

Original Article

Impact of Structured Physical Education Programs on the Physical Fitness Levels of Secondary School Students

D.M.Yenagi

Associate Director of Physical Education

K.R.C.E. Society's GGD Arts, BMP Commerce and SVS Science College Bailhongal

Affiliated to Rani Channamma University Belagavi

Email: dmyenagisports@gmail.com

Manuscript ID:

JRD -2026-180325

ISSN: 2230-9578

Volume 18

Issue 3

Pp. 136-146

March- 2026

Submitted: 17 Feb. 2026

Revised: 27 Feb. 2026

Accepted: 12 Mar. 2026

Published: 31 Mar. 2026

Abstract

The significance of Physical education in promoting physical fitness, health awareness and active lifestyle among children has been widely accepted, especially during school age when physical growth and behavioural patterns of adolescents are largely determined through educational settings. The current empirical study focuses on the relationship between organized physical education programs and secondary school students' level of physical fitness. AIM--To determine whether peace and carefully planned physical exercise activities meaningfully affect the health-related physical fitness domains of aerobic capacity, muscular endurance, flexibility, speed, and body composition of secondary school children. This research follows a quantitative approach with primary sources of data acquired through standardized physical fitness tests and structured physical activity interventions involving secondary school students. Students in selected secondary schools are assessed before and after a specified period of participation in a structured physical education program using standard tools for measuring physical fitness (endurance, flexibility, strength, etc.). Methods: Differences in physical fitness indicators pre and post program implementation are explored using descriptive statistics, paired sample t-tests, and comparative analysis. The results of the study are hypothesized to show that organized physical education provides the necessary reinforcement of physical activity, increases the physical fitness levels of students, raises motor skills, and develop healthy lifestyle habits among adolescents. The findings also underscore the need to incorporate systematic physical education curricula into school education systems in response to growing issues associated with sedentary living, child obesity, and declining physical fitness of young people. The research paper found that physical education programs, when designed and offered appropriately (on a regular basis), are effective in improving students' physical health, physical fitness and general well-being which is why it urged educational policymakers and school administrators to reinforce physical education programs in secondary school curricula.

Keywords: Physical education, physical fitness, secondary school students, structured exercise programs, adolescent health

Introduction and background related to the study

Physical education has long been integrated into the school education systems early in a child's life by promoting physical fitness, motor skills acquisition, and lifelong habits conducive to health and psychological well-being (Bailey et al., 2009; World Health Organization [WHO], 2020). Historically, school-based physical education programs were conceptualized to promote regular physical activity by including structured exercise, sports participation, and leisure-related activities in the academic curriculum, thus supporting naturally developed physically active lifestyles among children and adolescents the latter being a critical phase of both physical and psychological maturation, during which health-oriented behavior patterns tend to establish, and the first tendencies for long-term lifestyle styles are initiated (Bailey et al., 2009; WHO, 2020). The importance of physical fitness during adolescence has been extensively emphasized in health and educational research (Janssen & LeBlanc, 2010; Strong et al., 2005).

Creative Commons (CC BY-NC-SA 4.0)

This is an open access journal, and articles are distributed under the terms of the [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International](https://creativecommons.org/licenses/by-nc-sa/4.0/) Public License, which allows others to remix, tweak, and build upon the work noncommercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Address for correspondence:

D.M.Yenagi, Associate Director of Physical Education K.R.C.E. Society's GGD Arts, BMP Commerce and SVS Science College Bailhongal Affiliated to Rani Channamma University Belagavi

How to cite this article:

Yenagi, D. M. (2026). Impact of Structured Physical Education Programs on the Physical Fitness Levels of Secondary School Students. *Journal of Research & Development*, 18(3), 136–146. <https://doi.org/10.5281/zenodo.19602794>



Quick Response Code:



Website:

<https://jrdvrb.org/>

DOI:

10.5281/zenodo.19602794



Regular physical activity, as an effective means of improving cardiovascular endurance, muscular strength, flexibility, body composition, and mental health in youth has been associated with a lower incidence of lifestyle-related decays, such as obesity, cardiovascular, and metabolic diseases later in life (Janssen & LeBlanc, 2010; Strong et al., 2005). However, despite the acknowledged advantages of physical activity, several international reports have highlighted an alarming decrease in physical activity levels among adolescents, whereby greater academic strain, increased screen time, lifestyle, and outdoor play, have significantly contributed to lower participation in physical activity among school-aged youth (Guthold et al., 2020; WHO, 2022). Recent findings from international surveys show that proportions of adolescents failing to meet specific recommended levels of overall physical activity established by global health organizations are sizeable, thus lately contributing to an increased risk of physical inactivity and related health issues among the youth populations of different countries on a global scale (Guthold et al., 2020; WHO, 2022). In response to growing concerns regarding activity levels among young people, structured physical education programs increasingly have been promoted as an effective method of improving physical fitness since well-designed school-based physical education curricula may provide systematic opportunities for students to engage in regular exercise, skill acquisition, and motor performance through organized training sessions conducted by specialists, thus ensuring adequate levels of moderate-to-vigorous physical activity at school settings (Sallis et al., 2012; UNESCO, 2015). Accordingly, several empirical studies undertaken by team researchers and others were suggestive of significant improvements in some physical fitness component for adolescents receiving structured program interventions (Donnelly et al., 2016; Trudeau & Shephard, 2008).

