new media technology), the standard of their instruction is augmented; therefore, their efficacy also receives a considerable boost [77,78].

At this particular time, a rising number of scholars have explored the connection between continuous professional development (CPD) and educators' self-efficacy. Donnell and Gettinger [79] ascertained that high-quality professional development predicted increased educator self-efficacy. Lee et al. [80] established that professional development (e.g., knowledge dissemination, learning motivation, organizational culture) was also a favorable predictor of governmental auditors' self-efficacy. Teachers who place a higher value on professional development are likely to experience an increase in educator self-efficacy; for example, when educators recognize the benefits of professional development, they engage more deeply in related activities and demonstrate an elevated self-efficacy in their teaching practices [81].

Research findings from diverse intervention programs have suggested that continuing professional development (CPD) initiatives have the potential to augment teachers' self-efficacy [82]; for example, one empirical study revealed that participation in a two-week professional development course markedly enhanced both teacher self-efficacy and instructional quality [83]. Some scholars have asserted that factors such as decision-making, collaborative practices, reflective practices, and ongoing updates may act as favorable indicators of teachers' self-efficacy [84]; however, a contrasting investigation indicated that engagement in a narrowly specified area of professional development (e.g., individualized learning professional development) was linked to teachers' self-efficacy. In contrast, other areas of engagement demonstrated a statistically insignificant association with teachers' self-efficacy [85], thereby highlighting the necessity for further inquiry. Moreover, participation in CPD may elevate teachers' pedagogical competencies, transform their beliefs and attitudes, and promote student achievements and developmental outcomes. Guskey [86] posited that professional development constitutes a meticulously structured, continuous, and systematic effort

designed to enhance an individual's professional knowledge, skills, and attitudes in order to ultimately foster student achievement.

The main result of this investigation was the confirmation of the effectiveness of a professional learning program created by educators who had earlier participated in the ongoing professional development intervention for physical education concerning students' physical fitness and academic success. Certainly, this study confirmed the considerable effect that physical activity exerts on motivation and concentration levels. This corroborates the hypothesis that enhancements in the quality of physical education can stimulate physiological arousal and alleviate sensations of tedium while concurrently improving attention span and concentration [87–89]. Additionally, a remarkable decline in anxiety levels was noted. This result corresponds with previous empirical evidence showing that physical exercise can diminish signs associated with stress and anxiety disorders, increase enjoyment, and foster academic achievement [90]. By mitigating this psychological burden, an increased allocation of cognitive resources for working memory is rendered available for educational activities [91]. Conversely, it is posited that anxieties and detrimental thoughts instigated by stress deplete working memory capacity, consequently restricting the cognitive resources accessible to students during the learning process [92].

A further important finding, which reveals a favorable association between QPE and scholarly success, involved the development of skills to organize study efforts and to show greater adaptability [93]. This finding originated from the positive effects associated with physical activity. Indeed, a noteworthy body of academic literature has corroborated that individuals who undertake consistent training demonstrate superior problem-solving and decision-making skills [94–97].

The most significant outcome of the current research was the validating evidence substantiating the effectiveness of the physical literacy (PL) program in improving cognitive capabilities among participants in the intervention. Compared to the control groups, the experimental group showed considerable progress in educational outcomes after completing a 16-week intervention. In accordance with the prevailing body of research, we assert that this outcome originated from augmented focus and attentional capacity [98,99], enhanced working memory [100], diminished anxiety levels, increased motivation, elevated organizational competencies for scholarly endeavors, and a reduction in off-task activities [101–103]. Crucially, the prevailing body of research supports the notion that quality physical education (QPE) can significantly boost academic performance in children, as they demonstrate enhanced speed and accuracy in executing various cognitive tasks (e.g., on-task behavior, executive function skills, and academic achievement) after participating in a physical activity session [104–107].

Additionally, empirical findings have clarified that quality physical education (QPE) contributes to enhancements in academic achievement due to its effectiveness in facilitating the distribution of cognitive resources critical for the performance of tasks that engage working memory [108,109]. These findings imply that QPE is essential for the encouragement of physically active behaviors [110]. QPE serves as a vital mechanism for imparting essential knowledge, skills, physical fitness, and constructive attitudes that are imperative for individuals to become skilled movers and competent performers, which are crucial for participation in a diverse range of physical activities (PAs). QPE offers an extensive array of physically active pursuits that are developmentally appropriate and meaningful for students [111]. It adopts proficient instructional strategies to deliver optimal educational experiences for students and to nurture favorable learning contexts. In essence, high-quality physical education ought not to be limited to an exclusive emphasis on the pivotal domain of physical health via athletic involvement [112] but should focus on fostering in youth a cognitive-motor repertoire that develops in alignment with the rhythms of personal growth and the opportunities provided by the environment [113]. Indeed, it becomes feasible to attain proficiency in increasingly sophisticated motor skills by embarking on significant motor experiences that promote

the formation and organization of fundamental motor patterns alongside their executive variations. From this standpoint, quality physical education permits the instillation of significance into lived experiences by metamorphosing bodies into “incubators” of knowledge [114].

Several theoretical frameworks are documented that may shed light on the relationship between physical education (PE) and better academic performance [115–118]. Certain empirical research findings propose that PE may have direct advantageous influences on the central nervous system through the enhancement of cerebral volume, improvement of cerebral blood flow, promotion of synaptic plasticity, and facilitation of neurogenesis, all of which are vital for different dimensions of perception, cognition, memory, and attentional processes [119–121]. Further analyses demonstrate that physical education (PE) contributes beneficially to psychological metrics such as self-esteem, motivation, social engagement, and communication [122], which are fundamentally important for achieving academic success. Moreover, research indicates that insufficient motor skills may have detrimental effects on these psychological constructs and hinder cognitive development [123]. The results demonstrate a link between higher rates of physical activity (PA), improved attentional capacity, the ability to maintain concentration in academic environments, and overall academic success [124].

