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DEVELOPING ENDURANCE IN SECONDARY SCHOOL STUDENTS THROUGH THE APPLICATION OF MEANS SPECIFIC TO ATHLETICS IN EXTRACURRICULAR ACTIVITIES

Speciality 533.04 - Physical education, sport, physiotherapy and recreation

Abstract of the PhD thesis in Educational Sciences

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TABLE OF CONTENTS

CONCEPTUAL RESEARCH MILESTONES

The topicality and importance of the topic

The importance of the optimal development of all motor skills in students - adolescents, including endurance, which in most cases is the most deficient, is stressed by all specialists in the field. Identifying the causes of poor development and appropriate remedies is a priority for them [48]. Also, specialists in the field, through a detailed review of the scientific literature, mention that, it has not yet been demonstrated that the system of multi-year training of students in secondary schools has been properly and sufficiently investigated.

At this age, the intellectual level of the child, makes him more receptive to new ways of transmitting knowledge, perfecting movement and achieving a motor and physical aesthetics. The secondary cycle results in the development of the locomotor substrate and the nervous system, which are necessary for learning complex motor skills and speed efforts. Through certain exercises, athletics and movement games can contribute to ensuring a multilateral and harmonious development [16].

One of the most important issues in the field of physical education and fitness is the development of endurance in young children. Resistance training in sport should contribute to strengthening the health of the younger generation, which is particularly important given the prevalence of hypokinesis in school-aged children [22].

Specialists consider that to achieve athletic performance in most tests, especially those involving long-distance cyclic motor activity, is impossible without a sufficiently increased level of endurance development. Currently, girls and boys aged 15 to 19 years can access increased athletic performance through resistance training, but this development will not lead to increased training, stopping the increase in performance, or stopping athletic activity [25]. Instead, it will be addressed through effective organization of the training process [8].

Mruț, 2022, states that running is the best way to combine the useful with promoting a healthy lifestyle. As civilization advanced, fewer and fewer people had to run to survive, which led to the development of new skills that allowed a person to survive. Now that these skills are more accessible, people can use their leisure time in a way that most people will find comfortable. Our ancestors would have seen these aspects as extremely harmful, if not lethal. Today's sports are characterised by rapidly increasing records, increasing intensity of training, intense competition and fierce rivalry between athletes. It takes more than 10 years of diligent practice, while adhering to an exercise programme, to achieve above-average sporting results [25]. The ability to exert effort can mature from an early age if all activities begin with light games and exercises that serve as a foundation before adding more intense effort [12, 6].

Most specialists in the field agree that leisure and recreational activities accompany the development of people's personalities. Games are a particularly great and useful form of activity, with multiple educational benefits for children and fun and rewarding benefits for adolescents and adults. Although the term "play" is associated with children, leading to a generic definition of the expression as "an activity specialized in the upbringing of children", people of all ages, according to experts in the field, play for both internal reasons (needs, urges, urges) and external reasons (leading to different actions) [15].

According to specialists in the field (Povestca, 2021), they state that the issue of efficiency, due to the increasing intensity, competition on the international stage and the setting of new world records for both men and women, the problem of improving the efficiency of the training and coaching process in the Endurance Running event has become more pressing in recent years. All this ultimately leads to a pressing need to address the issues of training efficiency through the rationalisation of specialised physical training. This will be achieved through the efficient development of the physical skills required for this test in Athletics, including: speed in an endurance regime, endurance in a speed regime, strength in an endurance regime and endurance in a speed regime - strength - combined motor skills are what determine performance in this athletic test. [20, 21, 23].

Looking at the motivation behind the choice of the theme, I was convinced that this theme best meets the developmental needs of children in secondary school, which is why I am interested. The completion of this thesis will help me to fully complete the theoretical and methodological training necessary for my future teaching activities. The theoretical part will help me to understand the current directions of athletics in secondary school, as well as the characteristics related to age and motor skills training. As it serves as a basis for general training and lays the foundation for the acquisition of motor skills in other sports, the training and development of elementary sports skills in athletics should be the main objective of the work of future sports teachers and coaches. The best way to address age-specific needs is through play, and children find it very engaging, their interest in movement games being another important reason for choosing the subject. The last and most important reason for choosing this theme is that we have been practicing competitive athletics for 9 years, and we consider the development of endurance in this sport to be an area that needs to be studied very carefully.

Also, 22 years of experience as a physical education and sports teacher and 9 years of athletics practice, endurance events (800, 1500, 3000 hurdles, 10 km march), are the basis for this study. The development of endurance at the secondary school level is an important factor both from a physiological point of view (development of cardio-respiratory capacity) and general motor skills.

Considering the motor and functional aspect, we consider that this motor quality, endurance, needs special attention at this age level. On the basis of the knowledge gained, we propose to develop an age-appropriate programme containing the most effective means.

The aim of the research is to identify the causes of insufficient development of motor quality endurance in secondary school students and to make the training process more effective in their development in extracurricular activities through the use of movement games and specific means.