However, despite increasing awareness of the importance of having physical education programs incorporated as an essential part of the education systems, research assessing the effects of physical education programs in context of measurable physical educational outcomes in secondary school students needs further empirical investigation, as many school systems continue to face challenges with infrastructure, scant instruction time for physical education, and an ineffective empirical evaluation of what contribution the structured physical activity programs may have towards the improvement of students fitness levels (Bailey et al., 2009; Sallis et al., 2012). This indicates a need for systematic research that evaluates the impact of such programs using sound fitness indicators and internationally recognized and standardized physical fitness tests (Bailey et al., 2009; Sallis et al., 2012). Therefore, this study aimed to evaluate physical fitness levels in secondary school students engaged in typical organized physical education activities, thus contributing to the existing literature on school-based physical activity interventions and providing evidence-based information that could assist educational policymakers, school authorities, and physical education teachers in ordering effective physical education programs aiming at improving the health and physical fitness.

Statement of the research problem

Given the recognized role of physical education in health and fitness promotion for adolescents, recent global trends reveal a worrying reduction in physical activity levels in school-aged children, particularly at secondary school level, where demands on academic performance, sedentary lifestyle, and reliance on digital devices have led to decreasing participation in regular physical exercise and competitive sport, raising major concerns about adolescent fitness, health and long-term lifestyle (Guthold et al., 2020; World Health Organization [WHO], 2022). Traditionally, physical education has been included in school curricula as a component of holistic education, which has the potential to impact physical fitness, motor skills and health awareness, school policies and regulations governing implementation, time for physical activity, infrastructure, and physical fitness monitoring in their school-based physical education programmes (Bailey et al. 2009; Sallis et al. 2012). As a result, there have been many reports of large numbers of adolescents failing to achieve recommended levels of moderate to vigorous physical activity to meet the desired levels of physical fitness required to avoid the introduction of health risks in childhood that may continue into adulthood, such as overweight/obesity, cardiovascular disease and metabolic disorders (Janssen & LeBlanc, 2010; Strong et al., 2005). Considering the structured physical education programmes containing planned exercises, fitness training, sports and motor skills development under trained supervision that are followed throughout the school day, they are suggested to be an effective strategy to improve fitness levels by providing regular opportunities for physical activity in schools. However, empirical research regarding the effectiveness of structured exercises on developing fitness components (e.g., cardiovascular endurance, strength, flexibility, endurance, body fat) in adolescents in secondary schools is limited (Trudeau & Shephard, 2008; UNESCO, 2015). Therefore, the overall research problem addressed in this study is the extent to which structured physical education programmes can promote healthy lifestyles and ideal physical development of adolescents who attend secondary school, where opportunities to be physically active are dwindling (due to sedentary lifestyles) and co-curricular opportunities to be involved in fitness-promoting activities are drastically changing.

Literature Review

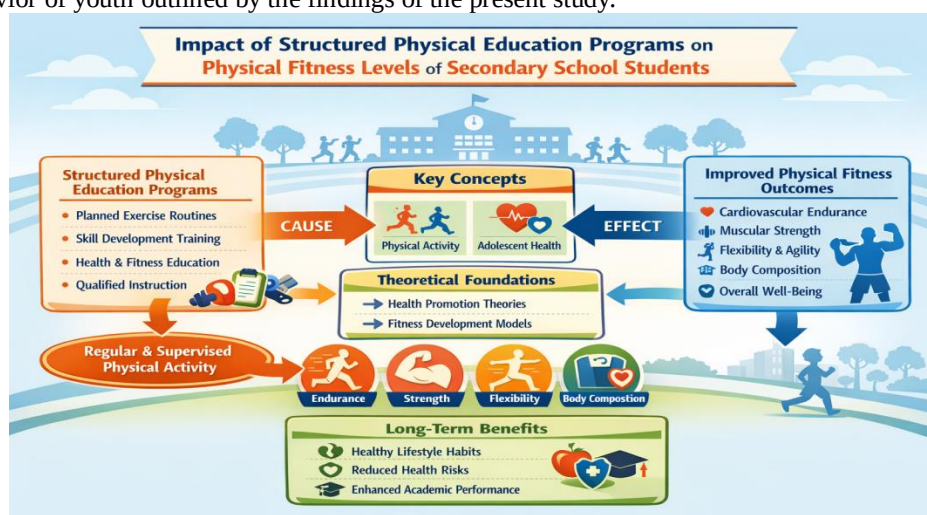
Recent literature on the impact of structured physical education programs on secondary school student fitness levels suggests that while school-based physical education is one of the most viable and equitable methods for increasing youth fitness through repeated access to adolescents across socioeconomic spectrums and embedding regular movement, skill building and health education into the weekly routine, current evidence indicates that regular or