Lastly, concerning the students' physical fitness, an important finding was that the physical literacy (PL) program can greatly advance respiratory functions in pediatric populations. Involvement in exercise reinforces respiratory musculature, increases lung volume, and improves oxygen utilization [125]. In the ongoing research, a comparative evaluation of pre- and post-intervention metrics of ventilatory parameters indicated a statistically significant increase in Forced Expiratory Volume in one second (FEV1) and Forced Vital Capacity (FVC) within the experimental sample ($p < 0.05$). In stark contrast, the control group demonstrated no significant improvements in pulmonary metrics subsequent to the training protocol ($p \geq 0.05$). This inconsistency can reasonably be attributed to the premise that physical activity generates more substantial ventilatory responses, consequently encouraging augmented and enduring ventilation to fulfill gas exchange requirements during physical exercise and subsequent training changes. Previous research has suggested that engaging in physical activity to enhance motor skills can improve maximal respiratory function in inactive individuals [126] while strengthening inspiratory muscle capacity in active, healthy youth [127]. Additionally, it has been established that training brings about unique transformations in the respiratory system, evidenced by a rise in diaphragm mass and enhanced respiratory muscle strength in youth [128]. Several prior studies have validated comparable results, illuminating connections between physical activity and dynamic lung volumes (specifically FEV1 and FVC). Cohort studies reveal that children involved in habitual physical activity may have larger lung volumes [129]. Various research efforts have highlighted the association between physical activity and FEV1 and FVC in early adolescence [130]. An intervention study focused on seven-year-old children demonstrated a correlation between physical training and increased lung volumes over a five-year follow-up duration, though the interpretation of these results is limited by the presence of a non-randomized control group. Longitudinal analyses carried out in adulthood propose that physical activity might be linked to a more gradual decrease in pulmonary function [131]. These findings indicate that physical fitness may improve maximal lung function during the formative years of childhood.

In the scope of this investigation, it is vital to highlight that meaningful physical education constitutes a foundational aspect of superior physical education [132], and superior physical education inherently demands the utilization of a pedagogical strategy that is informed by and enhances physical literacy. Quality physical education underscores the importance of physical literacy as a developmental benchmark that cultivates an individual's bodily awareness, physical proficiency, and enjoyment in engaging with physical and motor activities.

Physical education represents the initial and, in various situations, the only systematic framework in which the student can participate in motor experiences that hold semantic and logical associations with different learning processes. Hence, it profoundly contributes to the progression of the educational journey through the awareness of the corporeal self, the acquisition of motor competencies, and the enhancement of both quantitative and qualitative opportunities for executing motor sequences in which the individual can deeply engage not merely on the physical-motor level but also cognitively [133]. In the domain of pedagogical practice focused on delivering high-quality physical education, particularly with respect to the methodologies, tools, and effectiveness with which the discipline's objectives are actively pursued, the interpretations and values ascribed to the body, movement, and the caliber with which the educator conveys skills pertinent to physical literacy acquire paramount importance. Physical literacy establishes a scholarly underpinning to steer the creation of interventions. At the same time, physical literacy has become a pivotal focus of research concerning the application of interventions for children and adolescents worldwide. This relationship is founded on the assumption that the improvement of physical literacy can beneficially impact self-efficacy and motivation associated with the learning experience [134]. As a result, it is reasonable to surmise that dimensions of physical literacy might be interconnected with educational attainment across areas that extend past physical education. Alongside the fundamental educational relevance of physical literacy, recognizing this correlation can support the creation of educational frameworks founded on physical literacy to elevate young learners' holistic academic achievement [135].

Drawing from the discussions articulated, these results correspond with earlier investigations that support the notion of a considerable linkage among professional development (PD), educators' self-efficacy, and students' physical fitness alongside academic performance [136]. Accordingly, it is vital that educational organizations enable teachers to partake in lifelong educational opportunities and that students sustain a disciplined approach to quality physical activity [137–140].

This analysis corroborates the beneficial correlation between continuing professional development (CPD), self-efficacy, quality physical education, physical fitness, and academic success; nevertheless, certain limitations embedded in this research call for more in-depth exploration. To begin with, the existing research is confined to the participation of students from a singular geographic region, which subsequently limits the generalizability of the findings to a broader student cohort. Additionally, a prominent deficiency is evident in scrutinizing the long-term outcomes of both interventions. Moreover, the investigation is characterized by a restricted age spectrum, and the information was compiled during a solitary time period. Acknowledging that physical literacy (PL) represents a key educational dimension, the association between PL and academic performance may differ in various cultural and educational environments; thus, exploring its realization among students around the globe could furnish enlightening perspectives on this under-researched theme. Finally, another limit of this study was the possibility that the changes were actually produced by the discriminatory factor of the teacher who had participated in CPD compared to the one who did not, changing the sessions performed and causing a differential variable between the experimental and control groups to be added. Consequently, it is advisable that subsequent inquiries explore analogous variables within a more comprehensive and diverse sample encompassing educators and learners across primary, secondary, and tertiary educational tiers. Nonetheless, the outcomes garnered may yield meaningful implications for subsequent scholarly investigations. Therefore, the advantages of this study were amplified by this proficient strategy that encourages the advancement of the quality of Physical Education within our academic establishments.

5. Conclusions

In an ever-evolving social context, the entirety of the educational system is called upon to engage in a task of remarkable importance, responding with adeptness and professionalism to the novel challenges presented by modernity. The function of the educator emerges as pivotal and essential, wherein their role is articulated through an educational commitment directed at transforming students into informed and engaged adults, active citizens within a perpetually evolving reality. This highlights the imperative to fortify one's professional identity, augment pedagogical experiences, and enhance the standard of one's training, which has become the foremost priority for all educators. The teaching profession increasingly demands continual development of competencies essential for addressing the responsibilities and challenges that rapid cultural and social transformations and globalization impose on the educational domain. Within this framework, teachers' self-efficacy and the provision of quality physical education (QPE) through professional learning (PL) can be considered fundamental determinants of effective instruction, which subsequently affects students' physical fitness and academic performance.

The findings of this study entailed significant results in terms of enrichment of literature because physical literacy has a potentially powerful impact on an individual's sense of self and self-confidence, communication with others, knowledge and understanding of PA, and motivation and accomplishments. On the other hand, PE teachers better appreciated the importance of PE-CPD as a vehicle for improving their professional competence, which also benefits their students.

