

**SOFIA UNIVERSITY „ST. KLIMENT OHRIDSKI”  
DEPARTMENT OF SPORT  
SPORTS GAMES AND MOUNTAIN SPORTS DIVISION**

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**MARTIN YORDANOV YORDANOV**

**THE EFFECT OF EXTRACURRICULAR ACTIVITY  
ON THE PHYSICAL FITNESS OF 15-16 YEAR OLD  
STUDENTS**

**A B S T R A C T**

**of a dissertation for the award of an educational and scientific degree  
„PhD”**

**Sofia, 2023**

The dissertation is structured in 3 chapters, conclusions and recommendations, and contributions. It contains 174 pages, of which 40 pages are appendices and a list of publications. It is illustrated with 32 tables and 43 figures. The bibliography comprises 137 titles, of which 104 in Cyrillic and 19 in Latin, 7 documentary sources and 7 websites.

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Composition of the Specialized Scientific Jury for official protection:

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„PhD” in the professional field – 1.3.**

**Pedagogy of education in (Methodology of education in physical  
education and sport)**

**Supervisor:  
Prof. Georgi Ignatov, PhD**

Sofia, 2023

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## **Introduction**

The current way of life is marked by a paradoxical contradiction. The constant race with time, the upgrade of our standard, and the digital revolution are factors upon which every day we are facing a number of irritants around us which are not specific to human perception. Noise, closed areas with not enough natural light and air, a major flow of information, the growing mind workload, etc. All of the above have a negative effect on the health development of the individual. It's unanimously accepted that the stress is the one biggest and most dangerous illness of the modern person.

The regular physical activity has a positive impact on the psychological stance of children and teenagers, especially when it comes to building and forming of their confidence, adaptability, team work and empathy. Sports are also one of the most effective ways of dealing with smoking, the inactive way of life and obesity. In Bulgaria we exhibit a disturbing level of school age diseases and part of the issue is the ineffective gym classes.

Inadequate to today's needs is the frame of the weekly program in Bulgaria, in which gym classes take place two to three times, 40 minutes each. It is necessary to look for possibilities for outdoor activity and additional classes taken outside of the school. Aiming to overcome the invisible boundary which sports often introduce as incompatible with education, special attention has to be brought up to integration of the education in general and the outdoor sport activities.

Our intentions of scientific examination are headed towards this direction exactly. In the dissertation we study the effect of applying additional motor activity, apart from school gym classes, on the physical condition of students. As a result of implementing it, a higher level of physical qualities is expected.

## **CHAPTER ONE**

### **I. CONDITION OF THE PROBLEM AS SEEN IN LITERATURE SOURCES**

#### **I.1. Condition and problems in physical education and sports in high school education in the Republic of Bulgaria.**

The white sports book (2007) is the first major European sports initiative, determining strategic pointers in the development of sports in the European Union, especially in social and economic context. It shows that time spent in sport, regardless if it is in gym class or outdoor activities, could lead to substantial educational and health benefits.

In a thesis of his, G. Ignatov (2010) describes the fundamental reasons for the failed conducting of the educational process of the gym class during high school, which are as follows: the lack of good facilities – 43%, the not enough serious approach of the classmates – 31%, the teacher’s lack of motivation and competency- 19%, and the lack of school materials for sport – 7%.

An important point of view introduced by D. Stoyanova, V. Vasileva, I. Ilieva and D. Raykov (2019), claims that „Parents and teachers are the core motivators for youngsters to engage in physical activity and sports. Their attitude as adults with wide range of life experience, gets projected on children’s understanding of the world and on the benefits of various types of activities“.

Regardless of the efforts of the state institutions, fractures and discrepancies with the desired changes are observed, when it comes to the educational and physical awareness fields, according to K. Minev (2017):

\*Lowered demands towards the class as a key form of specialized activity, during which along with the educational motor tasks, students are being taught to be disciplined, responsible, and a number of other ethical and moral qualities.

\*Lowered demands towards the preliminary preparation, planning and organizing, and the actual execution of the sports class subject.

\*Worsened condition of the material base. The schools were deprived of facilities and other technical means.

\*With the existence of 4513 school buildings throughout the country, the number of gyms is 1836 or 40%, while 817 schools (around 20%) don’t have any kind of gym facilities within their premises. The sport facilities of a Bulgarian student average to 0.34 square meters of indoor and 3 square meters of outdoor gym grounds, whereas those of a European student average

to 3-3.5 square meters of indoor and 15-20 square meters of outdoor grounds, or almost 6 to 8 times more (according to Kr. Rachev, 1994).

\*The number of the affected children and students rapidly dropped in the out of class forms and especially in the out of school facilities for sports training activity. The number of students in those facilities in 1993 in comparison to 1988 has decreased more than 3 times. Out of 37 sport schools only 9 remain. Now, the municipality of the capital is about to shut down also the children's workshops.

A key moment in the process of the reforms, without a question, is the implementation of the State educational requirements and the standards in the cultural and educational field for the subject „Physical education and sport“, and the order of the minister of education for the addition of the third extra gym class and the modular training (<https://www.mon.bg>; [www.mpes.government.bg](http://www.mpes.government.bg)).

R. Chausheva (2013) points out the following reasons for the ineffective functioning of sports in school:

\*The insufficient motivation of the students;

\*The lack of motivation amongst the teachers because of their low professional, economic, and social status, lack of financial stimulus for initiative and results of the out of class forms;

\*The attitude of the school boards towards sport activities- the underestimated place of sport in society determines the extent of their lack of interest and low level of support;

\*The shared responsibility between MON and MMC including their structures leads to lowered control, missing commensurability of results, missing liability for the documenting of the effectiveness of the programs;

\*The lack of mechanisms for attracting other interested parties among public organizations.

The antivirus measures related to the Covid-19 pandemic, the shutting down of gyms and playgrounds (<https://coronavirus.bg/bg/>), leads to the loss of the chance for children and teenagers to get enough movement. For the majority of students the gym classes are the only time they get to do sports. The online form of education boosts the fear of insufficient physical activity and of kids not doing sports.

Shutting down the activities of sport clubs and of all out of class sport activities, additionally leads to children's impairment. The fact that there are no student games has a very negative impact on student's motivation. The competitive element which is currently missing is of real importance.

The commission for culture and education of the European parliament proposed the following resolution (<https://www.europarl.europa.eu/committees/bg/cult>):

\*A thorough assessment to be made of the economic and social impact of the Covid-19 pandemic when it comes to sports in all member countries and according to the results of this assessment, a European way of tackling the challenges and mitigation of the possible aftermath.

\*Structured and systematic exchange of best practices between the member countries for dealing with the consequences of the crisis on sports and systematic analysis of data and information regarding the partaking in sport activities and the effect of Covid-19.

\*It is useful to study the development of new ways of practicing sports in situations in which physical distance is required.

\*The European sport model has to be kept and encouraged since the solidarity, justice and the virtue based approach will be more important than ever for the resurrection of the sports sector and the survival of the mass sports.

## **I.2. The role and the place of out of class activity in gym class and sports**

The level of physical development and physical capabilities of children and students in comparison to previous generations and their peers is substantially lowered. This ascertainment is pretty much the result of the absolute lack of interest of certain municipalities and state structures, the lack of advertisement campaigns for sports for everybody and the insufficient knowledge of the population regarding the possibilities for practicing physical exercises and sport.

Aiming to improve the cardio, respiratory and muscle condition, the bone system, the cardiovascular system and the metabolism, as well as the reduction of anxiety and depression symptoms, the Secretariat of the World health organization (WHO, 2010) came up with the the following recommendations:

1. Children and youngsters between 5 and 17 years old need to gain a minimum of 60 minutes of everyday motor activity with moderate to high intensity.
2. The motor activity done for more than 60 minutes daily will assure more health benefits.
3. Most of daily motor activity has to be in aerobic stance. Activities with high intensity have to be mixed, including such that strengthen the muscle and bone systems, at least three times per week.



The mentioned data above is in support of the claim that in class activities are too insufficient to satisfy the natural biological needs of children of the necessary for them healthy motor activity. It's obvious that the boosted sport activity, done through various forms of out of class exercises, helps the improvement of the health condition and physical development of the students, as well as their better focus throughout the learning process. Also, this activity is the best way for keeping them away from the bad habits and addictions like alcohol abuse, cigarettes, drugs, aggression and discrimination of all kinds. Out of class sport activities have unlimited and irreplaceable opportunities for cooperation and intercultural communication between the children (S.Kinov, 2014).

In recent years a great interest in additional after school activities is observed, that responds to the needs of more and more students. In school practices along the gym class as a main form of work, there are also out of class and out of school formats. They are done in the daily, weekly and annual school agenda (at out of class time).

Out of class activity in physical education and sport according to Z. Dimitrova (2015) stands out with the following:

- \*It is voluntary. The content and the format of organization of the exercises is determined according to the interests of students and the conditions which the school can provide;

- \*It is built according to the wide social activity of the students, joined together in gym groups under the systematic control and guidance of the teacher;

- \*In the process of out of class work, the pedagogical board has mostly structural and methodical nature. It has to encourage the realization of creativity among the students.

A study concluded by P. Peneva, I. Ilieva (2014), shows that students that are active in the organized out of class forms and other sport activities, have higher levels of physical capabilities because they are highly trained. This can be achieved through complex preparation.

### **I.3. Features of the school age (from 12 to 17), physical development and motor activity**

Iv. Kadiyski (1989), describes the development of students with periods of constant and temporary growth. According to B. Minchev (2014) the time between ages 12 and 20 years old, also called teenage, is divided into early and late period and causes impact on the physical qualities and is the reason for the realization of the full-fledged capabilities of the organism.

The usual growth and development of the youngster's body depends on a number of factors of endogenous and exogenous origin. Those factors affect throughout the different periods of the ontogenesis, while frequently cooperating with each other.

The endogenous factors are the core qualities of each person that are passed on by the parents.

The exogenous or outer factors start to cause a bigger impact after the birth of the child. Knowing them and also the compliance with the anatomical and physiological features of the youngsters, are a key factor when it comes to working on improving their physical development and increasing their physical capabilities, without it hurting them (V. Stoev, Z. Stanchev, 1981; V. Gavrijski, 1993).

Ages between 12 and 15, according to the author L. Stefanov (2015), is characterized by:

- \*The height growth during puberty 11-12 years old for the boys and 13-14 for the girls;

- \*The boosting of the functions of the sex glands. Secondary gender marks appear;

- \*Changes in endocrine functions. The cooperation between the sex hormones, pituitary gland and the thyroid leads to changes in the neurological system;

- \*Decreasing of the working capacity of the nerve cells and the tonicity of the brain cortex. Children respond slower and inadequate to verbal signals;

- \*Increasing of the tonicity of the structures under the cortex

- \*Vegetative disorders appear;

- \*Fatigue caused by brain and physical activity;

- \*Easier transition between various moods.

Puberty causes stronger functional disturbances for girls, but finishes earlier- at around 15-years-old, whereas boys get out of it at around the ages of 16-17 (L. Stefanov, 2015).

The activation of the sex glands functions with the coming of puberty leads to the fact that the growth of the teenager could sometimes reach 15-20 cm in a couple of months. This causes a number of problems with the activity of different organs and systems. Firstly, the increasing size of the heart during this period and the growth of the body's length, lead to the fact that the arteries stretch and change. Therefore, the strong heart contractions which has become more powerful, release a bigger blood flow in the relatively narrow vascular which often provokes the so called 'Juvenile hypertension'.

If the teenager leads a healthy lifestyle with active motor activity agenda, they are not in jeopardy of unfortunate consequences of such disturbance. And vice versa, if in that case the child is limited in terms of regular physical action, by the time it turns 35-40 years old this person could turn hypertensive.

The intensive growth of the body in length causes stretching of the muscles, the extensions of the back, so the thinned out muscles are not in a position to 'hold the back' and the youngsters often have problems with their posture. In order to prevent such problems (back deformations), it is necessary to train the back muscles and their static endurance, and to maintain constant control of the posture.

That's why it is important to lead an active lifestyle at that age, to engage in different physical exercises to prevent the possibility for those unfortunate changes in the physical and mental condition, and the student's health in general. The meaning of physical education highly increases if the student makes a conscious decision to take part in it.

Ch. Sotirov (2019) shares that 'the optimal motor activity would be that which ensures for a person the biggest opportunities for a normal mental and physical development or makes up and corrects the deviations that occur during the different age periods.'

