



The Influence of Physical Education Over A Semester on the Psycho-Physical Development in Elementary School Students

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Abstract

Study purpose. The aim of this study was to determine the impact of the physical education program over a semester on physical fitness, sport-specific skills (football and basketball) and the quality of life in elementary school students (7th and 8th grade).

Materials and methods. 128 students (64 boys and 64 girls) from three elementary schools, aged 13-14, participated in the study. A battery of five diagnostic tests was used to assess physical fitness: Modified Agility “T” test, Illinois Agility Run Test, 10x5 Shuttle Run Test, Standing Balance Test and 2-Minute Step in Place Test. Training polygons with elements of sports were used to assess football and basketball skills. Determining the level of quality of life was carried out with a pediatric quality of life questionnaire (Pediatric Quality of Life Inventory TM – PedsQL).

Results. The study found statistically significant improvements in the results of most physical fitness tests in all team sports on training polygons, as well as in the level of quality of life for both boys and girls in both grades.

Conclusion. It can be concluded that the physical education program was well organized and implemented and thus had a positive effect on improving the psycho-physical status of students.

Keywords: physical fitness, quality of life, children, football, basketball.

Introduction

The physical education program is characterized by the use of a large number of aerobic and anaerobic physical activities (Deng, Zhang & Chen, 2021), which influence the improvement of children's physical status, their training and practicing various motor skills (basic and sports-specific) and contribute to the development of psycho-social characteristics of children (Milenković, 2021). Attending a physical education program contributes to the development of physical fitness, acquiring knowledge and motor skills (Faigenbaum et al., 2015). Simultaneously, the frequent negative phenomenon in the form of physical inactivity among children can be suppressed with an effective physical education program (Habyarimana, Tugirumukiza & Zhou, 2022; Wintle, 2022). In this way, potential health problems

such as obesity and hypertension can be prevented (Hills, Andersen & Byrne, 2011; Aguilar-Cordero et al., 2020). All this further affects the overall level of quality of life in children (Bermejo-Cantarero et al., 2021).

The development of physical fitness has been done through organized and systematic physical exercise. In physical education classes, the improvement of physical fitness is not too great because of the small scope and intensity of work, however, with proper and optimal work, it is possible to influence adaptive changes in the level of physical fitness of students (Milenković, Karalejić, Savić & Milenković, 2013). In addition to the development of physical fitness, the physical education program also contributes to the training and practice of sport-specific skills which physical fitness is significantly related to (Milenković, Branković, Petković, Kostić & Stanković, 2008; Koksteyn, Musalek, Wolanski, Murawska-Ciałowicz & Stastny, 2019; Milenković, 2022). As part of the work on the development of sport-specific skills in the physical education program, technical elements from

team sports, soccer and basketball are also used, which are related to manipulating the ball and accuracy of hitting the target.

Soccer practice, in addition to learning and practicing simple technical elements, also stimulates the motor and cognitive development of children, especially the ability to sustain attention. During the soccer game, the participant analyzes the changing situations through perception and realizes them using his cognitive abilities, thereby executing his decision using his technical and kinetic abilities (Alesi et al., 2015). The specificity of soccer is reflected in polystructural complex acyclic and cyclic movements with or without the ball, which are manifested through one or more motor dimensions. The efficiency of movement is based on a rational technique that enables the full motoric potential of the player/student (Milenković, Pelemiš & Branković, 2011). Basketball consists of complexes of simple and complex movements with a combination of cyclic and acyclic movements with frequent periods of high-intensity play and frequent changes in the direction of movement (Stanković, Lazić, Milenković, Nurkić & Kocić, 2022). Playing basketball successfully, which is classified as a complex anaerobic sport, requires endurance, precision, speed, agility, explosive strength, as well as cognitive abilities (Kocić, 2008; Ademović, 2015; Cao et al., 2022). These team sports have a very significant place in the physical education program, both in compulsory and optional activities due to their popularity among students (Kim et al., 2022).