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Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy restrictions.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Reis, L.N.; Reuter, C.P.; Burns, R.D.; Martins, C.M.D.L.; Mota, J.; Gaya, A.C.A.; Silveira, J.F.D.C.; Gaya, A.R. Effects of a physical education intervention on children's physical activity and fitness: The PROFIT pilot study. *BMC Pediatr.* **2024**, *24*, 78.
2. da Silva, R.H.; Nobre, G.C.; Pessoa, M.L.F.; Soares, Í.A.; Bezerra, J.; Gaya, A.R.; Mota, J.A.; Duncan, M.J.; Martins, C.M. Physical activity during school-time and fundamental movement skills: A study among preschoolers with and without physical education classes. *Phys. Educ. Sport Pedagog.* **2024**, *29*, 302–314.
3. Kim, S.R.; Choi, S.; Keum, N.; Park, S.M. Combined effects of physical activity and air pollution on cardiovascular disease: A population-based study. *J. Am. Heart Assoc.* **2020**, *9*, e013611.
4. Lindgren, M.; Börjesson, M. The importance of physical activity and cardiorespiratory fitness for patients with heart failure. *Diabetes Res. Clin. Pract.* **2021**, *176*, 108833.
5. Strain, T.; Flaxman, S.; Guthold, R.; Semenov, E.; Cowan, M.; Riley, L.M.; Bull, F.C.; Stevens, G.A. National, regional, and global trends in insufficient physical activity among adults from 2000 to 2022: A pooled analysis of 507 population-based surveys with 5·7 million participants. *Lancet Glob. Health* **2024**, *12*, e1232–e1243.
6. Mehta, A.; Kondamudi, N.; Laukkanen, J.A.; Wisloff, U.; Franklin, B.A.; Arena, R.; Lavie, C.J.; Pandey, A. Running away from cardiovascular disease at the right speed: The impact of aerobic physical activity and cardiorespiratory fitness on cardiovascular disease risk and associated subclinical phenotypes. *Prog. Cardiovasc. Dis.* **2020**, *63*, 762–774.

7. Bahls, M.; Ittermann, T.; Ewert, R.; Stubbe, B.; Völzke, H.; Friedrich, N.; Felix, S.B.; Dörr, M. Physical activity and cardiorespiratory fitness—A ten-year follow-up. *Scand. J. Med. Sci. Sports* **2021**, *31*, 742–751.
8. Mihailova, A.; Kaminska, I. Lung volumes related to physical activity, physical fitness, aerobic capacity and body mass index in students. In *SHS Web of Conferences*; EDP Sciences: Les Ulis, France, 2016; Volume 30, p. 00017.
9. Hancox, R.J.; Rasmussen, F. Does physical fitness enhance lung function in children and young adults? *Eur. Respir. J.* **2018**, *51*, 1701374.
10. Berntsen, S.; Wisløff, T.; Nafstad, P.; Nystad, W. Lung function increases with increasing level of physical activity in school children. *Pediatr. Exerc. Sci.* **2008**, *20*, 402–410.
11. Fuertes, E.; Carsin, A.E.; Antó, J.M.; Bono, R.; Corsico, A.G.; Demoly, P.; Gislason, T.; Gullón, J.A.; Janson, C.; Jarvis, D.; et al. Leisure-time vigorous physical activity is associated with better lung function: The prospective ECRHS study. *Thorax* **2018**, *73*, 376–384.
12. Enright, S.J.; Unnithan, V.B.; Heward, C.; Withnall, L.; Davies, D.H. Effect of high-intensity inspiratory muscle training on lung volumes, diaphragm thickness, and exercise capacity in subjects who are healthy. *Phys. Ther.* **2006**, *86*, 345–354.
13. Ploughman, M. Exercise is brain food: The effects of physical activity on cognitive function. *Dev. Neurorehabilit.* **2008**, *11*, 236–240.
14. Bidzan-Bluma, I.; Lipowska, M. Physical activity and cognitive functioning of children: A systematic review. *Int. J. Environ. Res. Public Health* **2018**, *15*, 800.
15. Hillman, C.H.; Motl, R.W.; Pontifex, M.B.; Posthuma, D.; Stubbe, J.H.; Boomsma, D.I.; De Geus, E.J. Physical activity and cognitive function in a cross-section of younger and older community-dwelling individuals. *Health Psychol.* **2006**, *25*, 678.
16. Cipriano, C.; Kilag, O.K.; Samutya, M.; Macapobre, K.; Villegas, M.A.; Suba-an, J. Physical Activity Interventions in Educational Settings: Effects on Academic Achievement Revisited. *Int. Multidiscip. J. Res. Innov. Sustain. Excell. (IMJRISE)* **2024**, *1*, 238–246.