#### **I.4. Overview of the scientific examinations in specialized literature, content and structure of the term „physical fitness“**

Iv. Popov (1979), defines the physical fitness as an 'aggregation of the physical qualities of a person', meaning above all their quantity. According to the author, the physical fitness is a process of constant development.

The term 'physical fitness' implies realization of the functional opportunities of the individual when it comes to the execution of tasks which require muscle activity (E. Flashman, 1970).

The term 'physical fitness' has an English origin and is widely spread in English speaking countries. In Bulgaria, under the influence of the Russian sport science until recently the term 'physical capability' was used, which pretty much would add to the unification of the term apparatus in the pedagogical sport science (M. Ignatova, 2016).

According to M. Peeva, S. Mavrudiev (2002), the difference between the physical and motor fitness as terms reflecting the complex motor potential of the individual, could be found in their nature. The authors believe that while the physical fitness is determined by mostly interior, genetical

abilities of a person, the motor fitness on the other hand could be observed as a way of transition and utilization of the advanced to a certain level physical qualities and their adaptation to the various by type and complexion motor tasks, formed mostly by phenotypic factors.

The physical education and sport as a mandatory school discipline is an indivisible part of the educational system and ensures the intellectual and physical development of the ones that partake in it. Its first and foremost aim is the increase of the physical fitness of the children as a fundament of the health and efficiency of the organism, as a structural component of a versatile individual, without which the manifestation in one field or another is practically impossible (L. Borisov, T. Marinov, K. Naydenova, 2012).

### **I.5. Essentials of the sport training.**

According to G. Ignatov (2010, 2016), the general physical training is aimed towards the versatile development of the motor system, whereas the improvement of the specific motor and functional capabilities is a task of the special physical preparation. The perfecting of the physical training is a long and never-ending process. Too correctly control the training is a question of teaching motor qualities at all stages of preparation.

The training is a process of learning, teaching and perfecting of the functional capabilities of an individual for reaching high sport results in a certain motor activity (Tsv. Jelyazkov, D. Dasheva, 2000, 2002, 2003).

Strength as a motor quality is the ability to overcome a certain resistance at the expense of muscular effort.

According to Tsv. Jelyazkov, D. Dasheva (2002, 2006), the muscular strength has different forms depending on the various motor activity:

\*Optimal strength- characterized by those maximum values of strength which a certain muscle (or muscular group) could reach despite its sizes under optimal conditions.

\*Relative strength- the attitude of the maximum strength when it comes to an individual's own weight.

\*Dynamic strength- the optimal meaning of strength which a certain muscle could reach for the possibly shortest time.

\*Strength endurance- the maximum (summed up) meaning of strength which a certain muscle could develop at the expense of a high number of unlimited pressures.

Another sphere of motor activities characterizing physical fitness, is the speed. According to Tsv. Jelyazkov (1998) it is 'a motor quality of a

person which allows them to engage in separate or whole movements for the possibly shortest time, e.g. with highest speed in the particular conditions of the motor activity’.

As of the current moment there are three main forms of manifestation of the speed (N. Zimkin, 1956; V. Zatsiorskiy, 1966; Y. Ruschukliev, 1973):

- A) Quickness of reaction
- B) Speed of a singular reduction
- C) Frequency of movements

The main methods of development of speed are as follows:

1. Repetitive method based on the execution of the separate segments with short distance and optimal tempo at full recovery;
2. Varying method- doing exercises, segments, etc. with rhythmic changing of high to low intensity;
3. Combined method based on the balance of different methods- repeatedly varying and interval varying.

Endurance as a motor quality is the ability to get work done continuously with a specific intensity or ability of the organism to resist fatigue for a longer period of time (Tsv. Jelyazkov, 1981, 1986, 1998; P. Slunchev, 1998). From a sport pedagogical point of view we distinguish:

1. General endurance – the ability of a person to execute physical activity continuously with moderate intensity with the use of big part of the muscular apparatus, causing positive effect on their sports specialization.
2. Special endurance- characterizes the longevity and effectiveness of the specific work in the chosen type of sport (discipline).

When the specific work capacity is related to high demands towards the speed qualities of the athlete, it is defined as speed endurance. It’s specific for: 200, 400, 800, 1500 m in athletics, swimming- 200, 400, 800m; skating- 1000m; sport games- basketball, football, hockey, handball, water ball; sport combat, etc.

This specific work capacity which is characterized with substantial resistance (own weight, opponent, etc.) is defined as strength endurance specific for: rowing, gymnastics, ski running, sport combat- wrestling, canoeing, swimming. When the intensity of the specific load in certain sports and disciplines is defined by the same meaning of resistance and speed, this particular work capacity is speed-strength endurance. It is specific for sport games, cycling, ice skating, sprint running in athletics, throws in athletics.

For perfecting of the various components of endurance are mostly used the equal, repetitive and interval method, the interval-changing method and the game method.

The agility is a complex motor quality interconnected to the rest qualities. It is the ability of the organism to coordinate the separate movements and actions by time, space and effort, according to the motor task. Agility is mostly seen in the none cyclical sports- wrestling, tennis, sport games, etc.

Main methods for development of agility are the repetitive and interval-changing method in different form- competitive, flowing, and circular, with the environment changing frequently.

The flexibility is an ability to execute movements with high amplitude in certain direction (Kr. Zlatev, 1986; K. Aladjov, 1995; V. Gavriyski, 1966). E. Flashman (1970), looks at the flexibility as spacious and dynamic flexibility in connection to the speed of body movement. The spacious flexibility characterizes the ability of the body or certain parts of it to move or stretch for as far as possible in different directions. It is passive, active, and anatomical. The dynamic flexibility determines the ongoing movements for folding or stretching with a high as well as low amplitude.

The main means for flexibility development are physical exercises with boosted amplitude. They could be active movements (simple, bouncing, reaching) and passive movements (executed with the help of a partner, under the athlete's own weight). The most frequently used method is the repetitive one with gradual increase in the amplitude of movements. In recent years, the most popular practice when it comes to developing flexibility are the so called stretching exercises.

### **1.6. Working hypothesis**

The data shows that the organized mandatory sport activities of students in schools average to only 87 minutes per week, which is way less than the minimum of around 190 minutes average weekly sport activities according to the National association for sports and physical education in the United States (2006) and the recommended by the World health organization (2010) 60 minutes daily.

From the shown facts and their analysis it is logical to conclude that since the school programs cannot offer more and better motor activity to the students, it is only right to look for such, along with the spontaneous, purposefully organized motor activity in out of school time- before or after school, on weekends and during vacations (St. Kinov, 2014).

Taking under consideration the shown above, we came up with our working hypothesis as follows: we presume that through applying the developed by us program for extra motor activity out of class, we will improve the physical fitness of 15-16-year-old students.

## **CHAPTER TWO**

### **II. METHODOLOGY AND ORGANIZATION OF THE EXAMINATION**

#### **II.1. Purpose of the examination**

The purpose of the examination is through applying the out of class program developed by us to improve the physical fitness of 15-16-year-old students.

#### **II.2. Tasks of the examination**

1. Analysis of the condition and problems of physical education in high schools in the Republic of Bulgaria.
2. To examine and generalize the role and place of the out of class activity in physical education and sport according to the existing literature sources.
3. Conducting surveys with students and teachers.
4. Creating of a program for additional motor activity in out of class time for 15-16-year-olds.
5. Examination of the current physical fitness of students in the ninth grade at the beginning and end of the school year, after applying a program for its improvement.
6. Tracing of the changes in the motor qualities in the conducted experiment and their impact on the physical fitness of the examined students.
7. Results analysis. Conclusions and suggestions.

#### **II.3. Methodology of the examination**

##### **II.3.1. Contingent of the examination**

The selection of the examined individuals is random. Contingent of the examinations are 60 students (boys) in the ninth grade, distributed as follows:

1. Experimental group – 30 students distributed as follows:  
17 SCh „Damyán Gruev“ – 8 students; 88 SCh „Dimitar Popnikolov“ – 8 students; 15 SCh „Adam Mitskevich“ – 7 students; 57 SCh „St. Naum Ohridski“ – 7 students.
2. Control group – 30 students from 123 SCh „Stefan Stambolov“.

##### **II.3.2. Object of the examination**

Dynamic of the explored features after applying the experimental program for additional motor activity.

### **II.3.3. Subject of the examination**

The subject of the examination is the effect of the developed by us program on the physical fitness of 15-16 year old students. Comparing the received results of the experimental (EG) and the control (CG) groups.

### **II.3.4. Organization of the examination**

In the process of the organizational and survey activity, the following experimental examinations can be distinguished:

**Stage I** – From September 2020 until September 2021, the following activities were done:

- \*Study and analysis of the literature sources concerning the problem;
- \*Defining of the purpose and the work hypothesis of the examination;
- \*Creating a program for additional motor activity in out of class time for 15-16-year-old students.

**Stage II** – From September 2021 until June 2022, the following activities took place:

- \*Conducting surveys with students and teachers of physical education and sport, regarding the additional motor activity in out of class time;
- \*Defining of the controlled and experimental groups and updating the test battery;
- \*Researching the final condition of the physical fitness of students from both groups;
- \*Direct partaking in the execution of the educational training activity with the experimental group;
- \*In the work process, perfecting the program for additional motor activity in out of class time for 15-16-year-old students;
- \*Organization and conducting of the final experiment;
- \*Putting down and analyzing the expected changes in the physical fitness of students from EG and CG.

**Stage III** – From June 2022 until October 2022, the following activities were done:

- \*Mathematical statistics;
- \*Analysis and summary of the data from the examinations.
- \*Making conclusions and recommendations, forming of the dissertation.

### **II.4. Methods of the examination**

For the resolving of the given tasks, the following scientific methods were used:



1. Research and analysis of the literature sources
2. Discussions
3. Survey
4. Pedagogical observation
5. Pedagogical experiment
6. Anthropometric method
7. Sport pedagogical testing
8. Math statistical methods

We measured the final level of physical fitness of students with a testing battery, which includes 3 anthropometric indicators and 11 tests of physical fitness. The tests are borrowed from „The system for assessment of the physical capability of students from I to XII grade“ MON, NSA (2019) and from McKenzy (2011). The methods of testing is applied in both of the groups – EG and CG (table 1).

For establishment of the effect of impact of the applied new methodology for physical fitness of the students, at the end of the experimental period a second examination is conducted with the control and experimental groups. The purpose is to compare the results of the two examinations and the changes that occurred which would prove or deny our working hypothesis.

The data of the examination were a subject of statistical processing by a specialized computer software – IBM „SPSS“ 19 and Excel. A variable, correlational, and comparing analysis were applied in accordance with the tasks of the experiment conducted by us (V. Gigova, 1999, 2009; K. Kalinov, 2010; R.A. Abdul & T.K. Chuan, 2004).

The variable analysis aims to ascertain the average level ( $X$ ), the varying level, and the uniformity of the examined indicators:

- $X$  – average arithmetical indicator;
- $X_{\min}$  – minimal value of the indicators;
- $X_{\max}$  – optimal value of the indicators;
- $S$  – standard deviation
- $R$  – Width of the variation
- $V$  – coefficient of the variation in percentages;
- $(K-S)$  – coefficient of the distribution of the indicators according to Kolmogorov-Smirnov.

The comparing analysis is used for showing the existing differences between the average values of the indicators of the examined students and establishing the statistical worth of the effect of the program applied by us.

The t-criteria is used for dependent and independent sources and the corresponding guarantee possibility P(t).

**Table 1. List of the tests**

<b>№ of test</b>	<b>Name of the test</b>	<b>Measures</b>	<b>Accuracy</b>	<b>Direction</b>
1.	Standing height	Cm	1	+
2.	Weight	Kg	1	+
3.	Body mass index (BMI)	(kg) / (m) <sup>2</sup>	0,01	+/-
4.	Jump from one place on two feet	Cm	1	+
5.	Ball throwing – 3 kg	Cm	1	+
6.	Optimal amount of squats for 30 seconds	Amount	1	+
7.	Sitting down from a laying position 30 sec	Amount	1	+
8.	Agility test (T-rest )	Sec	0,01	-
9.	Test „Sit and touch“	Cm	1	+
10.	Running 30 m	Sec	0,01	-
11.	60 m sprint for men	Sec	0,01	-
12.	Step test for 3 min	Amount	1	+
13.	Running 200 m (shuttle running)	Sec	0,01	-
14.	Test „Stork“	Sec	0,01	-

The correlational analysis gives the opportunity to determine the level and direction of the statistical relation between the indexes of the examined indicators for physical fitness, received by the testing of the experimental group, as well as the reasons for their manifestation. The statistical indicators that are used are called correlation coefficients (r) and their value is always between -1 to +1. To establish the correlation connections we applied the coefficient of the ordinary line correlation of Pierson. The results of the correlation analysis are shown in correlational matrixes and figures.