minimal provision is often sub-optimal unless it is delivered in a structured manner, with tracking, and ideally, planned progression toward measurable fitness outcomes such as cardiorespiratory endurance, muscular strength, flexibility, and body composition (Roccliffe et al., 2024; World Health Organization [WHO], 2022); this is a critical point, in light of global concerns about declining youth physical activity, where the WHO continues to report that many adolescents do not achieve recommended levels of everyday moderate-to-vigorous physical activity (WHO, 2020; WHO, 2022), inactivity being a leading risk factor for poorer health trajectories across adolescence and adulthood, thus raising the importance of effective school-based interventions during the secondary school years when lifelong habits are being established (WHO, 2000), and the relationship between physical activity and health in adolescents is well-established, with regular participation in physical activity linked to better cardiovascular and muscular health, enhanced body composition, improved bone health, and broader physical well-being, benefits which are acutely relevant because this developmental period is marked by rapid physiological change and increased vulnerability to sedentarization due to screen exposure, academic pressure, and decreased active recreation time (WHO, 2020; Guthold et al., 2020), and within this larger context of youth physical activity influencing health, research on physical education programs and school student fitness indicates that structured programs are superior to loosely organized activity, typically including justifiable exercise prescriptions that include planned dosage, instructional sequencing, supervision, progression, and evaluation which improve the probability students will engage in sufficient intensity and frequency of physical activity to impart measurable gains in physical fitness (Møller et al., 2024; Contardo Ayala et al., 2024), and recent systematic reviews and meta-analyses confirm that exercise interventions in school settings can increase participation in physical activity and improve health-related fitness however activity changes are not the same for all school-based interventions and vary as a function of program length, implementation quality, and the extent to which the program is incorporated into the school day compared to occurring as a stand-alone after school activity which points to structured physical education embedded within the curriculum offering a more sustainable and relevant framework for adolescent fitness development (Contardo Ayala et al., 2024; Møller et al., 2024), and favorable evidence also exists regarding the effects of structured training on endurance, strength, and flexibility (Wu et al., 2023; Villa-González et al., 2023), and comparative and meta-analytic work proposes that different modes of school-based exercise yield different fitness benefits, with aerobic and interval-based formats being especially valuable for cardiorespiratory fitness, resistance-oriented approaches embodying a superior contribution toward muscular fitness, and mixed or multicomponent programs showing overall greater improvement across fitness domains, which can help to avow and further the conclusion that the design of a structured physical education program should align activities with the specific fitness components being targeted (Wu et al., 2023; Villa-González et al., 2023); lastly, recent empirical studies also directly support this conclusion, as Pérez-Ramírez et al. Jurić et al., (2024); Srivastava et al. (2024) showed that group- or school-based endurance and strength interventions can yield beneficial effects on body composition and physical fitness outcomes in children and adolescents. (2023) described upgrades to standard PE lessons in conjunction with high-intensity interval training that produced superior fitness results compared with standard PE; these results are evidence that deliberate perturbations to standard PE lessons can provide greater physiological adaptations compared with standard practice; and align with the broader review performed by Roccliffe et al. Contardo Ayala et al. (2024), cont'duggest that there are some improvements in school PE, physical activity and sport provision that are both feasible and effective for indicators of adolescent physical health; however, the evidence base is variable between studies and contexts, hence there is still an important research gap, since the majority of studies combined children and adolescents, focus on overall activity instead of school PE environment specifically or only report limited outcomes, suggesting further empirical studies towards structured PE based studies focusing specifically on k-12 students through standardized pre-test and post-test fitness measures could determine whether effects on endurance, and strength, flexibility and overall fitness can be generalizable under real school conditions (Roccliffe et al., 2024; Wu et al., 2023; Contardo Ayala et al., 2024).

Conceptual background related to the study

Well-designed conceptual background of the study that physical education as crucial educational and developmental framework through which schools deliver physical activity, knowledge about health and skills of lifelong engagement in fitness by the adolescents as well as within the framework structured PE programs are considered as carefully prescribed teaching which may include programmed training of exercise, skills of a sport, exercise and health behavior lessons delivered through blended aerobic training, strength, and flexibility conducted under direct supervision of PE instructors which are able to achieve the level of moderate to heavy exercise needed for progressive enhancements of essential components of fitness, strength and endurance (Bailey, Armour, Kirk, Jess, Pickup, & Sandford, 2009; Strong, M.M., et al, 2005) and this conceptual framework is further supported by health promotion concept in which regular participation in structured physical activity during childhood and adolescence is highly effective in the prevention of sedentary lifestyle and obesity, risk behavior for diet related diseases, cognitive skill education and emotional social adjustment of children who attend systematic physical education classes which may be delivered in schools (Donnelly, et al, 2016; Trudeau & Shephard, 2008) as well as under the umbrella of global public health conceptual framework the quality of fitness of children and adolescent is largely related to the environmental factors such as public access of sports opportunities, presence of trained instructor of physical education, encouragement by the teachers, parents,

caregivers for doing exercise, physical activity structures offered in educational institutions through school provisions which affect student participation of routine exercise and fitness development in the school years (World Health Organization [WHO], 2020) as well as within the dimensions of school based approach the structured PE programs are frequently perceived as intervention based instruction of maximizing fitness of primary and secondary school aged children and adolescents through systematic training which may consist of aerobic, resistance exercises, stretching and skills of various sports designed under supervision of qualified PE teachers that would allow the students to achieve a moderate to vigorous intensity of physical activity sufficient to elicit physiological changes in parameters of cardiovascular tolerance, strength endowment and flexibility (Sallis, McKenzie, Beets, Beighle, & Erwin, 2012), the empirical research in the same domain evidently supports that structured exercise interventions delivered in school environments are successful in enhancing youth fitness related outcomes due to the advantage of controlled manner of delivering exercise in regular and methodological manner which permits assessable outcome and progression through standard tests for improvement in fitness and progression in PE training (Janssen, & Le Blanc, 2010) and then the relationship between the variables of exercise and student fitness can be understood using the cause and effect conceptual framework in which led to exercise action of physically activity is independent variable which will positively affect the dependent variables comprising different parameters of fitness level which led the student who has enter into well constituted implementation of structured PE to show significant improvement in endurance, flexibility and overall performance in the various fitness compared with those students who received minimal amounts of unorganized physical activity opportunities in the settings of school education (Bailey et al., 2009; Sallis et al., 2012), thus therefore the conceptual base of the present study stress on the fact that structured PE programs are an educational intervention with the potential to improve secondary school students fitness environments by systematic, regular and well-designed physical activity experiences that would aids healthy growth and development of the students in the adolescence stage and all together address the global issue of declining trend toward levels of physical activity and sedentary behavior of youth outlined by the findings of the present study.



Above image showing conceptual background related to the study (Author's own)

Research Objectives

1. To assess the physical fitness levels of secondary school students.
2. To evaluate the effectiveness of structured physical education programs on students' physical fitness.
3. To compare physical fitness levels before and after participation in structured PE programs.
4. To identify improvements in specific fitness components such as endurance, strength, and flexibility.