17. Haverkamp, B.F.; Wiersma, R.; Vertessen, K.; van Ewijk, H.; Oosterlaan, J.; Hartman, E. Effects of physical activity interventions on cognitive outcomes and academic performance in adolescents and young adults: A meta-analysis. *J. Sports Sci.* **2020**, *38*, 2637–2660.
18. Wassenaar, T.M.; Williamson, W.; Johansen-Berg, H.; Dawes, H.; Roberts, N.; Foster, C.; Sexton, C.E. A critical evaluation of systematic reviews assessing the effect of chronic physical activity on academic achievement, cognition and the brain in children and adolescents: A systematic review. *Int. J. Behav. Nutr. Phys. Act.* **2020**, *17*, 79.
19. De Bruijn, A.G.; Kostons, D.D.; Van Der Fels, I.M.; Visscher, C.; Oosterlaan, J.; Hartman, E.; Bosker, R.J. Effects of aerobic and cognitively-engaging physical activity on academic skills: A cluster randomized controlled trial. *J. Sports Sci.* **2020**, *38*, 1806–1817.
20. Mavilidi, M.F.; Drew, R.; Morgan, P.J.; Lubans, D.R.; Schmidt, M.; Riley, N. Effects of different types of classroom physical activity breaks on children's on-task behaviour, academic achievement and cognition. *Acta Paediatr.* **2020**, *109*, 158–165.
21. Khan, N.A.; Hillman, C.H. The relation of childhood physical activity and aerobic fitness to brain function and cognition: A review. *Pediatr. Exerc. Sci.* **2014**, *26*, 138–146.
22. World Health Organization. *WHO Guidelines on Physical Activity and Sedentary Behavior*; World Health Organization: Geneva, Switzerland, 2020.
23. Zhao, H.; Wu, N.; Haapala, E.A.; Gao, Y. Association between meeting 24-h movement guidelines and health in children and adolescents aged 5–17 years: A systematic review and meta-analysis. *Front. Public Health* **2024**, *12*, 1351972.
24. Fisher, A.; Boyle, J.M.; Paton, J.Y.; Tomporowski, P.; Watson, C.; McColl, J.H.; Reilly, J.J. Effects of a physical education intervention on cognitive function in young children: Randomized controlled pilot study. *BMC Pediatr.* **2011**, *11*, 97.
25. Ardoy, D.N.; Fernández-Rodríguez, J.M.; Jiménez-Pavón, D.; Castillo, R.; Ruiz, J.R.; Ortega, F.B. A physical education trial improves adolescents' cognitive performance and academic achievement: The EDUFIT study. *Scand. J. Med. Sci. Sports* **2014**, *24*, e52–e61.
26. Reed, J.A.; Maslow, A.L.; Long, S.; Hughey, M. Examining the impact of 45 minutes of daily physical education on cognitive ability, fitness performance, and body composition of African American youth. *J. Phys. Act. Health* **2013**, *10*, 185–197.
27. Donnelly, J.E.; Hillman, C.H.; Castelli, D.; Etnier, J.L.; Lee, S.; Tomporowski, P.; Lambourne, K.; Szabo-Reed, A.N. Physical activity, fitness, cognitive function, and academic achievement in children: A systematic review. *Med. Sci. Sports Exerc.* **2016**, *48*, 1197.
28. Castelli, D.M.; Beighle, A. The physical education teacher as school activity director. *J. Phys. Educ. Recreat. Danc.* **2007**, *78*, 25–28.
29. Demchenko, I.; Maksymchuk, B.; Bilan, V.; Maksymchuk, I.; Kalynovska, I. Training future physical education teachers for professional activities under the conditions of inclusive education. *BRAIN Broad Res. Artif. Intell. Neurosci.* **2021**, *12*, 191–213.
30. Parker, M.; Patton, K. What research tells us about effective continuing professional development for physical education teachers. In *Routledge Handbook of Physical Education Pedagogies*; Routledge: London, UK, 2016; pp. 447–460.
31. Kavanaugh, T.C.; Tomaka, J.; Moralez, E. Professional preparedness and psychosocial beliefs as predictors of quality physical education and recreation services to students with disabilities. *Ther. Recreat. J.* **2021**, *55*, 414–431.
32. Milana, M.; Klatt, G.; Vatrella, S. *Europe's Lifelong Learning Markets, Governance and Policy*; Springer International Publishing: Cham, Switzerland, 2020.
33. Bergan, S.; Matei, L. The future of the Bologna process and the European Higher Education Area: New perspectives on a recurring topic. In *European Higher Education Area: Challenges for a New Decade*; Springer International Publishing: Cham, Switzerland, 2020; pp. 361–373.
34. Fleming, T. Models of Lifelong Learning 3. *Oxf. Handb. Lifelong Learn.* **2021**, *2*, 35.