## **II.5. Meaning of the program for out of class activity for 15-16 year old students**

The purpose of the developed by us program for additional motor activity is to improve the physical fitness of 15-16-year-old students. In relation to this, our intention is to better the accomplished results from working with the students by the established learning programs for physical education and sport in school.

We have additional aims with the idea of creating conditions and opportunities through the forms and means of the physical culture for the engaging of students in out of class physical exercises and sport:

1. Making popular the sport and the benefits for students from the healthy physical activity;
2. Increase in the number of students taking part in out of class forms and sport, taking under consideration the improvement of their physical fitness and functional condition;
3. Ensuring the opportunity for sport exercises under the supervision of qualified specialists;
4. Gaining of initial skills and habits in tasks with competitive nature;
5. The establishment of social qualities in students- abilities for team work, tolerance, leadership, discipline, confidence, fair play;
6. Providing of sport tools for conducting the tasks;
7. The use of the sport as prevention of violence and aggression among the students, against the digital revolution, alcohol abuse, cigarettes, drugs, and wrong eating habits;
8. Active media policy for popularizing the benefits of sport and physical activity, as a fundament for healthy lifestyle from an early age.

The annual distribution of the classes for the suggested program for additional motor activity can be seen at Table 2.

Training is distributed in total for one student year for two hours per week, 60 minutes each, while taking under consideration the days off and vacations in 2021/2022. A thorough thematic distribution of the training in the mentioned types of sports is shown on pages 14, 15, 16, 17 of the dissertation.

**Table 2. Annual distribution of the classes for training 15 and 16 year olds**

Content of the program	Months of training and educational activity										Total Hours
	9	10	11	12	1	2	3	4	5	6	
<b>Athletics</b>											<b>16 Hours</b>
1 <sup>st</sup> week		2							2		4
2 <sup>nd</sup> week		2							2		4
3 <sup>rd</sup> week		2						2			4
4 <sup>th</sup> week		2						2			4
<b>Football</b>											<b>16 Hours</b>
1 <sup>st</sup> week			2							2	4
2 <sup>nd</sup> week			2							2	4
3 <sup>rd</sup> week			2						2		4
4 <sup>th</sup> week			2						2		4
<b>Basketball</b>											<b>16 Hours</b>
1 <sup>st</sup> week				2	2	2					6
2 <sup>nd</sup> week				2	2						4
3 <sup>rd</sup> week				2	2						4
4 <sup>th</sup> week					2						2
<b>Volleyball</b>											<b>16 Hours</b>
1 <sup>st</sup> week							2				2
2 <sup>nd</sup> week						2	2	2			6
3 <sup>rd</sup> week						2	2				4
4 <sup>th</sup> week						2	2				4
<b>Tests</b>											<b>4 Hours</b>
1 <sup>st</sup> week											
2 <sup>nd</sup> week											
3 <sup>rd</sup> week										2	2
4 <sup>th</sup> week	2										2
<b>TOTAL:</b>	<b>68 Hours</b>										

## CHAPTER THREE

### III. ANALYSIS OF RESULTS

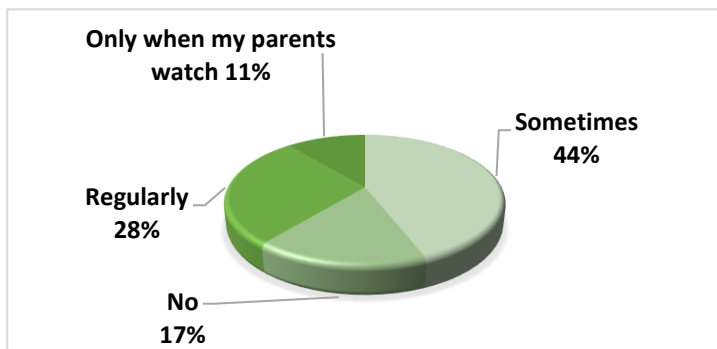
#### III.1. Analysis of the survey results

##### III.1.1. Questionnaire survey No. 1 with IX grade students.

The present study aimed to investigate the students' opinion on the implementation of the subject "Physical Education" in the Bulgarian school, as well as extracurricular sports activities. The survey method was used with a specially closed questionnaire consisting of 17 questions. The survey was conducted during the months of September and October 2021. The subjects of the study were 65 students (37 boys and 28 girls) from four secondary schools in the city of Bishkek. 17 „Damyán Gruev“ Secondary School (19 students), 57 „Sv. St. Naum Ohridski“ (15 students), 15 „Adam Mickiewicz“ Secondary School (14 students) and 88 „Dimitar Popnikov“ Secondary School (17 students). The obtained results are analyzed and presented on the basis of frequency (f) and percentage (%) analysis.

Of the students studied, 57% are boys and 43% are girls. All the students surveyed were in class IX and 5% of them were 14 years old, 52% were 15 years old, 40% were 16 years old and 3% were 17 years old at the time of filling the questionnaire.

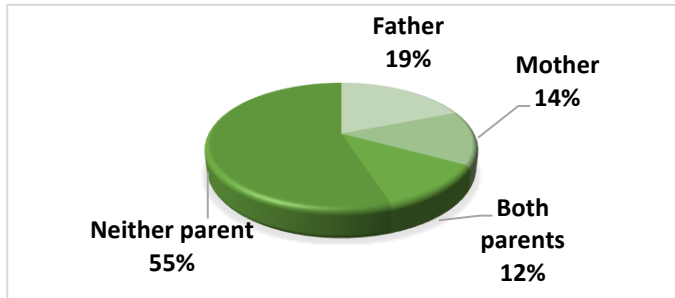
To the question, "Do you follow sports programs on the media?", 44% of students answered "Sometimes", 28% answered "Regularly", 17% answered "No", and 11% answered "Only when my parents watch" (Fig.1).



**Fig. 1. Question, "Do you follow sports programs on the media?"**

In the next question, "What is your parents' attitude towards sport?", 60% answered that their parents have a "Positive attitude towards sport", 9% answered that they have a "Negative attitude towards sport" and 31% answered that they have "No attitude towards sport".

When asked what we consider to be an interesting question, "Which of your parents is involved in sport?", 19% said "Father", 14% said "Mother", 12% said "Both parents" and 55% said "Neither parent" (Figure 2).



**Fig. 2. Question: "Which of your parents plays sports?"**

In the next question, "What interests do you have outside school?", 26% of the surveyed students answered - "Computers, Internet", 23% - "Sports", 17% - "Dancing", 12% - "Tourism", 8% - "Cinema, Theatre", 5% - "Fine Arts", and 9% indicated "Other" interests. On the positive side, sport ranks second with very close percentages with the answer "Computers, Internet".

To the question, "Are you convinced that physical activity is good for a person's health?", 79% of the surveyed students answered "Yes" and 21% "No opinion". No students answered "No".

To the next question, "Do you currently play any kind of sport?", it is pleasing to note that 28% answered "Yes", 37% answered "Yes, sometimes for fun", 21% answered "No, I have no free time", and 14% answered "No, I have other preferences". There were no answers - "No, due to lack of funds" (Fig. 3).

In response to the next question, "What form of sport training do you prefer?", 62% answered - "Class form (at school)", 23% - "Extracurricular form related to sport activities" and 15% - "Online form". None indicated - "Other" form (Figure 4).

Responses to the indicator question, "Why do you participate in PE and sport classes?" are shown in Figure 5.

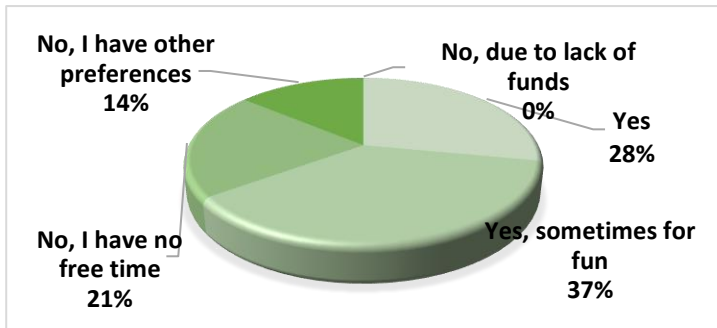


Figure 3. "Are you currently involved in any sport?"

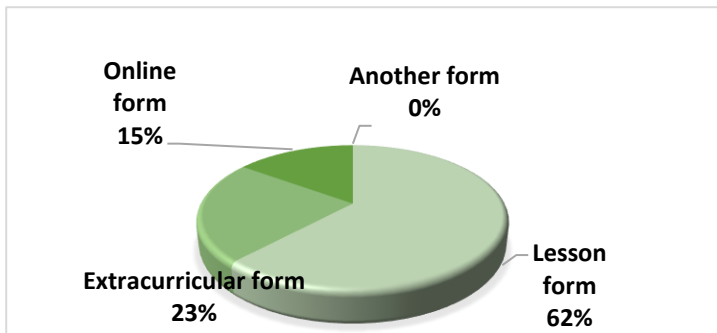


Fig. 4. Question: "Which form of sports education do you prefer?"

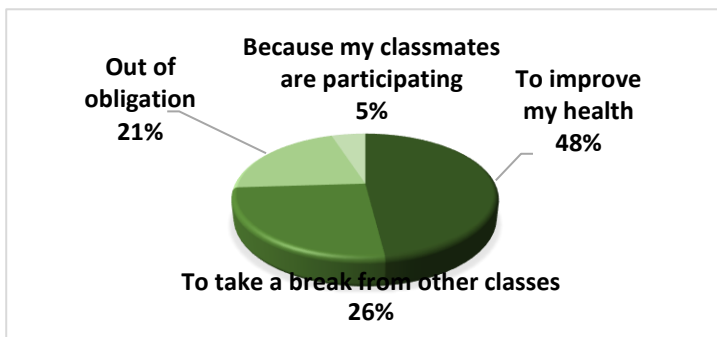
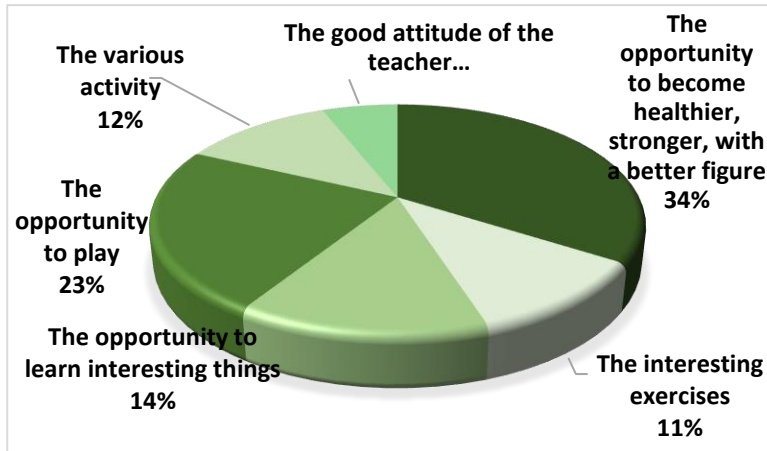


Fig. 5. Question: "Why do you participate in physical education and sport classes?"

48% of the surveyed students answered - "To improve my health", 26% - "To take a break from other classes", 21% - "Out of obligation" and 5% answered - "Because my classmates are participating" (Figure 5).

To what we consider to be the important question, "What do you like about the PE and sport lesson?" (Fig. 6).



**Fig. 6. Question: "What do you like about the PE and sport lesson?"**

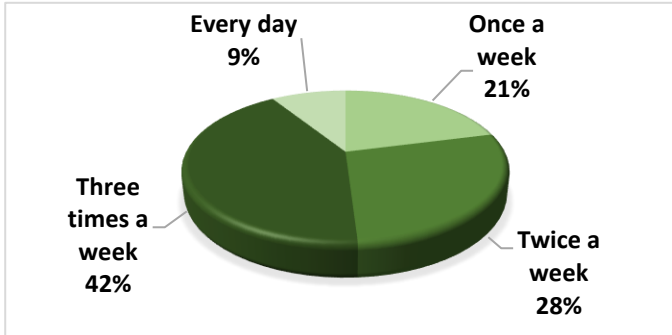
Students responded as follows: 34% - "The opportunity to become healthier, stronger, with a better figure", 11% - "The interesting exercises", 14% - "The opportunity to learn interesting things", 23% - "The opportunity to play", 12% - "The various activity" and 6% - "The good attitude of the teacher" (Figure 6).