The connection between the level of physical activity and quality of life in children and adolescents is the subject of many studies (Janssen & LeBlanc, 2010; Tremblay et al., 2011; Wu et al., 2017; Wunsch et al., 2021). A higher level of physical activity improves quality of life both physically and mentally (Marker, Steele & Noser, 2018). Success in completing the tasks provided by the physical education program and optimal physical development contributes to students' self-confidence in other areas of learning and work (Bailey, 2018).

Based on theoretical assumptions, the aim of this research was to determine the impact of the physical education program over a semester on physical fitness, sports-specific skills and the quality of life of elementary school students. It is assumed that there is a positive influence of the physical education program on the mentioned elements of psychophysical development of children. When talking about the importance of this research, it should be noted that it is important to identify the level of impact of the physical education program on students, that is, how effective it is in improving physical fitness, motor skills and knowledge and preserving health in modern living and working conditions.

Materials and methods

Participants

A sample of 128 children, aged 13–14, was drawn from three elementary schools. They participated in two testings that were conducted at the beginning and at the end of the first semester of the school year 2022–23. Regular attendance of physical education classes was a criterion for inclusion in the research. The sample was further divided into students of the seventh (32 male and 32 female) and of the eighth grade (32 male and 32 female).

The school authorities, the children's parents, as well as the children themselves gave the consent for testing the students. The research was approved by the Ethics Committee of the Faculty of Sports, Union University – Nikola Tesla in Belgrade (code: 172/22).

Measuring instruments

Physical Fitness

A battery of five diagnostic tests (Wood, 2008) was used to test physical fitness. The previous research has established that these tests are reliable and valid for assessing physical fitness: Modified agility "T" test – MAT (Sassi, et al., 2009); Illinois agility run test (Hachana et al., 2014); 10×5 shuttle test (Boddington, Lambert, St Clair Gibson & Noakes, 2001); Standing balance test (Geldhof et al., 2006); 2-minute step in place test (Haas, Sweeney, Pierre, Plusch & Whiteson, 2017).

Sport Polygons

To assess the sport-specific skills, polygons which contain the basic technical elements of soccer and basketball were used, those ones which have already been studied in the older grades of elementary school (grades 7th and 8th).

Description of the soccer polygon (Fig. 1). From the starting position (point A), the student starts a curvilinear movement between the cones (slalom) during which he dribbles the soccer ball in a length of 10 meters (slalom starts from the left side of the first cone). After exiting the slalom, the student passes the ball towards the wall, which is 5 meters away. After the ball bounces off the wall, the student receives the ball and returns the same way by curvilinear movement between the cones by entering the slalom from the left side of the first cone. After exiting the slalom from point B, he shoots the ball towards a small soccer goal measuring 1×0.5 meters, located at a distance of 5 meters. A shot on goal marks the end of the polygon and measuring the time. For missing a goal, two seconds are added to the total time. For a task done incorrectly (wrong movement, knocking down a cone, going around the cone from the wrong side, etc.) one second is added to the total time.

Description of the basketball polygon (Fig. 2). From the starting position (point A), the student takes the first ball from the hoop and uses both hands to shoot at a horizontal target (basket for balls) 5 meters away using the technique of passing from the chest. Afterwards, he takes the next ball from the hoop with which he performs a curvilinear movement (driving the ball – dribble) between the cones over a length of 10 meters by entering the slalom from the right side of the first cone. The ball is guided alternately with both hands in all phases of the polygon. After exiting the slalom, the student passes the ball towards the wall 3 meters away. The ball is passed with both hands from the chest and on the floor. After the ball bounces off the wall, the student catches the ball and returns the same way by curvilinear movement between the cones by entering the slalom from the left side of the first cone. After exiting the slalom, the student guides the ball in a straight line in a length of 5 meters to point B, from which a jump shot is made at the basket. After the shot, the student takes the ball and takes it back to the hoop where he drops it, which marks the end of the polygon and measuring the time. Two seconds are added