35. Conesa, J.; Batalla-Busquets, J.M.; Bañeres, D.; Carrion, C.; Conejero-Arto, I.; del Carmen Cruz Gil, M.; Garcia-Alsina, M.; Gómez-Zúñiga, B.; Martínez-Argüelles, M.J.; Mas, X.; et al. Towards an educational model for lifelong learning. In *Advances on P2P, Parallel, Grid, Cloud and Internet Computing: Proceedings of the 14th International Conference on P2P, Parallel, Grid, Cloud and Internet Computing (3PGCIC-2019) 14*; Springer International Publishing: Cham, Switzerland, 2020; pp. 537–546.
36. Godbout, P. Emergence of physical literacy in physical education: Some curricular repercussions. *Phys. Educ. Sport Pedagog.* **2023**, *28*, 503–516.
37. Endres, T.; Leber, J.; Böttger, C.; Rovers, S.; Renkl, A. Improving lifelong learning by fostering students' learning strategies at university. *Psychol. Learn. Teach.* **2021**, *20*, 144–160.
38. Calderón, A.; Scanlon, D.; MacPhail, A.; Moody, B. An integrated blended learning approach for physical education teacher education programmes: Teacher educators' and pre-service teachers' experiences. *Phys. Educ. Sport Pedagog.* **2021**, *26*, 562–577.
39. Tolentino, J.C.G.; Sinio, C.D. Implementation of the Revitalized Tertiary Physical Education Program in a Higher Education Institution in Pampanga Grounded on the Statutory Policy of the Commission on Higher Education and UNESCO's Quality Physical Education Model. *Int. J. Multidiscip. Appl. Bus. Educ. Res.* **2024**, *5*, 488–512.
40. Caldwell, H.A.; Di Cristofaro, N.A.; Cairney, J.; Bray, S.R.; MacDonald, M.J.; Timmons, B.W. Physical literacy, physical activity, and health indicators in school-age children. *Int. J. Environ. Res. Public Health* **2020**, *17*, 5367.
41. Annali della Pubblica Istruzione. MIUR—Indicazioni Nazionali per il Curricolo della Scuola Dell'infanzia e del primo ciclo D'istruzione; Numero speciale degli Annali della Pubblica Istruzione, Anno LXXXVIII; Le Monnier: Firenze, Italy.
42. Quennerstedt, M.; McCuaig, L.; Mårdh, A. The fantasmatic logics of physical literacy. *Sport Educ. Soc.* **2021**, *26*, 846–861.
43. Liu, Y.; Chen, S. Physical literacy in children and adolescents: Definitions, assessments, and interventions. *Eur. Phys. Educ. Rev.* **2021**, *27*, 96–112.
44. Fairman, J.C.; Smith, D.J.; Pullen, P.C.; Lebel, S.J. The challenge of keeping teacher professional development relevant. In *Leadership for Professional Learning*; Routledge: London, UK, 2022; pp. 251–263.
45. Sancar, R.; Atal, D.; Deryakulu, D. A new framework for teachers' professional development. *Teach. Teach. Educ.* **2021**, *101*, 103305.
46. Dixit, S.; Srivastava, S.; Reddy, R.S.; Faghy, M.A.; Tedla, J.; Kakaraparthi, V.N.; Gular, K.; Gupta, K. Correlation between self-reported or supervised physical activity (PA) in non-communicable diseases (NCD) and co-morbidities during COVID-19 pandemic: A Systematic Review. *Am. J. Phys. Med. Rehabil.* **2024**, *10*, 1097.
47. Alhumaid, M.M.; Khoo, S.; Bastos, T. Self-efficacy of pre-service physical education teachers toward inclusion in Saudi Arabia. *Sustainability* **2020**, *12*, 3898.
48. Latino, F.; Tafuri, F.; Saraiello, E.; Tafuri, D. Classroom-based physical activity as a means to improve self-efficacy and academic achievement among Normal-weight and overweight youth. *Nutrients* **2023**, *15*, 2061.
49. Latino, F.; Saraiello, E.; Tafuri, F. Outdoor Physical Activity: A Training Method for Learning in an Experiential and Innovative Way. *J. Phys. Educ. Sport* **2023**, *23*, 1852–1860.
50. Medrano-Ureña, M.D.R.; Ortega-Ruiz, R.; Benítez-Sillero, J.D.D. Physical fitness, exercise self-efficacy, and quality of life in adulthood: A systematic review. *Int. J. Environ. Res. Public Health* **2020**, *17*, 6343. Doi: 10.1097/PHM.0000000000002520.
51. Tinning, R. 2010. Pedagogy and human movement: Theory, practice, research, New York, Routledge.
52. Martin, J.J.; Kulinna, P.H. Self-efficacy theory and the theory of planned behavior: Teaching physically active physical education classes. *Res. Q. Exerc. Sport* **2004**, *75*, 288–297.
53. Martin, J.J.; Mccaughy, N.; Hodges-Kulinna, P.; Cothran, D. The influences of professional development on teachers' self-efficacy toward educational change. *Phys. Educ. Sport Pedagog.* **2008**, *13*, 171–190.
54. Bandura, A. Self-efficacy: Toward a unifying theory of behavioral change. *Psychol. Rev.* **1977**, *84*, 191–215.
55. Ross, J.A. The impact of an inservice to promote cooperative learning on the stability of teacher efficacy. *Teach. Teach. Educ.* **1994**, *10*, 381–394.
56. Muntaner-Mas, A.; Morales, J.S.; Martínez-de-Quel, Ó.; Lubans, D.R.; García-Hermoso, A. Acute effect of physical activity on academic outcomes in school-aged youth: A systematic review and multivariate meta-analysis. *Scand. J. Med. Sci. Sports* **2024**, *34*, e14479.
57. Anderson, C.L.; Feldman, D.B. Hope and physical exercise: The contributions of hope, self-efficacy, and optimism in accounting for variance in exercise frequency. *Psychol. Rep.* **2020**, *123*, 1145–1159.
58. Humphries, C.A.; Hebert, E.; Daigle, K.; Martin, J. Development of a physical education teaching efficacy scale. *Meas. Phys. Educ. Exerc. Sci.* **2012**, *16*, 284–299.
59. Armour, K.; Quennerstedt, M.; Chambers, F.; Makopoulou, K. What is 'effective' CPD for contemporary physical education teachers? A Deweyan framework. *Sport Educ. Soc.* **2017**, *22*, 799–811.
60. Nakamura, F.Y.; Pereira, G.; Chimin, P.; Siqueira-Pereira, T.A.; Simões, H.G.; Bishop, D.J. Estimating the perceived exertion threshold using the OMNI scale. *J. Strength Cond. Res.* **2010**, *24*, 1602–1608. <https://doi.org/10.1519/JSC.0b013e3181d15658>.
61. Agans, J.P.; Stuckey, M.I.; Cairney, J.; Kriellaars, D. Four domains for development for all (4D4D4All): A holistic, physical literacy framework. *J. Appl. Sport Psychol.* **2024**, *36*, 880–901.
62. Whitehead, M. Definition of physical literacy: Developments and issues. In *Physical Literacy across the World*; Routledge: London, UK, 2019; pp. 8–18.
63. Carl, J.; Barratt, J.; Wanner, P.; Toepfer, C.; Cairney, J.; Pfeifer, K. The effectiveness of physical literacy interventions: A systematic review with meta-analysis. *Sports Med.* **2022**, *52*, 2965–2999.