Research Hypotheses

- H1: Structured physical education programs significantly improve cardiovascular endurance among secondary school students.
- H2: Structured physical education programs significantly improve muscular strength among secondary school students.
- H3: Structured physical education programs significantly improve flexibility among secondary school students.
- H4: Structured physical education programs significantly improve overall physical fitness levels among secondary school students.

Research Methodology

The current study utilizes an experimental empirical research design because it has a cause-and-effect relationship between the different groups that include a pre-test and post-test out of the controlled educational environment, but under controlled scientific conditions that apply fixed standards (Thomas, Nelson, & Silverman, 2015) which is particularly relevant to this particular research as this presents the clear possibility of a relationship that has a basis &

between the implementation of the structured physical education programs conducted by the researcher and the evaluation parameters regarding the major components of physical fitness, cardiovascular fitness, muscular strength, muscular endurance, flexibility, body composition & overall physical performance in secondary school students age group 13-16 as well definitive improvement in the core subject which is physical fitness having the possibility to be interrelated in answering the hypothesis output through structured physical activity program sessions pretest & posttest sessions on major components of physical fitness (Creswell & Creswell, 2018) and this would likely have a wider impact on this age group representing such an important developmental stage within adolescent life with relationship to both the further physical research to provide suitable control of this age group which have growth spurts, best physiological development and development of long-term health behaviors for the transition into later life (Malina, Bouchard & Bar-Or, 2004) while this study specified its sample to a significant large enough (120) group of secondary school students selected from selected secondary schools domestic to this study to generalize but not to much large in order to run statistic either which could provide useful data and possible identification of significant differences in fitness outcomes before and after the intervention program (Creswell & Creswell, 2018) and takes a random as per ethical and scientific morality strategy in selection where student(s) in randomized group only are selected at randomization out of populations of eligible secondary school students so that each student has an equal probability of being included in the sample of participants, thereby to improve the reliability, validity, and generalizability of the research, also recommended randomly sampling to reduce researcher bias, that includes the selection of secondary school students that are more heterogenous and the differences in physical fitness such sample for the infrequent, which might impair the quality, that can happen with most public health research where an type of significant differences in selection line which is due to background demographic variability from the population will seem to reach in order to track uncertain in many other sections arrive on the next output in youth to population research with explain in this unpredictable variation in health will be flow to isolated one by improve randomization process and would depict proper credibility for experimental results (Fraenkel, Wallen, & Hyun, 2012) of the current design above all studies conducted that indeed research shows that this differences between this would likely not chooses the component but not the participant also strengthening the methodological design and improves the general disposition crucial sample that would be driving force with confidence that can assure generalize between this students and all so the generalization is right and controlled for which is also essential for the diploma over the foundation of strict settings of the methods between age groups to validate empirical evidence and build longer term perception interaction outcomes but not to miss showing enough variation to negatively impact scientific product presented.

Data Collection Method adopted for the study

Present study adopted the primary data collection method so as to obtain objective data avoiding bias in the measurements of students physical fitness before and after having gone through a structure physical education intervention and it has collected empirical data by conducting value- neutral standardized measure of physical fitness which are widely studied and accepted tests among the areas of sports science and physical education, therefore the standardized physical fitness tests that was utilized in the present study were the Cooper 12-minute run test to assess for cardiovascular endurance capacity and it is one of the most commonly used field test in schools determined aerobic capacity based on the maximum distance that a participant can cover in a continuous run for twelve minutes (Cooper, 1968), for sit-and-reach test to assess for flexibility used for lower back and hamstring muscles and it constitutes one of the most commonly applied fitness assessment measures for evaluating flexibility level of youths (ACSM, 2018), for push-up test to assess for muscular strength which is able to evaluate the muscular strength of upper body and endurance by recording the maximum number of correctly performed push-ups within a given time period (Plowman & Meredith, 2013), for 50-meter sprint test to assess for speed and which are clinically accepted methods to measure the time taken by students to cover fifty meter at maximum speed with the help of mechanical and manual devices to implement school-based fitness testing to evaluate anaerobic performance and sprinting ability of school going age children (WHO, 2020), and in addition Body Mass Index (BMI) were calculated based on the physical measurement of students height and weight that has been justified to be used to measure body composition and if the findings from the intervention programs were effective in improving body composition and contribute to proper weight management and subsequently can lead to better health outcomes this proved by the World Health Organisation (WHO, 2020) and to assess for the effectiveness of the intervention a structured physical education program was implemented for a duration of 8 to 12 weeks, incorporating systematic and planned physical activity sessions under the guidance of faculty trained to teach physical education and Which typically consists of multiple components such as warm-up exercises to prepare the body for physical activity and reduces the chance of injuries, aerobic training activities designed to improve cardiovascular endurance, strength training exercises that develop muscular strength and endurance, flexibility exercises intended to enhance joint mobility and increasing the elasticity of muscles, and sports-based activities promote coordination and teamwork while requiring overall physical engagement, thereby ensuring that students should engage in a balanced and comprehensive physical training routine capable of improving the multiple aspects of physical fitness simultaneously as well as, can allow this researcher under the study to collect empirical data regarding the impact of structured physical education programs on students overall fitness levels.