To one of the most important questions, namely, "In your opinion, is the educational process in the subject of physical education and sport carried out fully?", the respondents answered as follows: 40% - "Fully", 22% - "Somewhat", 15% - "Satisfactorily", 14% - "No" and 9% answered - "Can not judge. 14% of the students who answered "No" to the previous question, answered as follows to our next question: if your answer is negative, the reasons according to you were: 56% answered - "Not serious enough attitude from classmates" and 44% answered - "The teacher was not motivated enough and was not at the required level". No respondents answered, "Lack of good facilities" or "Other".

To the question, "How many times a week do you want to have PE



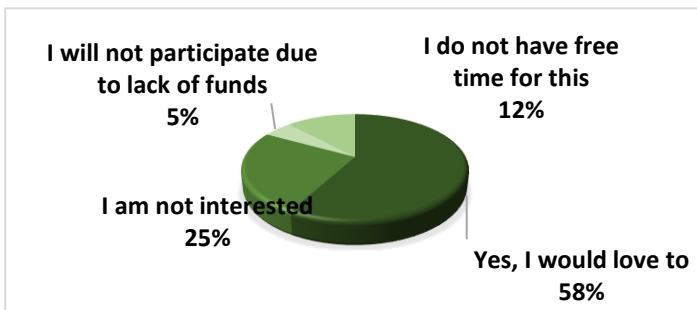
and sports activities in your school?", 9% answered "Every day", 42% answered "Three times a week", 28% answered "Twice a week", and 21% answered "Once a week" (Figure 7).



**Fig. 7. "How many times a week would you like to do PE and sport in your school?"**

On one of the last questions in the survey, "In your opinion, are the hours of sports at school enough to keep you physically active?", 46% of respondents answered "Yes, completely enough", 34% answered "You need additional sports activities outside school hours", and 20% answered "No".

As for the question, "Would you participate in additional sports activities outside school hours?", 58% of the students answer - "Yes, I would love to", 25% answer - "I am not interested", 12% answer - "I do not have free time for this" and 5% answer - "I will not participate due to lack of funds" (Fig. 8).



**Fig. 8. Question: sports activities outside school hours?"**

To the last question in the survey, "If your answer to the previous question is 'Yes,' for what purpose will you participate in these additional activities outside of school hours? ", the respondents who answered yes to the previous question (38 students - 58%) answered as follows: "To improve my physical fitness, for health, for a better figure" - 55%, "A varied activity that will help relax and unwind from the learning process" - 8%, "An opportunity to learn the technique of a sport" - 11%, "An opportunity to make new social contacts" - 13% and "Participation in exercises of a competitive nature" - 13%.

From the analysis of the students' opinions on the implementation of the subject "Physical Education" in Bulgarian schools, as well as the extracurricular sports activities, the following major conclusions and recommendations can be drawn:

1. The majority (60%) of the surveyed 15-16 year old girls and boys have a positive attitude towards sport. This is confirmed by the fact that 17% of them regularly follow sports programmes in the media and 44% do so sometimes, as well as by the fact that in 33% of young people one parent is involved in sport and in 12% of young people both parents are involved. Parents' involvement in sport can be seen as a positive example to their children and a way to encourage the younger generation to be active in sport.
2. 26% - computers and internet, 23% - sports, 17 - dancing, 12% - tourism, 8% - cinema, theatre, 5% - fine arts, and 9% indicated other interests.
3. Almost all students surveyed (79%) believe that physical activity is good for a person's health.
4. Against the backdrop of the two-year pandemic of Covid-19, and the overall immobilization of the younger generation observed worldwide, the low interest in sport is understandable. Only 28% of respondents are actively involved in sport and 37% play sport occasionally for pleasure.
5. The majority of students surveyed prefer the lesson form of education (62%). The extracurricular form related to sports activities is preferred by 23% and 15% are for online learning.
6. Surveyed students participate in physical education classes to improve their health (48%) and to unload from other classes (26%).
7. In terms of what they like about PE class, the opportunity to become healthier, stronger and fitter is at the top of their list (34%). Students then ranked the opportunity to play (23%), the opportunity to learn interesting things (14%), the variety of activities (12%), interesting exercises (11%) and the teacher's good attitude (6%).

8. According to 40% of the students surveyed, the teaching and learning process in the subject of physical education and sport is "completely" meaningful. According to 22%, it is "partly" fully conducted, and according to 15% it is "satisfactorily" conducted. 14% of the students are of the opinion that it is "not" fully conducted, mainly because of the insufficient serious attitude of the classmates and because the teacher was not motivated enough and was not at the required level.

9. In spite of all the difficulties they face nowadays, students understand that playing sports is important - 42% of them are willing to do PE and sports at school three times a week, 28% twice a week and 9% every day.

10. The attitude of students towards participation in extracurricular activities in order to maintain physical activity is also indicative - 34% of students believe that additional sports activities are needed outside school hours, while 46% of respondents believe that sports hours at school are quite sufficient.

11. Supporting the positive attitude towards extracurricular activities is the fact that 58% of the surveyed students would be happy to participate in additional sports activities outside school hours in order to improve physical fitness for health and a better figure (55%), an opportunity to create new social contacts (13%), participation in exercises of a competitive nature (13%), an opportunity to learn about the technique of a sport (11%) and a variety of activities that will help relax and unwind from the learning process (8%).

The present survey examines the opinion of the students about the implementation of the subject of Physical Education in schools and the need for extracurricular activities in sports among young boys and girls aged 15-16 years. This supports our hypothesis about the need for extracurricular sports activities and their positive impact on students' physical fitness.

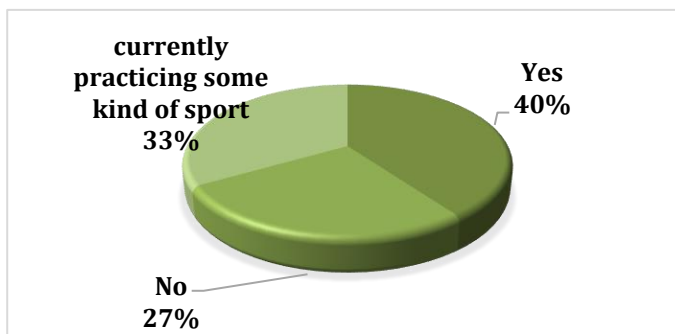
### **III.1.2. Survey No. 2 with teachers of subjects other than physical education and sport (Annex 2).**

Our survey aimed to investigate the opinions of teachers of subjects other than PE and sport on the state and ways of improving PE and sport in Bulgarian schools. In this way we wanted to consider a different perspective of teachers working in secondary education.

A specially designed closed questionnaire consisting of 12 questions was designed according to the nature of the study. The survey took place in October 2021. The subjects of the study were 30 teachers working in the following 6 schools in the city of Bishkek. 17 "Damyana Gruev" Secondary School, 123 "Stefan Stambolov" Secondary School, 57 "St. St. Naum

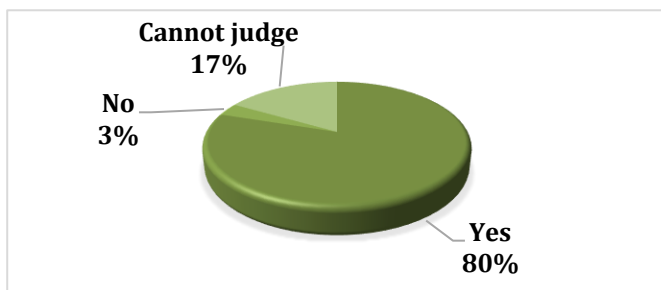
Ohridski, 147 Primary School "Yordan Radichkov", 52 Primary School "Tsanko Tserkovski" and 88 Secondary School "Dimitar Popnikov". The obtained results are analyzed and presented on the basis of frequency (f) and percentage (%) analysis.

Out of the total number of teachers surveyed, 40% of them responded that they have been involved in some kind of sport over the years, 33% are currently practicing some kind of sport, and 27% have never been involved in any sport (Fig. 9).



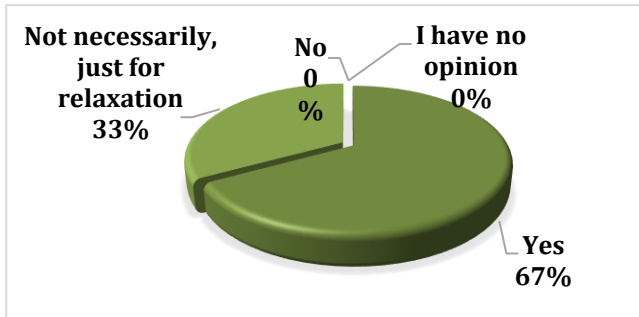
**Fig. 9. Have you been active in any sport?**

To the question "Do you think that the young generation in Bulgaria suffers from immobility and obesity?", 80% of the surveyed teachers answered positively, 3% answered negatively, and 17% with "Cannot judge" (Fig. 10).



**Fig. 10. Do you think that the young generation in Bulgaria suffers from immobility and obesity?**

When asked the next question, "Do you think students should play sports?", 67% answered "Yes" and 33% answered "Not necessarily, just for relaxation". No respondents answered "No" and "I have no opinion" (Figure 11).



**Figure 11. Do you think students should play sports?**

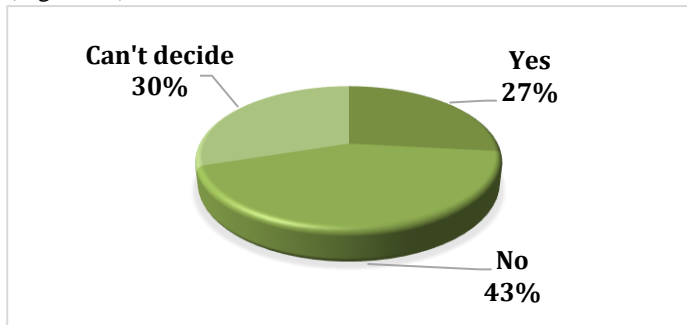
To the next question, "In your opinion, what is the purpose of physical education and sports classes at school?", 30% answered "For relaxation", 27% - "For the physical development of students", 23% - "To improve the health condition of students", and 10% each answered "To acquire knowledge and skills for a particular sport" and "Will support the integration, social activity and engagement of students". No respondents answered "Cannot judge".

To the important question, "In your opinion, are students motivated enough to attend PE and sport classes at school?", 47% answered negatively, 33% considered that students "Attend classes out of obligation" and only 20% answered positively.

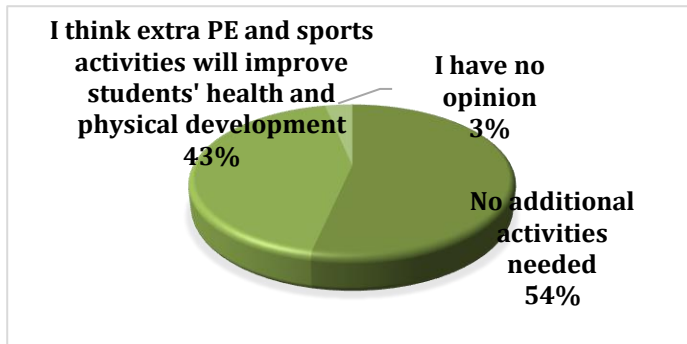
A large percentage of the teachers surveyed - 43% answered "No", 27% "Yes", and 30% "Can't decide" to the next question of the survey, "Is the PE and sport curriculum at school sufficient?" (Figure 12).

In response to the indicator question, "What do you think about students participating in extra PE and sports activities outside of school hours?", 54% of teachers surveyed responded, "I don't think extra activities are necessary", 43% responded, "I think extra PE and sports activities will improve students' health and physical development", and 3% responded, "I have no opinion"

(Figure 13).