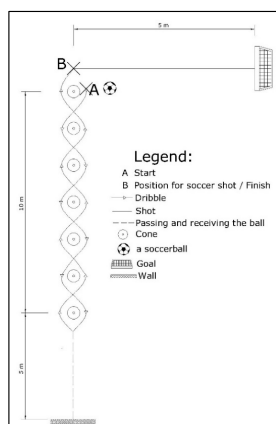


Fig. 1. Soccer Polygon

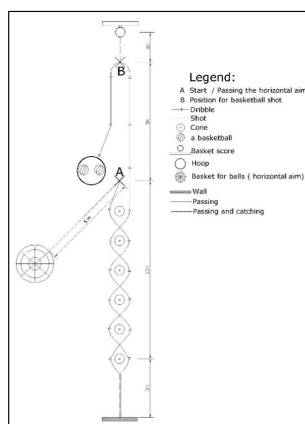


Fig. 2. Basketball Polygon

to the total time for each missed goal (basket, hoop). For a task done incorrectly (wrong movement, knocking down a cone, going around the cone from the wrong side, etc.) one second is added to the total time.

Quality of life questionnaire

Determining the level of health-related quality of life was carried out with a pediatric quality of life questionnaire (Pediatric Quality of Life Inventory™ – PedsQL) (Varni, Seid, Rode, 1999). The questionnaire is intended to assess the health-related quality of life of children and adolescents aged 5-18. This questionnaire is composed of 23 statements with a five-point Likert-type scale offered for giving the degree of agreement for a given statement. The offered degrees of agreement range from: 1 – I do not agree at all, to 5 – I completely agree. Conceptually, the PedsQL measures general well-being and functioning in daily life independent of the child's health status. It has been culturally adapted and validated for the Serbian language (Stevanović, Lakić, Damnjanović, 2011). The questionnaire consists of four subscales: Physical functioning (5 items), Emotional functioning (8 items), Social functioning (5 items), School functioning (5 items). The sum of the scores of all scales represents the overall quality of life. The reliabilities (Krombach's alpha coefficient) of the scales of this instrument are high (physical functioning $\alpha=0.64$, emotional functioning $\alpha=0.68$, social functioning $\alpha=0.75$, school functioning $\alpha=0.57$, psycho-social functioning $\alpha=0.73$).

Physical education program

Physical education programs for the seventh and eighth grade of elementary school according to the Rulebook of the Ministry of Education, Science and Technological Development of the Republic of Serbia (Službeni glasnik Republike Srbije – Prosvetni glasnik (Official Gazette of the Republic of Serbia – Educational Gazette), 2019a, 2019b) foresee the same teaching contents that are planned based on the assessment of their complexity for students, as well as facilities for the implementation of the program. So, first for all, there is a possibility of replacing certain teaching contents with some other teaching topics (e.g. sports or activities previously not included) depending on the existence of appropriate facilities. Secondly, their number of classes can be distributed to other teaching contents already

Table 1. Course contents that were performed in the first semester

Content name	no. of classes
Athletics	7
Artistic gymnastics	7
Soccer	10
Basketball	10
Rhythmics and dance	4
Optional activities – the program offers a number of different activities from which students can choose the ones the school has the facilities for (e.g. fitness training, badminton, table tennis, orienteering, martial arts, self-defense, sports that have already been involved in the compulsory program, training, practicing and improving the elements provided by the expanded parts of the teaching contents, etc.).	5
Polygons	3
Swimming and water polo (in the schools where there are not the facilities for performing these activities, that number of classes is distributed to other contents)	5
Testing and Measuring	3

existed in the program. Individual teaching contents within the program, in the form of basic and extended parts, are realized three times a week for 45 minutes.

Testing Procedure

The testings was done outdoors, on the open school grounds and in the gymnasium during physical education classes. Regardless of the experience with the testing procedure that the students had acquired during physical education classes in previous grades, in order to ensure the accuracy of the implementation, the students tried out all the tests two days earlier in trial testing to be prepared for the complete procedure during the main testing. Before each testing procedure (initial and final) a 15-minute warm-up was performed. In order to avoid negative effects on testing caused by fatigue there was a 1–2 minute rest period after completing each individual test and before moving on to the next one. At the beginning of the class before testing physical fitness and sport-specific skills, the pediatric questionnaire on quality of life was filled out.