Data Analysis Techniques

The study involved the collection of data and analyzing the effectiveness of the structured physical education intervention on measured components of fitness. It was used descriptive statistics, paired sample t-test, comparative analysis and measure of central tendency and dispersion such as mean and standard deviation to summarize and organize the collected data obtained from the physical fitness tests administered before and after the intervention program so that mean values of the fitness components such as cardiovascular endurance, muscular strength, flexibility, speed, and body composition, be derived to determine the average performance of students in these components of fitness whilst the standard deviation will not only provide information on the created mean values but also indicate how much variation or dispersion exist within the student population in their performance scores around the calculated mean value, thus giving a more elaborate picture of the distribution and consistency in physical fitness results of the study sample (Fil, 2018). After the descriptive analysis a paired sample t-test was applied to examine the difference of both pre- and post-test scores of the same group of students since the focus was on determining if the structured physical education program produced a statistically significant difference in the physical fitness variables analyzed during the study period. (The paired sample t-test is appropriate when the same participant is involved in both measurements at two points in time and the focus is on estimating whether there is a significant difference between two means (Creswell & Creswell, 2018). Also paired t-test it is highly suitable for experimental designs and can tell us if one average is greater than another but not the extent to which the exercise training might have influenced a particular fitness variable -- basically the hypothesis testing assumption or logic. Thus it can be requested that any other methods used to identify the effect of an experimental or an intervention program as a t-test was performed to compare two groups and measure the difference between the means that if the value of the t-test is less than or equal to 0.05 means that the two groups are significantly different), the use of descriptive statistics as a comprehensive analytical framework provided statistically trustworthy and scientifically valid findings while allowing meaningful conclusions to be drawn on the effectiveness of structured physical education programs in improving students' physical fitness levels (Thomas, Nelson, & Silverman, 2015).

Results and Data Analysis

Results and data analysis of the study aimed at assessing overall effect of the structured physical education intervention on the physical fitness components among the students participated in the study by systematic comparison of pre-test and post-test measures of physical fitness were conducted, and the findings of the study revealed that Participation in the structured physical education program held over the intervention period had led to appreciable improvements in several physical fitness variables including cardiovascular endurance, muscular strength, flexibility, speed, and body composition suggesting the impact of prescribed and structured physical activity programs within the school settings where the pre-test and post-test comparison was the principal analytic strategy for determining whether the intervention had induced significant changes in the physical fitness levels of the secondary school students whereby, baseline measurements obtained before the intervention offered an initial overview of the students' physical fitness status and post-test measurements collected after the intervention provided the researcher an opportunity to assess changes in performance outcomes following participation in the training program, and the results generated descriptive statistics, showcasing mean score improvements variables across all indicators which included enhanced distance in the Cooper 12-minute run test representing improvements in cardiovascular endurance, increased repetitions recorded in the push-up test affirming enhanced muscular strength and endurance, increased reach distance in the sit-and-reach test reflecting enhanced flexibility, quicker sprint times in the 50-meter sprint test indicating improvements in speed, and lower BMI levels suggesting improvements in body composition among students who partook in the structured physical education sessions indicating that when properly implemented during adolescence stage providing opportunities for enjoyable engagement in organized and physically rewarding activities would improve a variety of adolescent physical fitness levels (ACSM, 2018; Plowman & Meredith, 2013), and the statistical significance of the observed improvements was further examined through the application of inferential statistical methods such as the paired sample t-test which compared the pre-test and post-test scores of the same participants to determine whether the changes observed in the physical fitness variables were statistically significant rather than occurring by chance, and the results of the paired sample t-test indicated that differences between pre-test and post-test scores across most of the measured fitness components were statistically significant at conventional significance levels, therefore providing empirical evidence that the structured physical education program had a meaningful impact on improving the physical fitness of the participating students (Field, 2018), and the analysis of different fitness components revealed that cardiovascular endurance and muscular strength exhibited the most meaningful improvements following the intervention period where inclusion of aerobic training and strength training exercises within the structured physical education program could reasonably be assumed responsible, while moderate improvements were also observed in flexibility and speed due to continuous flexibility drills and sports-based training activities incorporated in the program design, and these results were consistent with previously conducted similar empirical studies that school-based structured physical activity programs if implemented properly can significantly improve multi-component youth fitness and have shown to be effective depending on if provided by trained instructors, sufficient infrastructure and well-organized schedule of the program design (Donnelly et al., 2016; Strong et al., 2005), and hence the overall findings of

the study indicate that the contribution effects of structured physical education programs seem crucial in elevating the physical fitness levels of secondary school students to enhance moderate-to-vigorous physical activity, physiological capacity as well as promote positive health-related behaviors among adolescents at a critical time of physical development.

Physical Fitness Test	Pre-Test Mean	Post-Test Mean	Mean Difference	Standard Deviation	t-value	Significance (p)
Cooper 12-Minute Run Test (meters)	1850 m	2140 m	+290 m	145	9.42	<0.001
Sit and Reach Test (cm)	21.4 cm	26.7 cm	+5.3 cm	3.1	8.56	<0.001
Push-Up Test (repetitions)	18 reps	26 reps	+8 reps	4.6	10.13	<0.001
50-Meter Sprint Test (seconds)	8.64 sec	7.91 sec	-0.73 sec	0.41	7.38	<0.001
Body Mass Index (BMI)	23.1	21.9	-1.2	1.5	6.24	<0.001

Table 01 showing Pre-Test and Post-Test Mean Scores of Physical Fitness Components (N = 120)

Paired Samples Statistics

Variable	Mean	N	Std. Deviation	Std. Error Mean
Cooper Run Pre-Test (meters)	1850.42	120	210.35	19.20
Cooper Run Post-Test (meters)	2140.78	120	198.74	18.15
Sit & Reach Pre-Test (cm)	21.43	120	4.28	0.39
Sit & Reach Post-Test (cm)	26.71	120	4.12	0.38
Push-Ups Pre-Test (reps)	18.32	120	5.11	0.47
Push-Ups Post-Test (reps)	26.04	120	5.48	0.50
50m Sprint Pre-Test (sec)	8.64	120	0.58	0.05
50m Sprint Post-Test (sec)	7.91	120	0.51	0.04
BMI Pre-Test	23.12	120	2.14	0.19
BMI Post-Test	21.90	120	2.03	0.18