**Fig. 12. Is the physical education curriculum sufficient?**



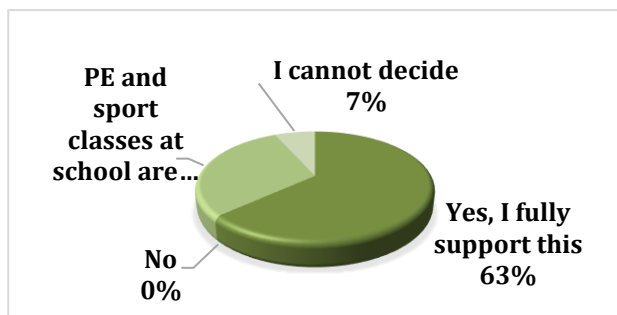
**Fig. 13. What do you think students participate in additional physical education and sport activities outside school hours?**

To the question "To what extent, in your opinion, the physical qualities of students are formed in physical education and sports classes at school?", 13% answered - "To a very high degree", 33% - "To a high degree", 47% - "To a low degree", and 7% - "I cannot judge".

To another interesting question, "To what extent, in your opinion, the physical qualities of students are formed in activities outside school (training, sports groups)?", 17% answer - "To a very high degree", 63% answer - "To a high degree", 13% - "To a low degree", and 7% answer - "I cannot judge".

To the question "Would you participate in the implementation of projects related to sport in school and outside?", 43% of the teachers responded with "Yes, I would participate", 54% responded with "Not in my field, I have no interest", and 3% responded with "I do not see the point".

To the last question, "Do you think health education is needed to provide students with the knowledge, attitudes, skills and experiences for healthy eating and physical activity throughout life?", teachers responded as follows: 63% - "Yes, I fully support this", 30% - "PE and sport classes at school are enough" and 7% - "I cannot decide". No teachers answered "No" (Figure 14).



**Fig. 14. Do you think health education is needed to provide students with the knowledge, attitudes, skills and experience to healthy eating and physical activity throughout life?**

From the analysis of the opinions of teachers in subjects other than Physical Education and Sport, the following major conclusions and recommendations can be drawn:

1. 33% of the teachers surveyed are currently practicing a sport, 40% have been involved in some type of sport over the years, and 27% have not been involved in any sport.
2. A very high percentage of respondents (80%) believe that the young generation in Bulgaria suffers from immobility and obesity. In this regard, 60% of the respondents, believe that students should do sports at all costs, and 33% believe that sports should not be compulsory, but only for relaxation.

3. According to the teachers, the purpose of PE and sports classes at school is for relaxation (30%); for students' physical development (27%); to improve students' health (23%), to acquire knowledge and skills for a particular sport (10%) and to support students' integration, social activity and engagement (10%).
4. Almost half of the teachers surveyed (47%) believe that students are not motivated enough to attend PE and sport classes at school. Another minority (33%) believe that students attend classes out of obligation, and only 20% believe that students are sufficiently motivated.
5. Not a small percentage of the teachers surveyed (43%) felt that the physical education and sport subject syllabus at school was insufficient. Only 27% think that it is sufficient, and 30% have no opinion on the matter, which, in our opinion, is caused by the fact that these are teachers who do not teach this discipline.
6. 54% of teachers are of the opinion that additional PE and sport activities are not necessary outside school hours, and the other half (43%) of teachers think that additional PE and sport activities will improve the health and physical development of students.
7. Teachers' opinions on how students' physical qualities are formed in PE and sport classes at school are of interest - 13% of them think that they are formed to a very high degree, 33% think that they are formed to a high degree, and 47% think that they are formed to a low degree. The remaining 7%, could not judge.
8. The answers to the opposite question - how the physical qualities of students are formed in activities outside school (trainings, sports groups) are also interesting. Here 17% are of the opinion that they are formed to a very high degree, 63% think that they are formed to a high degree, and 13% think that they are formed to a low degree. And here the remaining 7% could not judge.
9. The greater number of respondents (63%), fully support the need for health education that provides students with knowledge, attitudes, skills and experiences for healthy eating and physical activity throughout life, while 30% are of the opinion that physical education and sports classes at school are sufficient in this guideline.



### III.2. Analysis of the results of the pedagogical experiment.

#### III.2.1. Variational and comparative analysis of anthropometric indices.

The analysis of the individual indicators of the variance analysis starts with the measurement data of the anthropometric indicators - height and weight, as well as the body mass index calculated on their basis at the beginning of the study (Table 3). It guides us to identify overweight or initial stages of increased overweight. This would help us in selecting exercises and methods of conducting the lessons so that they impact on the physical fitness of the students and lead to a change in the values of the index under consideration.

**Table 3. Variance analysis of anthropometric indices**

Experimental group											
№	Indicator	n	Xmin	Xmax	R	$\bar{X}$	S	V	K-S	As	Ex
1	Height 1	30	161	188	27	175,83	7,65	4,35	0,136	-0,333	-0,944
	Height 2	30	162	188	26	176,33	7,64	4,33	0,200	-0,394	-0,965
2	Weight 1	30	46	79	33	60,63	8,85	14,59	0,200	0,075	-0,828
	Weight 2	30	46	78	32	60,27	8,44	14,00	0,200	0,147	-0,818
3	BMI 1	30	16,7	24,2	7,5	19,52	1,79	9,15	0,200	0,739	0,359
	BMI 2	30	16,5	23,9	7,4	19,30	1,67	8,68	0,148	0,884	0,941
Control group											
№	Indicator	n	Xmin	Xmax	R	$\bar{X}$	S	V	K-S	As	Ex
1	Height 1	30	166	186	20	174,07	5,26	3,02	0,156	0,230	-0,548
	Height 2	30	167	186	19	174,27	5,17	2,96	0,169	0,309	-0,578
2	Weight 1	30	50	74	24	58,57	6,59	11,24	0,031	0,730	-0,423
	Weight 2	30	50	74	24	58,43	6,60	11,29	0,010	0,752	-0,409
3	BMI 1	30	16,3	23,1	6,8	19,29	1,50	7,76	0,200	0,420	0,360
	BMI 2	30	16,7	22,8	6,2	19,20	1,46	7,60	0,171	0,534	0,136

For the first parameter "Growth", the values of the experimental group (EG) were  $X_1 \text{ min} = 161 \text{ cm}$ ,  $X_1 \text{ max} = 188 \text{ cm}$ , mean ( $\bar{X}_1$ ) = 175.83 cm and standard deviation ( $S_1$ ) = 7.65, with range ( $R_1$ ) = 27 cm, and for the control group (CG) were  $X_1 \text{ min} = 166 \text{ cm}$ ,  $X_1 \text{ max} = 186 \text{ cm}$ ,  $\bar{X}_1 = 174.07 \text{ cm}$  and  $S_1 = 5.26$  and  $R_1 = 20 \text{ cm}$ . The difference between the means (1.76 cm) indicates that the two groups entered the study with almost identical results with respect to the parameter "Growth". The coefficient of variation confirms the homogeneity of both groups, finding that it is higher in the experimental group of students  $V\% = 4, 35$ . The values for the EG and CG

groups are normally distributed - Kolmogorov-Smirnov (K-S) test, where  $\text{sig.} > 0,05$ . According to the asymmetry (AS), the value of EG has a negative value, i.e., a drawn left shoulder. In the case of CG, the asymmetry has a drawn right shoulder (Table 3).

After the second study, the values of the parameter "Height" had a normal distribution - Kolmogorov-Smirnov test (K-S), where  $\text{Sig} > 0.05$  and changed - in the experimental group (EG) were  $X_2 \text{ min} = 162 \text{ cm}$ ,  $X_2 \text{ max} = 188 \text{ cm}$ , mean ( $\bar{X}_2$ ) = 176.33 cm and standard deviation ( $S_2$ ) = 7.64, with range ( $R_2$ ) = 26 cm, and for the control group (CG) were  $X_2 \text{ min} = 167 \text{ cm}$ ,  $X_2 \text{ max} = 186 \text{ cm}$ ,  $\bar{X}_2 = 174.27 \text{ cm}$  and  $S_2 = 5.17$  and  $R_2 = 19 \text{ cm}$ . The coefficient of variation confirmed the homogeneity of both groups after the second study. The coefficient (AS) had similar values to those in the first study, i.e., a retracted left shoulder in EG and a retracted right shoulder in CG were maintained (Table 3).

We can see that an increment of 0.50 cm (0.28%) was realized in the course of the experiment from the EG. It is supported by 100.0% probability of guarantee (Pt). From a statistical point of view, the increment realized by CG in the 2nd trial of 0.20 cm (0.11%) is also supported with a guarantee probability ( $P(t) = 98.83\%$ ).

Comparing the growth increments of the two groups ( $dEG = 0.50 \text{ cm}$  and  $dCG = 0.20 \text{ cm}$ ), found a difference of 0.30 cm, indicating that the growth increment of the EG students was larger, supported by a probability of guarantee = 98.55%. The low values for this indicator are explained by the short period of the study from October to May.

The analysis of the data in the next indicator "Weight" of EG and CG students are presented in (Table 3). The experimental group at the beginning of the study had the following values -  $X_1 \text{ min} = 46 \text{ kg}$ ,  $X_1 \text{ max} = 79 \text{ kg}$ , mean ( $\bar{X}_1$ ) = 60.63 kg and standard deviation ( $S_1$ ) = 8.85, with range ( $R_1$ ) = 33 kg, while in the control group they were -  $X_1 \text{ min} = 50 \text{ kg}$ ,  $X_1 \text{ max} = 74 \text{ kg}$ ,  $\bar{X}_1 = 58.57 \text{ kg}$  and  $S_1 = 6.59$  and  $R_1 = 24 \text{ kg}$ . The two groups were approximately homogeneous according to the coefficient of variation ( $V1EG = 14.59$ ;  $V1CG = 11.24$ ). The values for EG had a normal distribution (K-S = 0.200, where  $\text{sig} > 0.05$ ), whereas for CG the distribution was not normal (K-S = 0.031, where  $\text{sig} < 0.05$ ).

The same pattern repeated at the end of the experiment. The two groups were again approximately homogeneous according to the coefficient of variation ( $V2EG = 14.00$ ;  $V2CG = 11.29$ ). The coefficient (AS) had positive values similar to those in the first study, i.e., the right shoulder was

preserved in both groups (Table 3). The results obtained in the EG were -  $X_2$  min = 46 kg,  $X_2$  max = 78 kg, mean ( $\bar{X}_2$ ) = 60.27 kg and standard deviation ( $S_2$ ) = 8.44, with range ( $R_2$ ) = 32 kg, while in the control group they were -  $X_2$  min = 50 kg,  $X_2$  max = 74 kg,  $\bar{X}_2$  = 58.43 kg and  $S_2$  = 6.60 and  $R_2$  = 24 kg.

The comparative analysis showed that the EG improved its performance over the course of the study by reducing the mean weight of the group by  $d = - 0.37$  kg (0.60%), which was supported by a probability of guarantee = 99.09, i.e. the improvement achieved was statistically significant. The control group improved its performance within a statistically insignificant range of  $d = - 0.14$  kg (0.23%) at  $P(t) = 89.67$ .

For this parameter, we notice that the difference between the increments of the experimental and control groups is 0.23 cm. It is statistically insignificant due to the value of Stewart's t-criterion = 2.796 and the probability of guarantee  $P(t) = 86.55$ . The low values in this indicator are also explained by the short period of the study from October to May.

The next indicator is Body Mass Index (BMI). It is formed from the previous two and provides information about the students' healthiness. From the analysis of variance performed on the results of this indicator, it can be seen that the mean values of the studied students of the two groups (EG and CG), fall within the normal guardedness for their age between 19 and 25%.

The results at the beginning of the study are shown in Table 3. The mean value of EG was  $\bar{X}_1 = 19.52$  and that of CG was  $\bar{X}_1 = 19.29$  with a difference between them = 0.23. The distribution was normal in all groups (K-S) - Sig > 0.05) at the beginning and at the end of the experiment. According to the coefficient of variation, EG and CG were homogeneous with values ranging up to 10-12%.

After the 2nd testing, the EG students improved their scores ( $\bar{X}_2 = 19.30$  ;  $X_{min} = 16.50$  ;  $X_{max} = 23.90$  and  $S_2 = 1.67$  and  $R_2 = 7.40$ ), with an increment of  $d = -0.22$  (1.12%), with a probability of guarantee  $P(t) = 100.0\%$ , at  $\alpha < 0.05$ , confirming its reliability. In CG the situation was the same, the results were ( $\bar{X}_2 = 19.20$  ;  $X_{min} = 16.70$  ;  $X_{max} = 22.80$  and  $S_2 = 1.46$  and  $R_2 = 6.10$ ), an improvement of  $d = - 0.09$  (0.48%) was realized, confirmed by  $t = 2.624$ ,  $P(t) = 98.63\%$ , at  $\alpha < 0.05$ , which is also reliable (Table 3).