Statistical analysis

Apart from the descriptive parameters (Mean $\pm$ St.Dev), the T test for dependent samples was used to determine the difference between the initial and final testing. The statistical package SPSS v.20.0 (IBM SPSS Statistics) was used for data processing. Statistical significance was established at the $p \leq 0.050$ level.

Results

This chapter presents the research results and their interpretation. Tables 1 and 2 show the basic statistical data (Mean $\pm$ SD) as well as the differences between the two tests,

Table 2. Pre- and post-test results in Mean±SD for 7th grade students

	Boys (32)			Girls (32)		
	Pre-test	Post-test	p	Pre-test	Post-test	p
MAT	8.29±1.25	7.93±1.16	<0.001*	9.32±0.96	8.85±0.92	<0.001*
ILL	20.55±2.34	19.38±1.83	<0.001*	23.13±2.29	21.93±1.92	<0.001*
10×5	14.93±1.26	14.39±1.04	<0.001*	16.46±1.5	15.84±1.23	<0.001*
SBT	20.11±10.19	20.98±8.44	0.113	18.16±7.44	20.22±5.25	0.002*
2-min	129.69±8.14	131.16±6.30	0.001*	121.41±4.88	122.75±3.84	<0.001*
Soccer	24.99±4.92	24.23±4.72	<0.001*	29.41±2.6	27.90±1.92	<0.001*
Basketball	23.81±3.33	22.93±3.13	<0.001*	26.22±1.97	24.51±1.78	<0.001*
PQL	78.19±11.32	84.01±8.08	<0.001*	77.85±6.20	85.39±4.73	<0.001*

* Significance level – $p \leq 0.050$; MAT – modified agility T test; ILL – illinois agility run test; 10x5 – 10x5 shuttle test; SBT – standing balance test; 2-min – 2-minute step in place test; PQL – pediatric quality of life.

Table 3. Pre- and post-test results in Mean±SD for 8th grade students

	Boys (32)			Girls (32)		
	Pre-test	Post-test	p	Pre-test	Post-test	p
MAT	7.7±0.98	7.24±0.81	<0.001*	7.81±0.99	7.35±0.92	<0.001*
ILL	19.46±2.46	18.38±1.84	<0.001*	22.41±2.23	21.07±1.96	<0.001*
10×5	15.56±2.74	14.61±1.66	<0.001*	15.58±1.32	14.93±1.11	<0.001*
SBT	17.16±7.9	19.00±4.97	0.017*	18.59±6.67	19.92±5.51	0.075
2-min	126.84±7.23	128.62±5.58	<0.001*	124.06±4.58	125.09±3.7	<0.001*
Soccer	21.25±4.4	20.18±3.25	<0.001*	23.86±3.07	22.77±2.94	<0.001*
Basketball	24.85±2.9	22.88±2.04	<0.001*	23.28±2.16	22.28±2.19	<0.001*
PQL	76.8±6.71	85.29±4.64	<0.001*	81.92±9.66	86.31±6.65	<0.001*

before the beginning and after the end of physical education classes in the first semester. All results are shown separately for boys and for girls.

The results of two tests of male and female students of the seventh grade presented in Table 2, point out that there are statistically significant differences in all three areas examined in this research. In boys, only one test of physical fitness (balance test SBT) did not show a statistically significant improvement in results. A statistically significant improvement in results was recorded in other physical fitness tests, as well as in team sports polygons and questionnaires for determining the level of quality of life.

Similar results can be seen in the eighth grade students (Table 3). Statistically significant improvements were recorded in all parameters in boys, while in girls only in the SBT there was no statistically significant difference.

Discussion

Assuming that there is a positive impact of the physical education program on the psycho-physical development of children, the aim of this research was to determine the impact of that program over a semester on physical fitness, sports-specific skills and the quality of life of elementary school students. The results showed a statistically significant improvement in scores on most physical fitness tests. Statistically significant progress was recorded in the fields of

both team sports, as well as in the level of quality of life for both boys and girls in both grades. This outcome is also suggested by earlier views of experts that the physical education program has the potential to significantly contribute to the physical, life, social and cognitive development of children. This program particularly affects the development of children's basic movement skills and physical competencies that are necessary for the development of sports activities, and can also support the development of social skills and social behavior, self-esteem and attitudes at school, and in certain circumstances, academic and cognitive development (Bailey, 2006).