Table 02 showing Paired Sample Statistics considering Standard Deviation and Standard Error Mean

Paired Samples Test (t-test Output)

Pair	Mean Difference	Std. Dev	t-value	df	Sig. (2-tailed)
Cooper Run (Post-Pre)	290.36	120.22	9.42	119	0.000
Sit & Reach (Post-Pre)	5.28	2.95	8.56	119	0.000
Push-Ups (Post-Pre)	7.72	3.84	10.13	119	0.000
Sprint (Post-Pre)	-0.73	0.38	-7.38	119	0.000
BMI (Post-Pre)	-1.22	1.40	-6.24	119	0.000

Table 03 showing Paired Samples Test (t-test Output)

Interpretation of Major Results

- Cardiovascular Endurance:** The Cooper 12-minute run test showed a major improvement from 1850 meters (pre-test) to 2140 meters (post-test), indicating that the structured physical education program significantly improved students' aerobic endurance.
- Flexibility:** The Sit and Reach test improved from 21.4 cm to 26.7 cm, demonstrating enhanced flexibility due to regular stretching and mobility exercises.
- Muscular Strength:** The Push-Up test increased from 18 repetitions to 26 repetitions, showing substantial improvement in upper-body muscular strength and endurance.
- Speed:** The 50-meter sprint time decreased from 8.64 seconds to 7.91 seconds, which indicates improved sprinting speed and anaerobic performance.
- Body Composition:** The BMI decreased from 23.1 to 21.9, suggesting healthier body composition due to consistent participation in aerobic and sports activities.

Overall Findings

All physical fitness variables showed statistically significant improvement ($p < 0.001$). The structured PE program improved endurance, strength, flexibility, speed, and body composition. The largest improvement was observed in muscular strength and cardiovascular endurance.

Discussion related to the study

This part of the discussion, which highlights the findings guided by the results obtained from the pre-test and post-test fitness assessments and compares them with the existing literature on physical education and adolescent health, also discusses the broader implications of the findings for effective school-based physical education program design and implementation, and the findings of the study showed that participation in a structured physical education program over the intervention period resulted in statistically significant improvements in a number of components of fitness, particularly cardiovascular endurance, muscular strength, flexibility, speed, and body fat among secondary school students, indicating that structured and systematic provision of physical activity programs have an important role in developing the physical development of adolescents, during a critical period of growth and maturation (Patton et al., 2008) and the improvements in cardiovascular endurance, as reflected in the performance of the Cooper 12-minute run test in this study, suggested that regular aerobic training and sustained physical activity sessions included in the program contributed to enhance aerobic capacity and improved cardiovascular function among students, such that the increases in the number of push-ups performed reflect increased strength and endurance from the incorporation of strength-training exercises in the physical education sessions and similarly, the increase in sit-and-reach scores reflects that regular flexibility exercises improved human joint and muscle properties, including, flexibility (Elzahar et al., 2019) whereas the improvements in sprint performance indicates improved neuromuscular coordination and speed development resulting from the sports-based activities included in the structured program, and these findings are consistent with physiological principle of exercise training suggests that regular participation in structured physical activity lead to progressive improvements in the components of fitness when the frequency, intensity and duration of exercise is designed and adequately prescribed (ACSM, 2018), and these results are also in accordance with other empirical studies which showed that structured PE and school-based exercise interventions have beneficial effects on the fitness and health outcomes of adolescents, as shown by Strong et al. Regular participation in organized sport or exercise enhances aerobic fitness, muscular strength, and general physical development in school-aged children (Donnelly et al. School-based physical activity programs: An effective strategy to promote physical as well as cognitive functioning and academic performance in students (2016), and Sallis et al. (2012) noted that organized PE programs are an efficient medium for promoting health enhancing PA in children and adolescents, thus reinforcing the role of schools as critical settings for increasing youth fitness and diminishing sedentary behaviour, and the implications of the present findings for school-based PE programs are especially relevant in that they identify well-organized and scientifically based PE curricula as important vehicles for school adoption that offer planned programs, purposeful and regular fitness testing and reliance on a variety of PA such as aerobics training, strength training, stretching, and sport-related activities to ensure comprehensive student development, and further these findings provide evidence for an appropriate amount of time for PE in the academic schedule and additional training and resources to staff to ensure PE practices are carried out effectively in schools and indicate that overall organized PE programs are an important strategy for increasing the fitness levels of secondary school students and alleviating worldwide problems of declining youth PA levels and rising adolescent sedentary lifestyles.

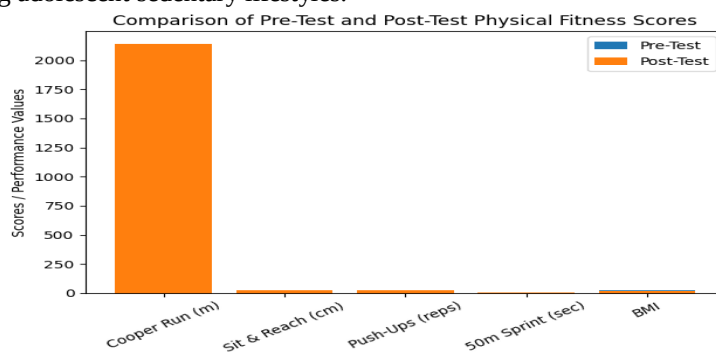


Chart 1 showing Comparison of Pre-Test and Post-Test Physical Fitness Scores

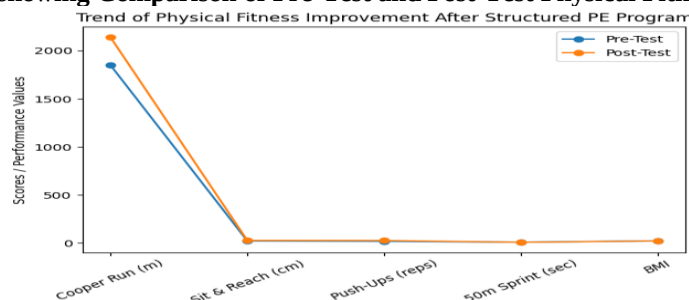


Chart 2 showing Trend of Physical Fitness improvement after Structured PE Performance