64. Gu, X.; Zhang, T.; Lun (Alan) Chu, T.; Zhang, X.; Thomas Thomas, K. Do physically literate adolescents have better academic performance?. *Percept. Mot. Skills* **2019**, *126*, 585–602.
65. Perotta, F.; Corona, F.; Cozzarelli, C. The efficacy of the project motorfit: Educational Actions through physical activity in schools. *Sport Sci.* **2011**, *4*, 34–39.
66. Graham, B.L.; Steenbruggen, I.; Miller, M.R.; Barjaktarevic, I.Z.; Cooper, B.G.; Hall, G.L.; Hallstrand, T.S.; Kaminsky, D.A.; McCarthy, K.; McCormack, M.C.; et al. Standardization of spirometry 2019 update. An official American thoracic society and European respiratory society technical statement. *Am. J. Respir. Crit. Care Med.* **2019**, *200*, e70–e88.
67. Castro-Piñero, J.; Marin-Jimenez, N.; Fernandez-Santos, J.R.; Martin-Acosta, F.; Segura-Jimenez, V.; Izquierdo-Gomez, R.; Ruiz, J.R.; Cuenca-Garcia, M. Criterion-related validity of field-based fitness tests in adults: A systematic review. *J. Clin. Med.* **2021**, *10*, 3743.
68. COCIS. *Protocolli Cardiologici per il Giudizio di Idoneità allo Sport Agonistico 2003*; Casa Editrice Scientifica Internazionale: Roma, Italy, 2023.
69. Cornoldi, C.; De Beni, R.; Zamperlin, C.; Meneghetti, C. *AMOS 8-15. Strumenti di Valutazione di Abilità e Motivazione allo Studio per Studenti Dagli 8 ai 14 Anni*; Erickson: Trento, Italy, 2005.
70. Cohen, J. A Power Primer. *Psychol. Bull.* **1992**, *112*, 155–159. <https://doi.org/10.1037/0033-2909.112.1.155>.
71. Li, R.; Liu, H.; Chen, Y.; Yao, M. Teacher engagement and self-efficacy: The mediating role of continuing professional development and moderating role of teaching experience. *Curr. Psychol.* **2022**, *41*, 328–337.
72. Granziera, H.; Perera, H.N. Relations among teachers' self-efficacy beliefs, engagement, and work satisfaction: A social cognitive view. *Contemp. Educ. Psychol.* **2019**, *58*, 75–84.
73. Gümüş, E.; Bellibaş, M.Ş. The relationship between the types of professional development activities teachers participate in and their self-efficacy: A multi-country analysis. *Eur. J. Teach. Educ.* **2023**, *46*, 67–94.
74. Silva, A.F.; Oliveira, R.; Cataldi, S.; Clemente, F.M.; Latino, F.; Badicu, G.; Greco, G.; Leão, C.; Bonavolontà, V.; Fischetti, F. Weekly variations of well-being and interactions with training and match intensities: A descriptive case study in youth male soccer players. *Int. J. Environ. Res. Public Health* **2022**, *19*, 2935.
75. Boeve-de Pauw, J.; Olsson, D.; Berglund, T.; Gericke, N. Teachers' ESD self-efficacy and practices: A longitudinal study on the impact of teacher professional development. *Environ. Educ. Res.* **2022**, *28*, 867–885.
76. Mardiyah, S.U.K.; Setyawan, H.; García-Jiménez, J.V.; Eken, Ö.; Latino, F.; Pranoto, N.W.; Darmawan, A.; Shidiq, A.A.P.; Rahmatullah, M.I.; Tafuri, F.; et al. Differences in the Implementation of Physical Education (PE) Learning Management Based on Years of Work: Analysis of Differences in the Quality of Quality Assurance Culture. *Retos* **2024**, *55*, 797–803.
77. Fabriz, S.; Hansen, M.; Heckmann, C.; Mordel, J.; Mendzheritskaya, J.; Stehle, S.; Schulze-Vorberg, L.; Ulrich, I.; Horz, H. How a professional development programme for university teachers impacts their teaching-related self-efficacy, self-concept, and subjective knowledge. *High. Educ. Res. Dev.* **2021**, *40*, 738–752.
78. Tafuri, F.; Latino, F. School medical service: Strategies to promote psycho physiological well-being. *Pediatr. Rep.* **2024**, *16*, 214–231.
79. Sharp, S.R.; Rutherford II, G.L.; Echols, K.I. Creative science through inquiry: Improving teacher self-efficacy and outcome expectancy through adaptable, mystery-based professional development. *Int. J. Innov. Sci. Math. Educ.* **2022**, *30*. doi: <https://doi.org/10.30722/IJISME.30.01.005>
80. Donnell, L.A.; Gettinger, M. Elementary school teachers' acceptability of school reform: Contribution of belief congruence, self-efficacy, and professional development. *Teach. Teach. Educ.* **2015**, *51*, 47–57.
81. Lee, S.C.; Su, J.M.; Tsai, S.B.; Lu, T.L.; Dong, W. A comprehensive survey of government auditors' self-efficacy and professional Development for improving audit quality. *SpringerPlus* **2016**, *5*, 1263.
82. Rutherford, T.; Long, J.J.; Farkas, G. Teacher value for professional development, self-efficacy, and student outcomes within a digital mathematics intervention. *Contemp. Educ. Psychol.* **2017**, *51*, 22–36.
83. Sum, K.W.R.; Wallhead, T.; Ha, S.C.A.; Sit, H.P.C. Effects of physical education continuing professional development on teachers' physical literacy and self-efficacy and students' learning outcomes. *Int. J. Educ. Res.* **2018**, *88*, 1–8.
84. Lotter, C.; Smiley, W.; Thompson, S.; Dickenson, T. The impact of a professional development model on middle school science teachers' efficacy and implementation of inquiry. *Int. J. Sci. Educ.* **2016**, *38*, 2712–2741.
85. Ravandpour, A. The relationship between EFL teachers' continuing professional development and their self-efficacy: A structural equation modeling approach. *Cogent Psychol.* **2019**, *6*, 1568068.
86. Perera, H.N.; Calkins, C.; Part, R. Teacher self-efficacy profiles: Determinants, outcomes, and generalizability across teaching level. *Contemp. Educ. Psychol.* **2019**, *58*, 186–203.
87. Guskey, T.R. *Evaluating Professional Development*; Corwin Press: Thousand Oaks, CA, USA, 2000.
88. Shephard, R.J. Habitual physical activity and academic performance. *Nutr. Rev.* **1996**, *54*, S32–S36.
89. Latino, F.; Tafuri, F. Physical Activity and Academic Performance in School-Age Children: A Systematic Review. *Sustainability* **2023**, *15*, 6616.
90. Latino, F.; Tafuri, F. Physical Activity and Cognitive Functioning. *Medicina* **2024**, *60*, 216.
91. Philippot, A.; Dubois, V.; Lambrechts, K.; Grogna, D.; Robert, A.; Jonckheer, U.; Chakib, W.; Beine, A.; Bleyenheuft, Y.; De Volder, A.G. Impact of physical exercise on depression and anxiety in adolescent inpatients: A randomized controlled trial. *J. Affect. Disord.* **2022**, *301*, 145–153.
92. Kandola, A.; Stubbs, B. Exercise and anxiety. In *Physical Exercise for Human Health*; Springer: Singapore, 2020; pp. 345–352.