The findings obtained in this study indicate that the physical education program in the field of developing physical fitness and soccer and basketball skills, with its contents, had a positive effect on the largest number of parameters of physical fitness, except for balance (SBT) of the seventh-grade boys ($p = 0.113$) and eighth-grade girls ($p = 0.075$), as well as the skills of both team sports. Kriemler et al. (2010) also found that school physical education, which was composed of several teaching contents, improved the level of physical activity (0.44, 0.05 to 0.82; $p = 0.03$) and aerobic capacity (0.17, 0.01 to 0.32; $p = 0.04$). A similar nine-month study was conducted by Meyer et al. (2014) who, after completing a complex physical education program, observed beneficial effects in aerobic capacity (0.373 z-score units [95%-CI: 0.157 to 0.59, $p = 0.001$]). A physical education

program also develops students' cardio-respiratory fitness, but it is also suggested to be combined with other approaches to further increase the impact it can have on increasing physical fitness and physical activity in general (Young, Phillips, Yu & Haythornthwaite, 2006). School programs for the improvement of physical education can improve physical fitness as reflected by maximal oxygen uptake (VO_2max) (MD 1.19 mL/kg/min, 95% CI 0.57 to 1.82) (Neil-Sztramko, Caldwell & Dobbins, 2021), and also can statistically significantly improve muscle strength ($p < 0.001$), general strength ($p < 0.001$), cardiorespiratory fitness ($p < 0.001$), flexibility ($p = 0.005$) and overall health-related fitness score ($p = 0.001$) (Lee, So, Youn & Kim, 2021). School upbringing and education through soccer exercises improves the level of physical activity and psychological well-being, both in girls and in boys who from moderately to highly rate the level of enjoyment in this kind of sports activity (Larsen et al., 2021). A school soccer program improves various parameters of physical fitness (Larsen et al., 2023). Learning basketball skills in the physical education program can be done using a technical and tactical approach based on the level of physical fitness of the students. Both approaches in the physical education program can improve the results of learning basketball skills, so that a tactical approach is recommended for students with good physical fitness, while a technical learning approach is preferred for students with low physical fitness (Nur & Malik, 2021). The basketball program at school also helps in improving the motor efficiency of obese children (Elsayed, 2014). Team sports, including basketball and soccer in the physical education program, improve certain parameters of physical fitness such as balance ($p < 0.050$) and jumping abilities ($p < 0.050$) (Larsen et al., 2018).

The results of this research indicate that the physical education program has a positive effect on improving the quality of life of children. Both boys and girls of both grades (seventh grade boys $p < 0.001$; seventh grade girls $p < 0.001$; eighth grade boys $p < 0.001$; eighth grade girls $p < 0.001$) recorded a statistically significant change in the level of quality of life. These statements are also confirmed by other researches (Wu et al., 2017; Wunsch et al., 2021). The school-based physical education program ("Active School") shows positive effects on children's psychological well-being, social support and the school environment (Kvalø & Natlandsmyr, 2021). Physical education programs can reduce anxiety, increase resilience, improve well-being and increase positive mental health in children and adolescents. Therefore, taking into account the positive effects of physical education on health in general, it is suggested to increase the fund of physical education classes (Andermo et al., 2020). Also, it should be noted that there is a cause and effect relationship between attitudes towards physical activity and the level of participation in the activity itself. In this regard, it is considered that children with more positive attitudes towards physical activity participate more often in physical activity outside of school and show greater amounts of physical activity than those with less positive attitudes. Fostering children's positive attitudes towards physical activity is suitable for the promotion of children's current and later participation in physical activity (Zeng, Hipscher & Leung, 2011).