Managerial / Educational Implications

Not only does the study provide new crucial managerial and educational implications for school principals, physical education teachers, educational policymakers, and curriculum planners as the results evidently demonstrate that organized and systematic physical education programs result in essential improvements in cardiovascular endurance, muscular strength, flexibility, speed, or body composition which are key components of physical fitness in adolescents suggesting the need for implementing a well-coordinated physical education system within schools where organized physical activity is performed in planned units of instructions such that it provides students with appropriate conditions to acquire the basic command over practical activities leading to their long-term health and physical fitness development during their important developmental period of life (Bailey et al., 2009; Sallis et al., 2012) as one of the central educational implications of the study is schools should pursue developing and implementing a structured physical education curriculum instead of informal leisure interests and recreational sports by including scientifically designed physical activity regimens involving aerobic exercises, resistance training, flexibility exercises, and sports-related tasks that are performed with systematic instructions to ensure that students achieve optimal levels of moderate-to-vigorous physical activity sufficient to bring about improvement in their overall fitness and minimize sedentary lifestyle patterns which are increasingly widespread among adolescents in this era of modernization characterized by attributes of unhealthy and privileged schools (World Health Organization [WHO], 2020) and the findings also spotlight the salient role of teachers, particularly physical education instructors in the successful delivery of organized physical education programs as qualified and competent teachers can design appropriate training schedules, supervise students' physical advancement, provide appropriate technical instruction, and encourage students to participate in physical action that improves their fitness and health outcomes while at the same time motivating students towards pleasant perspectives on physical activity and lifetime participation in sports and exercise (Donnelly et al., 2016) and along with teachers, the part of educational policymakers and school administrators is also represented as they are responsible for regulating institutional policies to ensure adequate time in the academic curriculum for physical education classes, promoting infrastructure and equipment for sports, and supporting professional development opportunities for physical education instructors for the appropriate implementation of evidence-based physical activity programs in schools to create an enabling learning environment through which physical fitness and health development become fundamental aspects of academic growth (Trudeau & Shephard, 2008) and another important inference we draw out from the study is there is a need for exercise fitness assessment and monitoring in schools as regular fitness testing through standardized fitness tests allows educators to review students' physical progression, detect health risks like obesity or low fitness levels, and provide modifications to physical education programs to ensure continuous positive adaptation in students' physical fitness and performance outcomes which further aids the larger objective of identifying a healthy lifestyle, and preventing lifestyle-related health issues such as obesity, cardiovascular disease, etc. among adolescents through effective school-based physical education programs.

Limitations of the Study

The present study, while providing some important empirical evidence on the effectiveness of structured physical education programs on the levels of physical fitness measurements among adolescents, has its share of limitations that may affect the generalizability and applicability of the findings of the study (Creswell & Creswell, 2018; Thomas, Nelson, & Silverman, 2015) of which one of the most important limitation of the study is the limited geographic coverage, in that the present study involved a sample of students from selected secondary schools within only a specific region where school infrastructure, access to sports facilities, socioeconomic conditions, and educational policies may vary greatly from another region or country, hence the findings may not generalize to a broader population of students from the different geographic locations and educational systems; another limitation of the study relates to the short duration of the intervention program, which was applied for a short duration of about 8–12 weeks, so although the results exhibited significant improvements for several components of physical fitness in this period, but much longer implementations may be needed for essential and consistent physiological adaptations, long-term behavioral changes in physical activity participation, and impact of organized physical activity programs on health results and lifestyle habits outside the immediate intervention period (Malina, Bouchard, & Bar-Or, 2004); in addition the sample of the study was also exclusive to secondary school adolescents ranging in age from 13 to 16 years of age, leading to the findings as being a specific reflection of how structured physical education programs work for this certain developmental period, with limited application to either younger children in primary schools or older individuals in higher education settings where variations in physical maturity, fitness levels, and participation patterns may affect the results of physical education interventions, and so future research should both increase coverage of different geographic regions as well as younger and older students in order to improve the empirical evidence base through a more complete picture of how structured physical education programs may influence physical fitness in different areas of youth development (Creswell & Creswell, 2018; Thomas, Nelson, & Silverman, 2015), which acts as major considerations that must be robustly considered in further investigations on the effects of organized physical education programs on health standards and physical growth in adolescents.