Comparing the increments of EG and CG after the second testing showed that the difference of 0.13 in favor of EG was statistically significant with a probability of guarantee  $P(t) = 97.50\%$ . This proves our hypothesis that

the additional extracurricular activity program we implemented had a positive effect on improving the body mass index scores of the experimental group.

### III.2.2. Variance and comparative analysis of physical fitness indices

We used variance and comparative analysis to analyze the results of physical fitness indices from the test battery (Table 1).

We used the two-legged standing long jump test to assess the explosive strength of the lower limb muscles of 15-16 year old students. The coefficient of variation values for both tests were  $V < 10\%$ , indicating to us that the groups were homogeneous. The distribution is not normal only in the first test of EG - jump 1, where  $(K-S) = 0.021$ ,  $\text{Sig.} < 0.05$ , the remaining values have a normal distribution. The span  $R = 70-71$  cm of the experimental group was 38 cm larger than that of the control group. The highest score was achieved by a student from the EG in the second study  $X_{\text{max}} = 246$  cm.

In order to follow the changes that occurred at the end of the experiment in the long jump from a place with two legs, we consider the improvement of the results of the studied students. EG increased her performance ( $\bar{X}_2 = 213.27$  cm and  $S_2 = 18.34$ ) by 1.43 cm with a probability of guarantee  $P(t)=100.0\%$ , and  $\alpha < 0.05$ , confirming the reliability of the increment. For CG, the results were ( $\bar{X}_2 = 183.23$  cm and  $S_2 = 7.63$ ). An increment of 0.33 cm was also realized, which was confirmed by  $P(t)=99.77\%$ , with  $\alpha < 0.05$ . The improvement was significant, but it was in smaller dimensions compared to that of the experimental group (Table 4).

**Table 4. Comparative analysis of the indicator „Long jump from the spot“**

Jump from a place	I examination		II examination		d	d%	t	$\alpha$	P(t)
	$\bar{X}_1$	S1	$\bar{X}_2$	S2					
EG	211,83	17,98	213,27	18,34	1,43	0,68	-6,419	0,000	100,00
CG	182,90	7,46	183,23	7,63	0,33	0,18	-3,339	0,002	99,77
<b>Difference</b>	28,93		30,03		1,10				
<b>t</b>	8,141		8,283		4,498				
<b><math>\alpha</math></b>	0,000		0,000		0,000				
<b>P(t)</b>	100,00		100,00		99,99				

EG students improved their scores relative to other CG students by 1.10 cm. The 99.99% probability confirms that the resulting difference in mean growth is statistically significant. This gives us the right to claim that the extracurricular sports activity program we developed, further influenced in a positive sense the development of lower limb explosive power of the students (Table 4).

The next test that we will analyze is the "Throwing a solid ball - 3 kg". With it we assess arm and shoulder girdle strength.

The coefficient of variation shows that the values of all groups during the experiment are approximately homogeneous because V is between 10 - 30%. The distribution is normal (Sig > 0.05). The range, mean and standard deviation for EG were (R1EG = 610 cm,  $\bar{X}1EG = 623.33$  cm and S1EG = 132.39), for CG were (R1CG = 320 cm,  $\bar{X}1CG = 430.70$  cm and S1CG = 70.13). In this indicator, the high values of standard deviation are due to the large range in the two groups studied.

In the course of the experiment, EG improved its results ( $\bar{X}2EG = 626.97$  cm, S2EG = 132.96) with a realized increment  $d = 3.63$  cm. The increment was reliable ( $P(t) = 100.0\%$  and  $\alpha < 0.05$ ). For CG, the results were  $\bar{X}2CG = 432.43$  cm, S2CG = 70. The increment is  $d = 1.73$  cm, the probability of guarantee  $P(t) = 100.0\%$  and  $\alpha < 0.05$ , indicating that the difference is also statistically significant (Table 5).

**Table 5. Comparative analysis of the indicator „Throwing a dense ball – 3 kg“**

Dense ball	I examination		II examination		d	d%	t	$\alpha$	P(t)
	$\bar{X}1$	S1	$\bar{X}2$	S2					
EG	623,33	132,39	626,97	132,96	3,63	0,58	-9,586	0,000	100,00
CG	430,70	70,13	432,43	70,00	1,73	0,40	-4,833	0,000	100,00
<b>Difference</b>	192,63		194,53		1,90				
<b>t</b>	7,043		7,091		3,642				
<b><math>\alpha</math></b>	0,000		0,000		0,001				
<b>P(t)</b>	100,00		100,00		99,94				

Comparison of the mean increments of the experimental ( $dEG = 3.63$  cm) and control ( $dCG = 1.73$  cm) groups for this parameter showed that the difference of 1.90 cm was statistically significant confirmed by  $P(t)=99.94\%$ , with  $\alpha < 0.05$ . This leads us to assume that the arm and shoulder girdle strength of the EG students improved to a greater extent after the implementation of our experimental after-school activity program at the expense of CG (Table 5).

We begin our analysis of the results for the Maximum Squats in 30 sec test by noting that we observed a decrease in the coefficient of variation (V%) for EG compared to the previous test. The values are in the range of 10-12 < V, i.e. the sample is homogeneous. For CG, the sample is approximately homogeneous because the values are in the range of 10 < V < 30. With this test, we assess the strength of the students' lower limb muscles. All groups

have a normal distribution according to Kolmogorov-Smirnov. The low values of the range (R) indicate the greater accessibility of this test.

The mean score of the students of the EG at the beginning of the study was 28.20 sec. At the end of the experiment, we have a statistically significant improvement of the mean achievement ( $\bar{X}$ ) by 1.40 pc, which is 29.60 pc guaranteed with  $P(t)=100.0\%$ . The improvement of the average achievement ( $\bar{X}$ ) of CG is 0.10 pcs. which is very small and statistically insignificant as indicated by the value of the guarantee probability  $P(t) = 91.69\%$ , i.e., it cannot be considered as an improvement (Table 6).

**Table 6. Comparative analysis of the indicator „Maximum number of squats in 30 s“**

Squat for 30 sec	I examination		II examination		d	d%	t	$\alpha$	P(t)
	$\bar{X}1$	S1	$\bar{X}2$	S2					
EG	28,20	1,88	29,60	2,22	1,40	4,96	-7,917	0,000	100,00
CG	20,30	3,05	20,40	3,08	0,10	0,49	-1,795	0,083	91,69
Difference	7,90		9,20		1,30				
t	12,064		13,266		7,012				
$\alpha$	0,000		0,000		0,000				
P(t)	100,00		100,00		100,00				

The hypothesis that by implementing an extra-curricular physical activity program we developed in after-school hours, the physical fitness of 15-16 year old students will improve is supported by the comparison of the increments in this test. The difference between the increments of EG and CG is 1.30 pc. It is supported by a 100% probability guarantee, making it statistically significant (Table 6).

"Occupation of sitting from supine position for 30 s" this is the test we used to measure the strength of the students' abdominal muscles. According to the coefficient of variation, the values of the experimental group in both tests were homogeneous ( $V1EY = 8.21\%$ ;  $V2EY = 7.19\%$ ). The control group in both tests was at the borderline of homogeneity ( $V1EY = 11.80\%$ ;  $V2EY = 10.44\%$ ). The distribution was normal in both groups for this parameter K-S - Sig > 0.05, only in the second measurement of abdominal crunches in EG the distribution of values was not normal.

The achievement gain of the EG students of 1.23 repetitions or 4.56% was confirmed with a significance level of  $P(t)=100.00\%$ . The CG students also showed a statistically significant performance improvement of 1.83 repetitions over the course of the experiment, but at a much smaller magnitude relative to the EG students (Table 7).

**Table 7. Comparative analysis of the indicator „Occupation of sitting from the supine position for 30 s“**

Sit ups	I examination		II examination		d	d%	t	$\alpha$	P(t)
	$\bar{X}1$	S1	$\bar{X}2$	S2					
EG	27,03	2,22	28,27	2,03	1,23	4,56	-9,280	0,000	100,00
CG	19,87	2,35	20,23	2,11	0,36	1,83	-3,003	0,005	99,45
Difference	7,16		8,03		0,87				
t	12,155		15,009		4,802				
$\alpha$	0,000		0,000		0,000				
P(t)	100,00		100,00		100,00				

The better results of the students in the experimental group at the end of the study are the result of the impact obtained during the training of our proposed experimental program of extracurricular sports activities. This is confirmed by the difference between the increments of EG and CG (0.87 repetitions), which is statistically significant at the probability of guarantee  $P(t)=100.0\%$  (Table 7).

The metric of interest for the study is the t-test. It measures the quality of students' agility. As can be seen from Tab. 18, the differences between the achievements of the EG and CG boys are relatively small, which is reflected in the values of the coefficients of variation V (VEG = 7.83 % and CG = 4.58 %) at the beginning of the experiment. At the end of the study, the values hardly changed (VEG = 8.02 % and VCG = 4.56 %). This allows us to claim that the groups of students studied are homogeneous in terms of agility. The range of R is also very low, confirming the above.

From Table 8, it can be seen that the EG students outperformed their counterparts from CG, in terms of the level of performance on this indicator. A more detailed analysis shows that the improvement for the experimental group is 0.11 s, which is supported by the probability guarantee ( $P_t = 100.0\%$ ). The increment of the control group was 0.02 sec. The guarantee probability ( $P_t = 93.84\%$ ) indicates that the improvement is not statistically significant.

Analysis of the mean increments ( $dEY = -0.11$  s;  $dCY = -0.02$  s) supported by the probability of guarantee ( $P(t) = 100.0\%$ ) proves that the difference of 0.09 s is reliable. This supports our hypothesis, and we attribute these results to the influence of the experimental extra-curricular activity program we implemented in EG, which contributes to a better development of the motor quality agility (Table 8).

**Table 8. Comparative analysis of „T-test“ indicator**

T-test	I examination		II examination		d	d%	t	$\alpha$	P(t)
	$\bar{X}_1$	S1	$\bar{X}_2$	S2					
EG	10,64	0,83	10,53	0,84	-0,11	1,01	9,923	0,000	100,00
CG	12,54	0,57	12,52	0,57	-0,02	0,16	5,968	0,000	93,84
Difference	-1,90		-1,98		-0,09				
t	-10,275		-10,660		7,672				
$\alpha$	0,000		0,000		0,000				
P(t)	100,00		100,00		100,00				

Flexibility measured using the "Sit and Touch" test tracks changes in hip joint and spine flexibility of students. According to the mean values from the analysis of variance, students in both groups at the beginning of the study ( $\bar{X}_{EY} = 9.53$ ;  $\bar{X}_{CY} = 7.20$ ) had a mean flexibility score according to B. McKenzie. According to the coefficient of variation in this index, the values of the experimental group are heterogeneous i.e. ( $V > 30$ ). For the control group, they are approximately uniform  $10 < V < 30$  (Table 20). Therefore, the spread in the EG ( $R = 16-17$ ) was significantly larger than that of the CG ( $R = 3-4$ ). The distribution of the values of EG and CG in this indicator at the beginning of the experiment was not normal ( $K-S - Sig < 0.05$ ).

With a 100.0% probability guarantee (Table 21), we can assume that the experimental program had a significant effect on students' quality flexibility. The mean value of the EG of 9.53 cm increased to 10.87 cm. There was a statistically significant increase ( $d = 1.33$  cm /13.99%). For CG students, the changes were approximately the same but in smaller sizes ( $d = 0.77$  cm /10.65%). They are also confirmed with a 100.0% confidence level (Table 9).

**Table 9. Comparative analysis of „Sit and touch“ indicator**

Sit and touch	I examination		II examination		d	d%	t	$\alpha$	P(t)
	$\bar{X}_1$	S1	$\bar{X}_2$	S2					
EG	9,53	3,13	10,87	3,01	1,33	13,99	-10,269	0,000	100,00
CG	7,20	0,96	7,97	0,96	0,77	10,65	-7,388	0,000	100,00
Difference	2,33		2,90		0,57				
t	3,907		5,019		3,409				
$\alpha$	0,000		0,000		0,001				
P(t)	100,00		100,00		99,88				

Our hypothesis is confirmed by the comparison of the increments of the experimental and control groups ( $d_{EG} = 1.33$  cm and  $d_{CG} = 0.77$  cm).