However, there are also studies conducted in schools in which minor effects of physical education on the overall quality of life were obtained. Hartmann, Zahner, Pühse, Pud-

er and Kriemler (2010) found that the school physical education program did not affect the physical quality of life of the first-grade students and the physical and psychosocial quality of life of the fifth-grade students but that intervention had a positive impact on the psychosocial quality of life of the first-grade students. However, the overall impact of the school-based physical education program on the quality of life of elementary school children is low. Some researchers did not record any statistically significant changes in the quality of life of students after the implementation of the school-based physical education program (Kriemler et al., 2010).

This study is also subject to some limitations and shortcomings. Firstly, a larger sample of children covering a wider population from different geographic areas would likely yield much more accurate data. Secondly, a larger number of tests would complete the picture of students' physical fitness. Thirdly, there are licensed questionnaires for the assessment of the quality of life that are also filled out by parents, so they provide additional information about the condition and level of the quality of life of their children. Fourth, the fact that the program was not conducted by the same teacher in different schools can also be a drawback. On the other hand, if the sample were larger, it would not be physically possible for the same teacher to carry out the programs in all schools. Fifth, the time for monitoring the physical education program and determining its impact can be longer, e.g. the whole school year.

Conclusion

The school-based physical education program is an important factor for the development and improvement of the psycho-physical status of students. The very fact that this school program can be the only organized implementation of physical exercise for children who do not actively play any sport, that is, are not members of sports clubs, indicates the importance of this program and its professional organization. In today's sedentary lifestyle that affects both children and adolescents, every successful attempt to physically activate and engage in some form of physical exercise according to a professionally organized and guided program contributes to a better psycho-physical and health status. The habit of exercising that is formed in childhood and adolescence remains in the later years of life. Therefore, it is necessary to frequently evaluate this process in an attempt to improve it as much as possible.

The aim of this research was to determine the impact of the physical education program over a semester on motor performance, sport-specific skills and the quality of life of elementary school students, and it was shown that the program had a positive effect on most of the examined parameters, so the initial assumption was not rejected. The results show that the physical education program is, first of all, well designed and varied, and then also well organized and implemented. With the professional work of teachers and the engagement of students, it is possible to influence the increase in physical activity and the improvement of the psycho-physical status of students. However, given all the shortcomings, the results of this study should be interpreted with caution regardless of the acceptable risk of bias. In any case, longer-term research into such impacts is needed.

Conflict of interest

The authors did not receive support from any organization for the submitted work. The authors have no relevant financial or non-financial interests to disclose.

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Вплив занять фізичною культурою протягом семестру на психофізичний розвиток учнів початкової школи

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 8 с., 3 табл., 2 рис., 50 джерел.

Мета дослідження. Метою цього дослідження було визначити вплив програми фізичного виховання протягом семестру на фізичну підготовленість, специфічні спортивні навички (футбол і баскетбол) та якість життя учнів початкової школи (7 та 8 клас).

Матеріали та методи. У дослідженні взяли участь 128 учнів (64 хлопчики та 64 дівчинки) з трьох початкових шкіл віком 13–14 років. Для оцінки фізичної підготовленості використовували батарею з п'яти діагностичних тестів: Модифікований тест на спритність «Т», Іллінойський тест на спритність, тест «човниковий біг 10×5», тест на рівновагу в положенні стоячи та 2-хвилинний тест крокування на місці. Для оцінки навичок гри у футбол та баскетбол використовувалися тренувальні полігони з використанням елементів спортивних ігор. Визначення рівня якості життя проводилося за допомогою педіатричного опитувальника якості життя (Pediatric Quality of Life Inventory TM – PedsQL).

Результати. Проведене дослідження встановило статистично значуще покращення результатів більшості тестів для визначення фізичної підготовленості у виконанні всіх командних видів спорту на тренувальних полігонах, а також рівня якості життя як для хлопчиків, так і для дівчаток в обох класах.

Висновок. Можна зробити висновок, що програма з фізичної культури була добре організована та реалізована, що позитивно вплинуло на покращення психофізичного стану учнів.

Ключові слова: фізична підготовленість, якість життя, діти, футбол, баскетбол.

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