93. Mavilidi, M.F.; Ouwehand, K.; Riley, N.; Chandler, P.; Paas, F. Effects of an acute physical activity break on test anxiety and math test performance. *Int. J. Environ. Res. Public Health* **2020**, *17*, 1523.
94. Masini, A.; Marini, S.; Gori, D.; Leoni, E.; Rochira, A.; Dallolio, L. Evaluation of school-based interventions of active breaks in primary schools: A systematic review and meta-analysis. *J. Sci. Med. Sport* **2020**, *23*, 377–384.
95. Watson, A.; Timperio, A.; Brown, H.; Best, K.; Hesketh, K.D. Effect of classroom-based physical activity interventions on academic and physical activity outcomes: A systematic review and meta-analysis. *Int. J. Behav. Nutr. Phys. Act.* **2017**, *14*, 114.
96. Destriani, D.; Yusfi, H.; Destriana, D.; Setyawan, H.; García-Jiménez, J.V.; Latino, F.; Tafuri, F.; Wijanarko, T.; Kurniawan, A.W.; Anam, K.; et al. Results of beginner archery skills among adolescents based on gender review and shot distance. *Retos Nuevas Tend. Educ. Física Deporte Recreación* **2024**, *56*, 887–894.
97. Hillman, C.H.; Snook, E.M.; Jerome, G.J. Acute cardiovascular exercise and executive control function. *Int. J. Psychophysiol.* **2003**, *48*, 307–314.
98. Pontifex, M.B.; Scudder, M.R.; Drollette, E.S.; Hillman, C.H. Fit and vigilant: The relationship between sedentary behavior and failures in sustained attention during preadolescence. *Neuropsychology* **2012**, *26*, 407–413.
99. Hillman, C.H.; Pontifex, M.B.; Raine, L.B.; Castelli, D.M.; Hall, E.E.; Kramer, A.F. The effect of acute treadmill walking on cognitive control and academic achievement in preadolescent children. *Neuroscience* **2009**, *159*, 1044.
100. Bartholomew, J.B.; Jowers, E.M.; Physically active academic lessons in elementary children. *Prev. Med.* **2011**, *52* (Suppl. 1), S51–S54.
101. Mahar, M.T.; Murphy, S.K.; Rowe, D.A.; Golden, J.; Shields, A.T.; Raedeke, T.D. Effects of a classroom-based program on physical activity and on-task behavior. *Med. Sci. Sports Exerc.* **2006**, *38*, 2086–2094.
102. Budde, H.; Voelcker-Rehage, C.; Pietrabyk-Kendziorra, S.; Ribeiro, P.; Tidow, G. Acute coordinative exercise improves attentional performance in adolescents. *Neuroscience Letters* **2008**, *441*, 219–223.
103. Ellemberg, D.; St-Louis-Deschênes, M. The effect of acute physical exercise on cognitive function during development. *Psychol. Sport Exerc.* **2010**, *11*, 122–126.
104. Hillman, C.H.; Buck, S.; Themanson, J.; Pontifex, M.; Castelli, D. Aerobic Fitness and Cognitive Development: Event-Related Brain Potential and Task Performance Indices of Executive Control in Preadolescent Children. *Dev. Psychol.* **2009**, *45*, 114–129. <https://doi.org/10.1037/a0014437>.
105. Pesce, C.; Crova, C.; Cereatti, L.; Casella, R.; Bellucci, M. Physical activity and mental performance in preadolescents: Effects of acute exercise on free-recall memory. *Ment. Health Phys. Act.* **2009**, *2*, 16–22.
106. Fredericks, C.R.; Kokot, S.J.; Krog, S. Using a developmental movement programme to enhance academic skills in grade 1 learners. *S. Afr. J. Res. Sport Phys. Educ. Recreat.* **2006**, *28*, 29–42.
107. Setyawan, H.; Suyato, S.; Ngatman, N.; Purwanto, S.; Darmawan, A.; Shidiq, A.A.P.; Eken, Ö.; Pavlovic, R.; Latino, F.; Tafuri, F. The effect of implementing physical education class management archery material to improve concentration elementary school students. *Retos Nuevas Tend. Educ. Física Deporte Recreación* **2024**, *56*, 879–886.
108. Martins, J.; Marques, A.; Rodrigues, A.; Sarmento, H.; Onofre, M.; Carreiro da Costa, F. Exploring the perspectives of physically active and inactive adolescents: How does physical education influence their lifestyles? *Sport Educ. Soc.* **2018**, *23*, 505–519.
109. Bandeira, A.D.S.; Ravagnani, F.C.D.P.; Barbosa Filho, V.C.; de Oliveira, V.J.M.; de Camargo, E.M.; Tenório, M.C.M.; Sandreschi, P.F.; Dos Santos, P.C.; Ramires, V.V.; Hallal, P.C.; et al. Mapping recommended strategies to promote active and healthy lifestyles through physical education classes: A scoping review. *Int. J. Behav. Nutr. Phys. Act.* **2022**, *19*, 36.
110. Ho, W.K.Y.; Ahmed, M.D.; Khoo, S.; Tan, C.H.; Dehkordi, M.R.; Gallardo, M.; Lee, K.; Yamaguchi, Y.; Tao, Y.; Shu, C. Towards developing and validating Quality Physical Education in schools—The Asian physical education professionals’ voice. *PLoS ONE* **2019**, *14*, e0218158.
111. Colella, D. Physical Literacy e stili d’insegnamento. Ri-orientare l’educazione fisica a scuola. *Form. Insegn.* **2018**, *16* (Suppl. 1), 33–42.
112. Martins, J.; Onofre, M.; Mota, J.; Murphy, C.; Repond, R.M.; Vost, H.; Cremosini, B.; Svrdlim, A.; Markovic, M.; Dudley, D. International approaches to the definition, philosophical tenets, and core elements of physical literacy: A scoping review. *Prospects* **2021**, *50*, 13–30.
113. Telford, R.D.; Cunningham, R.B.; Fitzgerald, R.; Olive, L.S.; Prosser, L.; Jiang, X.; Telford, R.M. Physical education, obesity, and academic achievement: A 2-year longitudinal investigation of Australian elementary school children. *Am. J. Public Health* **2012**, *102*, 368–374.
114. Donnelly, J.E.; Hillman, C.H.; Greene, J.L.; Hansen, D.M.; Gibson, C.A.; Sullivan, D.K.; Poggio, J.; Mayo, M.S.; Lambourne, K.; et al. Physical activity and academic achievement across the curriculum: Results from a 3-year cluster-randomized trial. *Preventive Med.* **2017**, *99*, 140–145.
115. Olivier, E.; Archambault, I.; De Clercq, M.; Galand, B. Student self-efficacy, classroom engagement, and academic achievement: Comparing three theoretical frameworks. *J. Youth Adolesc.* **2019**, *48*, 326–340.
116. Setyawan, H.; Alim, A.M.; Listyarini, A.E.; Suri, P.T.; Mahsusi, J.; Rahmatullah, M.I.; Sugiarto, T.; Shidiq, A.A.P.; Kozina, Z.; Eken, Ö.; et al. Implementation of Archery Class Management at the Pre-Extracurricular Program Stage To Improve Archery Skills of Elementary School Students. *Retos* **2024**, *55*, 867–873.
117. Neeper, S.A.; Góaucomez-Pinilla, F.; Choi, J.; Cotman, C. Exercise and brain neurotrophins. *Nature* **1995**, *373*, 109.
118. Winter, B.; Breitenstein, C.; Mooren, F.C.; Voelker, K.; Fobker, M.; Lechtermann, A.; Krueger, K.; Fromme, A.; Korsukewitz, C.; Floel, A.; et al. High impact running improves learning. *Neurobiol. Learn. Mem.* **2007**, *87*, 597–609.