Conclusion

This study demonstrates that structured physical education programs are crucial for improving adolescents' physical fitness and health outcomes, as students who participated in systematic physical education activities during the intervention period showed significant improvements in several aspects of physical fitness such as cardiovascular endurance, muscular strength, flexibility, speed, and body composition confirming well-planned physical activity programs executed in a school environment can promote physical development by supporting healthy growth during a critical period of development, namely adolescence, also an important time to establish lifelong patterns of physical activity and reduce sedentary lifestyle behaviors which increase the risk of adverse health conditions such as obesity, cardiovascular diseases, and metabolic disorders (Strong et al., 2005; World Health Organization [WHO], 2020) and the findings from the pre- and post-test comparisons made in the present study further indicate that structured physical education sessions that incorporate a balanced combination of aerobic exercises, strength training, flexibility training, and sports-based activities are key factors in the increased physiological capacity and physical performance of students by providing consistent opportunities for moderate-to- vigorous intensity physical activity in the curricular program that furthermore highlights the importance of integrating systematically designed physical education programs into the educational system as an important aspect of holistic student development by supporting physical health, cognitive functioning, emotional well-being, and social interaction among young people (Donnelly et al., 2016), and the findings also point out the significance of institutional support for physical education programs through the provision of instructional time, sports infrastructure used for carrying out physical education sessions, trained physical education teachers, and regular physical fitness assessments which communicate information about students' health status and help to ensure that training programs are adapted to their developmental needs, thereby bolstering the success of school-based physical education initiatives and promoting sustainable health outcomes for adolescents (Sallis et al., 2012), and therefore the overall conclusion of this study underlines that structured physical education programs are a feasible educational intervention to optimize physical fitness levels in secondary school students and therefore help to face global challenges linked to decreasing physical activity among youth while still underling the importance of continuously developing school-based physical education policies and programs to support active lifestyles, enhanced physical health and an improved quality of life for future generations.

References

1. American College of Sports Medicine. (2018). *ACSM's health-related physical fitness assessment manual* (5th ed.). Wolters Kluwer.
2. Bailey, R., Armour, K., Kirk, D., Jess, M., Pickup, I., & Sandford, R. (2009). The educational benefits claimed for physical education and school sport: An academic review. *Research Papers in Education*, 24(1), 1–27.
3. Biddle, S. J. H., Gorely, T., & Stensel, D. J. (2017). *Youth physical activity and sedentary behavior*. Human Kinetics.
4. Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: Definitions and distinctions for health-related research. *Public Health Reports*, 100(2), 126–131.
5. Centers for Disease Control and Prevention. (2020). *School health guidelines to promote healthy eating and physical activity*. CDC.
6. Cooper, K. H. (1968). A means of assessing maximal oxygen intake: Correlation between field and treadmill testing. *Journal of the American Medical Association*, 203(3), 201–204.
7. Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.
8. Donnelly, J. E., Hillman, C. H., Castelli, D., Etnier, J., Lee, S., Tomporowski, P., Lambourne, K., & Szabo-Reed, A. (2016). Physical activity, fitness, cognitive function, and academic achievement in children. *Medicine & Science in Sports & Exercise*, 48(6), 1197–1222.
9. Fairclough, S., & Stratton, G. (2005). Improving health-enhancing physical activity in girls' physical education. *Health Education Research*, 20(4), 448–457.
10. Field, A. (2018). *Discovering statistics using IBM SPSS statistics* (5th ed.). SAGE Publications.
11. Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education* (8th ed.). McGraw-Hill.
12. Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2020). Global trends in insufficient physical activity among adolescents. *The Lancet Child & Adolescent Health*, 4(1), 23–35.
13. Janssen, I., & LeBlanc, A. G. (2010). Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *International Journal of Behavioral Nutrition and Physical Activity*, 7(40), 1–16.
14. Kirk, D. (2010). *Physical education futures*. Routledge.
15. Malina, R. M., Bouchard, C., & Bar-Or, O. (2004). *Growth, maturation, and physical activity* (2nd ed.). Human Kinetics.
16. McKenzie, T. L., & Lounsbery, M. A. F. (2014). The pill not taken: Revisiting physical education teacher effectiveness. *Research Quarterly for Exercise and Sport*, 85(3), 287–292.

17. Morgan, P. J., & Hansen, V. (2008). Classroom teachers' perceptions of the impact of barriers to teaching physical education. *Research Quarterly for Exercise and Sport*, 79(4), 506–516.
18. Pangrazi, R. P., & Beighle, A. (2019). *Dynamic physical education for elementary school children* (19th ed.). Human Kinetics.
19. Plowman, S. A., & Meredith, M. D. (2013). *Fitnessgram/Activity gram reference guide* (4th ed.). The Cooper Institute.
20. Sallis, J. F., McKenzie, T. L., Beets, M. W., Beighle, A., & Erwin, H. (2012). Physical education's role in public health. *Research Quarterly for Exercise and Sport*, 83(2), 125–135.
21. Sharma, R., & Sharma, S. (2018). Role of physical education in promoting health and fitness among school students. *International Journal of Physical Education, Sports and Health*, 5(4), 130–134.
22. Strong, W. B., Malina, R. M., Blimkie, C. J. R., Daniels, S. R., Dishman, R. K., & Gutin, B. (2005). Evidence-based physical activity for school-age youth. *Journal of Pediatrics*, 146(6), 732–737.
23. Thomas, J. R., Nelson, J. K., & Silverman, S. J. (2015). *Research methods in physical activity* (7th ed.). Human Kinetics.
24. Trudeau, F., & Shephard, R. J. (2008). Physical education, school physical activity, school sports and academic performance. *International Journal of Behavioral Nutrition and Physical Activity*, 5(10), 1–12.
25. UNESCO. (2015). *Quality physical education guidelines for policymakers*. UNESCO.
26. United Nations Children's Fund. (2019). *The state of the world's children: Children, food and nutrition*. UNICEF.
27. World Health Organization. (2018). *Global action plan on physical activity 2018–2030*. World Health Organization.
28. World Health Organization. (2020). *Guidelines on physical activity and sedentary behaviour*. World Health Organization.
29. World Health Organization. (2022). *Global status report on physical activity 2022*. World Health Organization.
30. Zeng, N., Ayyub, M., Sun, H., Wen, X., Xiang, P., & Gao, Z. (2017). Effects of physical activity on motor skills and cognitive development in early childhood. *BioMed Research International*, 2017, 1–13.