The difference of 0.57 cm was statistically significant confirmed by  $P(t) = 99.88\%$ , with  $\alpha < 0.05$  (Table 9).

The 30 m run test provides important information about the speed and explosive power of the students. The coefficient of variation for the two groups shows that the samples are homogeneous ( $10-12 < V$ ). The values of this index in the EG had a normal distribution ( $K-S > 0.05$ ), while in the CG the distribution at the beginning of the study was borderline normal, while at the end of the experiment it was not normal  $K-S < 0.05$ .

The students in the experimental group achieved the following results:  $X1 \text{ min} = 4.13 \text{ s}$ ,  $X1 \text{ max} = 5.1 \text{ s}$ , mean ( $\bar{X}1$ ) = 4.75 s and standard deviation ( $S1$ ) = 0.23, with range ( $R1$ ) = 1 s, while for the control group they were:  $X1 \text{ min} = 5.23 \text{ s}$ ,  $X1 \text{ max} = 7.7 \text{ s}$ ,  $\bar{X}1 = 6.12 \text{ s}$  and  $S1 = 0.48$  and  $R1 = 2.5 \text{ s}$ . According to the asymmetry (AS), the value of EG has a negative value, i.e., a pulled left shoulder. For CG, the asymmetry has a drawn right shoulder (Table 22). The difference between the means (1.37 sec) indicates that the EG group entered the study with a better score.

Analysis of this test shows that the improvement in EG is 0.03 s, which is supported by the probability guarantee ( $Pt = 100.0\%$ ). The increment in CG was 0.01 sec. The guarantee probability ( $Pt = 99.91\%$ ) indicates that the improvement is also statistically significant (Table 10).

**Table 10. Comparative analysis of the indicator „Sprint 30 m“**

30 m sprint	I examination		II examination		d	d%	t	$\alpha$	P(t)
	$\bar{X}1$	S1	$\bar{X}2$	S2					
EG	4,75	0,23	4,72	0,24	-0,03	0,57	8,475	0,000	100,00
CG	6,12	0,48	6,11	0,48	-0,01	0,13	3,694	0,001	99,91
Difference	-1,37		-1,39		-0,02				
t	-14,031		-14,144		4,932				
$\alpha$	0,000		0,000		0,000				
P(t)	100,00		100,00		100,00				

We attribute the low increment values to the narrow range of achievements that can be achieved in this test. We tracked the difference in mean increments between the two groups at the end of the experiment. It was 0.02 s in favor of the EG and was confirmed by the probability guarantee  $Pt = 100.0\%$  (Table 10).

The results of the 60 m sprint from place test for males, which brings information about the motor quality speed of the students, show an advantage of EG at the beginning of the experiment  $\bar{X} = 8.43 \text{ s}$ , against 9.58 s for CG. The coefficient of variation for the two groups shows that the samples are

homogeneous (VEG = 5.70%; VCG = 5.63%). The values of this indicator in CG had a normal distribution ( $K-S > 0.05$ ), whereas in EG the sample distribution was not normally  $K-S < 0.05$ . According to the asymmetry (AS), as in the previous test, the EG value has a negative value, i.e., a drawn left shoulder. The control group has a retracted right shoulder.

**Table 11. Comparative analysis of the indicator „60 m sprint from place for men“**

60 m sprint	I examination		II examination		d	d%	t	$\alpha$	P(t)
	$\bar{X}1$	S1	$\bar{X}2$	S2					
EG	8,43	0,53	8,35	0,54	-0,09	1,02	2,273	0,031	96,94
CG	9,58	0,55	9,55	0,54	-0,03	0,28	0,630	0,534	46,64
Difference	-1,14		-1,20		-0,06				
t	-8,231		-8,627		1,058				
$\alpha$	0,000		0,000		0,294				
P(t)	100,00		100,00		70,57				

The results of the 60 m sprint test for men at the second measurement marked a more significant improvement in the EG by 0.09 s, confirmed by (Pt = 96.94%), while in the CG the improvement by 0.03 s was insignificant at the probability guarantee (Pt = 46.64%). We attribute the low increment values to the narrow range of performance that can be achieved on this test, and the short time to impact on students' quality speed (8-9 months). At the end of the experiment, there was no significant difference between the mean increments of the two groups (Table 11).

The next metric was the "Step Test in 3 min". The purpose for which we used this test was to follow the development of the cardiovascular system of the students. Analyzing the test results, we report an initial mean value of 128.40 bpm for EG students, which if we compare it with that of CG (135.33 bpm) is better in terms of achievement with 6.93 bpm less (Table 26). The coefficient of variation shows that the values of the two groups during the experiment are homogeneous because  $V < 10 - 12\%$ . The range and standard deviation in EG were ( $R1EG = 24$  bpm and  $S1EG = 6.92$ ), in CG were ( $R1CG = 20$  bpm and  $S1CG = 5.37$ ).

The analysis shows that the students of the experimental group achieved in this indicator in the second testing an average of 124.53 ud/min, which is a realized improvement of the result by 3.87 ud/min less. The guarantee probability Pt = 100.0% confirms this claim of ours. The students in the control group also achieved a score improvement of 2.06 ud/min less, with Pt = 100.0% again (Table 12).

**Table 12. Comparative analysis of „Step test in 3 min“ indicator**

Step test in 3 min	I examination		II examination		d	d%	t	$\alpha$	P(t)
	$\bar{X}_1$	S1	$\bar{X}_2$	S2					
EG	128,40	6,92	124,53	6,95	-3,87	3,01	12,793	0,000	100,00
CG	135,33	5,37	133,27	5,42	-2,06	1,52	5,012	0,000	100,00
Difference	-6,93		-8,73		-1,80				
t	-4,339		-5,429		3,521				
$\alpha$	0,000		0,000		0,001				
P(t)	100,00		100,00		99,91				

The results shown in (Table 12) allow, with a high probability guarantee ( $P_t = 99.91\%$ ), to reject the null hypothesis and accept as true our alternative hypothesis. This means that the observed difference of (1.81 ud/min) between the mean increments of the two groups is significant. The evidence for this statement is the value of the comparison criterion  $t = 3.521$ , which is higher than the critical value.

The analysis of the values for the 200 m (shuttle run) test shows that the ES students, as a population, achieved a mean value of 35.83 sec for this indicator. However, it is noteworthy that there are students in the experimental group who have very high achievements. This is evidenced by the minimum values of  $X_{min} = 32.75$  sec. At the same time, in the control group the best achievement of the students is  $X_{min} = 38.18$  sec, which is 5.43 sec slower. However, the observed large difference, did not significantly affect the variability of the indicator, which was lower than 10% in both groups. This means that the maximum and minimum values reached are the exception and most of the cases are concentrated around the arithmetic mean.

It can be argued that the study population of EG and CG students are homogeneous in terms of the values of this speed endurance indicator. The distribution in both groups according to Kolmogorov-Smirnov is normal ( $\text{Sig.} > 0.05$ ). The coefficient (AS) has negative values, i.e., the left shoulder is preserved in both groups.

The comparative analysis of the results of this test shows that both groups improved their scores statistically significantly at the end of the study (EG by -0.39 s; CG by -0.14 s), with  $P_t > 95.0\%$ . It should be noted that the improvement in the control group students was of smaller magnitude (Table 13).

The last of the tests used was the Stork test. The purpose of this test is to monitor the development of the ability to maintain an equilibrium state (balance) in a static position by students.

**Table 13. Comparative analysis of the indicator „200 m running (shuttle run)“**

200 m shuttle run	I examination		II examination		d	d%	t	$\alpha$	P(t)
	$\bar{X}1$	S1	$\bar{X}2$	S2					
EG	35,83	1,72	35,44	1,74	-0,39	1,08	9,435	0,000	100,00
CG	40,30	1,23	40,16	1,21	-0,14	0,35	3,634	0,001	99,89
Difference	-4,47		-4,72		-0,25				
t	-11,582		-12,209		4,401				
$\alpha$	0,000		0,000		0,000				
P(t)	100,00		100,00		100,00				

The coefficient of variation shows that the two groups were approximately homogeneous at the beginning of the experiment (VEG = 30.07%; VQG = 13.90%). The distribution was not normal in the experimental group (K-S = 0.002 < 0.05). In the control group (K-S = 0.161 > 0.05), indicating that the distribution was normal. The range, mean and standard deviation in EG were (R1EG = 51 s,  $\bar{X}1EG = 42.07$  s and S1EG = 12.65), in CG were (R1CG = 17 s,  $\bar{X}1CG = 34.33$  s and S1CG = 4.77). According to Table 4, which is used to evaluate the balance in the Stork test, the score of the EG students is "above average", while that of the CG is "average".

We found that at the beginning of the experiment there was a statistically significant difference between the matched scores achieved by the experimental and control groups ( $\bar{X}1EG = 42.07$  s;  $\bar{X}1CG = 34.33$  s - the difference was 7.74 s). The guarantee probability P(t) = 99.66%, with  $\alpha < 0.05$ , indicates that the EG score at entry level is better than the CG score (Table 14).

**Table 14. Comparative analysis of „Stork“ indicator**

Stork	I examination		II examination		d	d%	t	$\alpha$	P(t)
	$\bar{X}1$	S1	$\bar{X}2$	S2					
EG	42,07	12,65	45,30	12,52	3,23	7,69	-16,510	0,000	100,00
CG	34,33	4,77	36,17	4,31	1,84	5,35	-9,251	0,000	100,00
Difference	7,74		9,13		1,40				
t	3,133		3,777		5,025				
$\alpha$	0,003		0,001		0,000				
P(t)	99,66		99,94		100,00				

Over the course of the study, there was a statically significant improvement in the EG score by 3.23 s ( $\bar{X}2EG = 45.30$  s), confirmed by P(t) = 100.00%, with  $\alpha < 0.05$ . At the same time, the CG students also showed a 1.84 s improvement in score compared to the first study ( $\bar{X}2CG = 36.17$  s), but in smaller magnitudes. To demonstrate the effectiveness of our

implemented extracurricular activity program in EG, we compare the increments of the two study groups at the end of the experiment. The increment of CG is 1.40 sec weaker than that of EG. The difference achieved at the expense of EG is statistically significant  $P(t) = 100.0\%$  (Table 14).

In conclusion, we can summarize that the program we developed for additional physical activity in extra-curricular time, had its positive impact on the development of the physical fitness indices of 15-16 year old students we studied.

### III.2.3. Correlation analysis of the studied indicators.

In our study we have used 14 indicators that are assumed to carry information about the nature of physical fitness. Under the influence of the targeted physical exercises included in our experimental program, a number of quantitative and qualitative changes occur among them, as a result of their mutual relationship and conditioning. A number of interesting correlations between the examined indicators of physical fitness of EG students (Fig. 15).

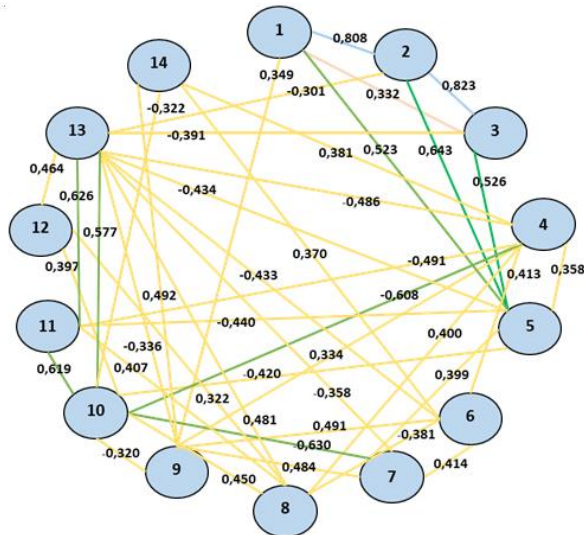


Fig. 15. Correlation-structure model in EG

1. Growth; 2. Weight; 3. BMI; 4. Long jump from place; 5. Throwing a solid ball - 3 kg; 6. Maximum number of squats in 30 sec; 7. Seated sit-up from supine position for 30 sec (abdominal crunches); 8. T-test; 9. Sit and touch;

10. Run 30 m; 11. 60 m sprint from spot; 12. Step test for 3 min; 13. 200 m run (shuttle run); 14. Stork.

Body mass index had a high correlation with weight ( $r = 0.823$ ) and a moderate correlation with height ( $r = 0.332$ ), which is normal since BMI is determined from weight and height values. We observe a large correlation between weight and height of the studied students ( $r = 0.808$ ), which is logical. We notice some correlations between anthropometric indices and those that carry information about the state of motor skills. Height, weight and BMI have a significant correlation with the indicator "Throwing a solid ball - 3 kg", having a result in the range ( $r$  from 0.5 to 0.7). We can argue that at this age, the three anthropometric indicators are of major importance in achieving a better result in this indicator and significantly influence the development of arm and shoulder girdle strength. Height has a moderate correlation ( $r = 0.349$ ) with the Sit and Touch flexibility indicator. The other two anthropometric indicators "Weight" and "Body Mass Index" have a moderate inverse correlation with the indicator "Run 200 m - shuttle run" (Fig. 15). This is also a logical result, higher weight respectively BMI, lead to lower scores.