119. Rodriguez, C.C.; Camargo, E.M.D.; Rodriguez-Añez, C.R.; Reis, R.S. Physical activity, physical fitness and academic achievement in adolescents: A systematic review. *Rev. Bras. De Med. Do Esporte* **2020**, *26*, 441–448.
120. Bang, H.; Won, D.; Park, S. School engagement, self-esteem, and depression of adolescents: The role of sport participation and volunteering activity and gender differences. *Child. Youth Serv. Rev.* **2020**, *113*, 105012.
121. León-Zarceño, E.; Moreno-Tenas, A.; Boix Vilella, S.; García-Naveira, A.; Serrano-Rosa, M.A. Habits and psychological factors associated with changes in physical activity due to COVID-19 confinement. *Front. Psychol.* **2021**, *12*, 620745.
122. Santos, J.; Petrica, J.; Serrano, J.; Batista, M.; Honório, S.; Maia, L. The attention of students during physical education class based on academic performance. *Retos Nuevas Tend. Educ. Física Deportes Recreación* **2020**, *38*, 222–228.
123. El Nady, H.G.; El Refay, A.S.; Salah, D.A.; Fahmy, R.F.; Mansour, S.A.; Sherif, L.S. Impact of Sport Specific Type on Pulmonary Function and Anthropometric Measures of Adolescents. *Biomed. Pharmacol. J.* **2023**, *16*, 763–771.
124. Latino, F.; Tafuri, F. Wearable Sensors and the Evaluation of Physiological Performance in Elite Field Hockey Players. *Sports* **2024**, *12*, 124.
125. Maćkała, K.; Kurzaj, M.; Okrzymowska, P.; Stodółka, J.; Coh, M.; Rożek-Piechura, K. The effect of respiratory muscle training on the pulmonary function, lung ventilation, and endurance performance of young soccer players. *Int. J. Environ. Res. Public Health* **2020**, *17*, 234.
126. Bjelica, B.; Milanović, L.; Aksović, N.; Zelenović, M.; Božić, D. Effects of physical activity to cardiorespiratory changes. *Turk. J. Kinesiol.* **2020**, *6*, 164–174.
127. Rożek-Piechura, K.; Kurzaj, M.; Okrzymowska, P.; Kucharski, W.; Stodółka, J.; Maćkała, K. Influence of inspiratory muscle training of various intensities on the physical performance of long-distance runners. *J. Hum. Kinet.* **2020**, *75*, 127.
128. Farì, G.; Di Paolo, S.; Ungaro, D.; Luperto, G.; Farì, E.; Latino, F. The impact of COVID-19 on sport and daily activities in an Italian cohort of football school children. *Int. J. Athl. Ther. Train.* **2021**, *26*, 274–278.
129. Cataldi, S.; Latino, F.; Greco, G.; Fischetti, F. Multilateral training improves physical fitness and fatigue perception in cancer patients. *J. Hum. Sport Exerc.* **2019**, *14*, S916–S926.
130. Latino, F.; Greco, G.; Fischetti, F.; Cataldi, S. Multilateral training improves body image perception in female adolescents. *J. Hum. Sport Exerc.* **2019**, *14*, S927–S936. <https://doi.org/10.14198/jhse.2019.14.Proc4.55>.
131. Albarrati, A.M.; Gale, N.S.; Munnery, M.M.; Cockcroft, J.R.; Shale, D.J. Daily physical activity and related risk factors in COPD. *BMC Pulm. Med.* **2020**, *20*, 60.
132. Latino, F.; Roig, R.M.; Setyawan, H.; Susanto, N.; Anam, K.; Saraiello, E.; Tafuri, F. Physiological responses of wheelchair basketball athletes to a combined aerobic and anaerobic training program. *Retos Nuevas Tend. Educ. Física Deporte Recreación* **2024**, *57*, 800–808.
133. la Torre, M.E.; Monda, A.; Messina, A.; de Stefano, M.I.; Monda, V.; Moscatelli, F.; Tafuri, F.; Saraiello, E.; Latino, F.; Monda, M.; et al. The potential role of nutrition in overtraining syndrome: A narrative review. *Nutrients* **2023**, *15*, 4916.
134. Nuriddinov, A. Physical activity, health and environment. *Am. J. Soc. Sci. Humanit. Res.* **2023**, *3*, 189–200.
135. Dapp, L.C.; Gashaj, V.; Roebbers, C.M. Physical activity and motor skills in children: A differentiated approach. *Psychol. Sport Exerc.* **2021**, *54*, 101916.
136. Jones, D.; Innerd, A.; Giles, E.L.; Azevedo, L.B. Association between fundamental motor skills and physical activity in the early years: A systematic review and meta-analysis. *J. Sport Health Sci.* **2020**, *9*, 542–552.
137. Jean de Dieu, H.; Zhou, K. Physical literacy assessment tools: A systematic literature review for why, what, who, and how. *Int. J. Environ. Res. Public Health* **2021**, *18*, 7954.
138. Engin, G. An Examination of Primary School Students' Academic Achievements and Motivation In Terms of Parents' Attitudes, Teacher Motivation, Teacher Self-efficacy and Leadership Approach. *Int. J. Progress. Educ.* **2020**, *16*, 257–276.
139. Kaloka, P.T.; Nopembri, S.; Yudanto, Y.; Elumalai, G. Improvement of Executive Function Through Cognitively Challenging Physical Activity with Nonlinear Pedagogy In Elementary Schools. *Retos Nuevas Tend. Educ. Física Deporte Recreación* **2024**, *51*, 673–682.
140. Ahmed, M.A.; Lawal, A.A.; Ahmed, R.A. Influence of teachers' self-efficacy on secondary school students' self-efficacy in biology in Ogbomoso, Nigeria. *JPBI (J. Pendidik. Biol. Indones.)* **2022**, *8*, 58–64.

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