"Long jump" has moderate correlations with "Throwing a solid ball" ( $r = 0.358$ ); "Squatting for 30 sec" ( $r = 0.413$ ); 'Sit and Touch' ( $r = 0.334$ ) and with the 'Stork' indicator ( $r = -0.381$ ), as well as downward moderate correlations with the 'T-test' ( $r = -0.400$ ); 'Men's 60m Sprint from Place' ( $r = -0.491$ ); '200m Shuttle Run' ( $r = -0.486$ ) indicators. We note a significant inverse correlation ( $r = -0.608$ ) between the 'Long Jump' and the '30 m Run' metric. The listed correlation coefficients indicate that the greater the lower limb explosive strength, the better the performance in sprinting, 200 m shuttle run, arm and shoulder girdle strength, agility and flexibility (Fig. 15).

For the 'Throwing a solid ball' indicator, a moderate upward correlation with the abdominal presses ( $r = 0.399$ ) came to the fore, as well as moderate downward correlations with the '30 m sprint' ( $r = -0.420$ ); '60 m sprint from place for men' ( $r = -0.440$ ) and '200 m shuttle run' ( $r = -0.434$ ) indicators. We can infer that performance in sprint tests and speed endurance depends inversely proportional to arm and shoulder girdle strength, while the same strength affects abdominal musculature strength in direct proportion.

Lower limb strength - Maximum squats in 30 sec test has a moderate upward correlation with the Abdominal Presses test, the Sit and Touch test and the Stork test, and a moderate downward correlation with the T-test and the 200 m shuttle run. This is logical, arm and shoulder girdle strength,

greater abdominal muscle strength and flexibility are prerequisites for higher performance in this indicator. On the other hand, lower limb muscle strength positively influences the qualities of agility, speed endurance and balance (Fig. 15).

The test "Sit-up from supine position for 30 s" (abdominal crunches) has a moderate correlation ( $r$  from -0.3 to -0.5) with "Throwing a solid ball", "Maximum number of squats for 30 s" and "Sit and touch", as well as a significant inverse correlation with sprint running for 30 m. ( $r = -0.630$ ) and moderate inverse correlation ( $r = -0.358$ ) with "200 m shuttle run" (Fig. 15). Greater abdominal muscle strength aided in achieving better sprint and speed endurance test results.

For the T-test, we report a moderate inverse correlation with the long jump from a standing position ( $r = -0.400$ ), with the number of squats in 30 s ( $r = -0.381$ ) and with the abdominal press test ( $r = -0.300$ ). All of these metrics represent different types of strength, so we can talk about a correlation between strength and agility, which in turn leads to improved results on the T-test. It should be noted that there is also a moderate correlation between the T-test and the 30 m run ( $r = 0.450$ ), 60 m sprint ( $r = 0.407$ ), 3 min step test ( $r = 0.322$ ) and 200 m shuttle run ( $r = 0.481$ ), i.e. there is an upward relationship between agility, speed and endurance.

The quality of agility - sit and touch test was moderately correlated ( $r = 0.349$ ) with the height indicator, with the long jump ( $r = 0.334$ ), with the number of squats in 30 s ( $r = 0.491$ ), with the abdominal press test ( $r = 0.484$ ), with the Stork test ( $r = 0.492$ ) and in moderate inverse correlation with the 30 m run ( $r = -0.320$ ) and with the 200 m shuttle run ( $r = -0.336$ ). The 30 m and 60 m sprints were significantly upwardly correlated ( $r = 0.5$  to  $0.7$ ) with the 200 m shuttle run. From the obtained results shown in the correlation matrix, we report a moderate inverse relationship between speed endurance and all other test battery metrics, with only the "T-test" and the "Stork" test showing a moderate upward relationship (Fig. 15).

The correlations found, undoubtedly confirm the effectiveness of the tools and methods used in the EG of the extra motor activity program we implemented in extra-curricular time. They contribute to the improvement of structural interrelationships between such motor qualities as: strength, explosiveness, speed, endurance, flexibility and agility. The correlations that emerge at the end of the study will assist teachers in selecting exercises to develop the relevant muscle groups and motor qualities.

## **IV. CONCLUSIONS AND RECOMMENDATIONS**

### **IV.1. Conclusions**

The results obtained from the survey with 15-16 year old students show some interesting trends regarding the implementation of the subject "Physical Education" in Bulgarian schools, as well as extracurricular sports activities.

1. The majority of girls and boys surveyed (60%) have a positive attitude towards sport. This is confirmed by the fact that 17% of them regularly follow sports programmes in the media, and 44% do so sometimes, as well as by the fact that in 33% of young people one parent is involved in sport, and in 12% of young people both parents are involved. Parents' involvement in sport can be seen as a positive example to their children and a way to encourage the younger generation to be active in sport.

2. It is gratifying to note the second place that sport occupies among the interests that respondents of this age have outside school: 26% - computers and the Internet, 23% - sports, 17 - dancing, 12% - tourism, 8% - cinema, theater, 5% - fine arts, and 9% indicate other.

3. Against the backdrop of the two-year pandemic of Covid-19, and the overall immobilisation of the younger generation observed worldwide, the low interest in sport is understandable. Only 28% of respondents are actively involved in sport and 37% play sport occasionally for pleasure. A worrying result is that 21% have no free time for sport and 14% have other preferences.

4. The positive attitude towards extracurricular activities is significant, as 58% of the surveyed students would be happy to participate in additional sports activities outside school hours, in order to improve physical fitness for health and better figure (55%), the opportunity to create new social contacts (13%), participation in exercises of a competitive nature (13%), the opportunity to learn the technique of a particular sport (11%) and a variety of activities that will help to relax and unwind from the learning process (8%).

The results of the second survey show the attitudes towards sport of teachers of subjects other than PE and sport, as well as their views on the need for additional extra-curricular sport activities. The following major conclusions can be drawn:

1. A very high percentage of the teachers surveyed (80%) believe that the young generation in Bulgaria suffers from immobility and obesity. In this regard, 60% of them believe that students should do sports at all costs, and 33% believe that sports should not be compulsory, but only for relaxation.



2. Half of the teachers surveyed believe that students are not motivated enough to attend PE and sports classes at school. Another minority (33%) believe that pupils attend classes out of obligation.
3. A large percentage of teachers (43%), believe that the syllabus of physical education and sports at school is insufficient. Only 27% think that it is sufficient, and 30% have no opinion on the matter, which, in our opinion, is caused by the fact that these are teachers who do not teach this subject.
4. 43% of teachers are of the opinion that additional PE and sport activities are needed outside school hours, believing that this will improve the health and physical development of students.
5. The majority of the teachers surveyed (63%), fully support the need for health education that provides students with the knowledge, attitudes, skills and experiences for healthy eating and physical activity throughout life, while 30% are of the opinion that PE and sport classes at school are sufficient in this regard.

The analysis of our study proves the significance of our hypothesis and allows us to draw the following conclusions:

1. The statistical significance of the changes from the control studies occurred in EG, prove the effectiveness of our developed program of additional physical activity in extra-curricular time, which builds on the results achieved in physical education and sports classes at school.
2. On the basis of the results obtained, it was found that the students who attended the organized extracurricular sports activities according to the program we developed, improved in greater dimensions all the indicators of the tests conducted compared to the students from the control group and possessed a higher level of physical fitness.
3. The correlations found, undoubtedly confirm structural interrelations between motor qualities strength, explosive power, speed, endurance, flexibility and agility, which in turn can be used by teachers when choosing exercises to develop the relevant muscle groups.
4. The synthesized findings lead us to conclude that the aim and objectives of the study have been met and the main working hypothesis has been confirmed. Our proposed program provides an opportunity to combat the emerging negative trend in recent years of declining physical fitness of students of all ages, further exacerbated by the existing Covid-19 pandemic.
5. The need for additional physical education and sports activities outside school hours is confirmed by the opinion of the teachers surveyed concerning the formation of physical qualities of students. Respondents

believe that students' physical qualities are formed mostly in activities outside school (training, sports groups).

#### **IV.2. Recommendations**

1. The main problem facing our society is that the young generation in R. Bulgaria suffers from immobility and obesity. Sport is one of the ways to avoid this big problem. It is not the first time that the opinion has been expressed that the physical education and sports curriculum at school is insufficient. In the development of extra-curricular forms of sport we see one of the opportunities for the purposeful and organised implementation of the tasks of physical education with children in their free time.

2. Participation in extracurricular sports activities would improve the physical fitness of pupils, give them the opportunity to make new social contacts, as well as participate in exercises of a competitive nature and, last but not least, help to unburden them from the educational process. It is precisely such forms of sporting activity that would contribute most to normalising the lives of young men and women in the aftermath of the Covid-19 pandemic.

3. Sporting activities would enable students to learn to make quick decisions, follow certain rules, exercise self-control over their behaviour by learning to manage their emotions and socialise. All this would help young people to prepare more quickly for the difficulties that await them after separation from their parents.

4. We appeal to the state institutions (mainly the Ministry of Education and the Ministry of Education) to organize discussions, round tables, seminars and conferences in order to find ways to finance and organize compulsory extracurricular sports activities, depending on the qualifications of the respective local physical education teachers, which will improve the health of students, reduce the risk of various addictions, protect young people from emotional problems and aggressive behavior.

5. To impose modern marketing approaches at the national and local level to overcome the weaknesses that are noticeable: the poor state of facilities for sports, ineffective information provision, low motivation and interest of adolescents, lack of established habits for sports activity, etc.

#### **V. CONTRIBUTIONS**

1. A survey was conducted with teachers of subjects other than Physical Education and Sport to explore their opinion on the state and ways of improving physical education and sport in Bulgarian schools. In this way we want to consider a different perspective.

2. A questionnaire survey was conducted with the students of class IX in order to study their opinion regarding the implementation of the subject "Physical Education" in Bulgarian school as well as extracurricular activities in sports.
3. A programme of extra-curricular physical activity was designed to build on the results achieved in the school PE and sport classes.

## **PUBLICATIONS RELATED TO THE THESIS**

**1. Ignatov, G., M. Yordanov (2022).** Study of teachers' opinion on the state of the subject physical education and sports in the Bulgarian school. *Trakia Journal of Sciences*, Vol. 20, No. 3, p.p. 210-220, Available online at: <http://www.uni-sz.bg>, ISSN 1313-3551 (online) doi:10.15547/tjs.2022.03.007

**2. Yordanov, M (2022).** Correlational structure of physical fitness of 15-16 year old students after implementation of an extra-curricular physical activity program. *Educational ideas and methodological paradigms - Proceedings in honor of the 60th anniversary of Prof. Dr. Dimitar Veselinov*. University Publishing House "Sv. Kl. Ohridski", ISBN 978-954-07-5567-0, pp. 332-341.

**3. Yordanov, M., G. Ignatov (2022).** Investigation of students' opinion on the subject of physical education in schools and extracurricular sports activities. *Fourteenth International Scientific Conference. Department of Sport. University of Physical Education and Sport, University of Science and Technology. 07-08. X. 2022. Proceedings. "Contemporary trends of physical education and sport"*. University Publishing House "Sv. Kliment Ohridski", ISSN 1314-2275.

**4. Yordanov, M. (2022).** Study of physical fitness indices of 15-16 year old students after applied program of additional physical activity in extra-curricular time. *Fourteenth international scientific conference. Department of Sport. Sofia University "St. 07-08. X. 2022. Proceedings. "Contemporary trends of physical education and sport"*. University Publishing House "Sv. Kliment Ohridski", ISSN 1314-2275.