Research objectives:

1. Literature review on aspects of resistance development in secondary school students.
2. Development and implementation of a resistance development programme for secondary school students based on the use of movement games.
3. Evaluation of the level of development and physical training of secondary school students.
4. To argue the effectiveness of the experimental program elaborated, based on the predominant development of resistance in movement games.

Research hypothesis: it was assumed that by designing and implementing a program aimed at developing endurance and based predominantly on movement games, optimally correlated with the fundamental means for its development - aerobic running - will contribute to the efficiency of the methodology for developing this quality and, implicitly, to increasing the functional capacities of children's bodies in full development, which influence it.

The objectives set for this study facilitate the investigative approach to achieve the goal and to demonstrate and verify the hypothesis. Thus, the analysis of specialized literature, the selection of the subjects who will participate in the experiment and the decision regarding the tests that will be used, are stages that define the first part of the research. Another task of the current work includes the initial testing of the subjects, the design of the training methods and the selection of the most suitable means that should be included in the training program. The present study includes the experimental application of the means in a training program that is aimed at optimizing the endurance capacity. This was followed by intermediate and final testing, the analysis and interpretation of the results and the write-up of the conclusions and practical recommendations.

Summary of research methodology and justification of chosen research methods

Scientific research methodology. The research was carried out on the basis of physical education theories and concepts as well as the morpho-functional peculiarities of secondary school students.

In this research I used the following research methods: bibliographic study, pedagogical observation, physical testing, pedagogical experiment, surveying, pedagogical experiment, statistical-mathematical data processing methods and techniques.

Scientific novelty and originality. The novelty consists in analyzing the impact of movement games introduced in the specially designed curriculum and used in extracurricular activities aimed at developing endurance in secondary school students. We developed a program that demonstrated the usefulness of developing endurance in secondary school students through extracurricular activities.

Theoretical significance it consists of theoretical argumentation regarding the importance of including movement games in the development of resistance in secondary school students, in the school curriculum and in physical education and sport classes.

The applicative value of the research is a key component of the thesis is that the results of the research can be applied as a standard method by PE and sport teachers in practical lessons with secondary school students, but also by coaches in athletics clubs.

Implementation of the scientific results was carried out in physical education lessons for secondary school pupils in the following schools: Liteni Secondary School and "Titu Maiorescu" Secondary School Iasi, as well as in other schools: Ciortești Secondary School, Iasi and the High School Comandor Alexandru Cătuneanu, Lunca Cetățuii, Iasi. The aim was to determine the situation of the research topic and to validate the experimental program for the development of endurance capacity in secondary school students by applying mean specific to athletics during extracurricular activities.

Volume and structure of the thesis: this work contains annotations in the following two languages: Romanian and English. The work also includes an introductory part, three chapters, general conclusions and recommendations, bibliographical list (200 sources), 35 appendices, 111 pages of contents, 32 figures and 10 tables. The research results have been published in 7 scientific articles.

Keywords: secondary school students, athletics, resistance development, recreational activities, movement games, extracurricular activities.

THESIS CONTENT

The PhD thesis is structured in three chapters. ***Chapter I*** contains the most relevant information from specialists in the field related to ***Theoretical foundations of the methodology for the development of moral qualities in children of different ages,*** *and more specifically aspects related to the morpho-functional peculiarities of pupils in the secondary school cycle*; aspects related to their age, as well as information related to physical and technical training.

The educational process brings subtle changes in the psychological growth of pre-teens. Observe more methodically and with purpose. Creative imagination develops. They memorize logically, but don't confuse main and secondary ideas. Schema is used for knowledge acquisition. They think logically and independently. They are expected to generalise and take a critical stance on what other people think. This leads to a tendency towards independence. Critical thinking is high, but not self-critical. The pre-teen has the ability to pursue a goal for a long time after setting it. They are particularly active. Loves sports, likes acts of courage and determination. There is a great interest in psychological health and the inner world. It is more difficult, but also more stable than it is more demanding, but at the same time more solid than the young schoolboy in terms of selecting friends. Pre-adolescence is usually a time of great searching and internal turmoil. They show that adolescents are looking for ways to integrate into adult society. During this period, nutrition is an important factor to be considered by coaches [9].

Part of the sports training that determines the general increase of the body's effort capacity, physical training is intended to support the technical content within the parameters of the competition regulations and, at the same time, to ensure the genetic basis of performance and stimulate the increase of the athlete's functional and morphological indicators. Physical preparation is achieved through a set of measures that guarantee a high level of functional capacity, including the development of basic and specific motor qualities, optimisation of morpho-functional indicators, mastery of the technical procedures used and optimal health. In athletics we can speak of general physical training and specific physical training, which aim to develop conditional capacities, such as strength, speed and endurance, and optimise coordinative capacities, i.e. balance, spatial and temporal orientation, rhythm and kinaesthetic sense.

In terms of the particularities of athletic training, regardless of the age at which participation in athletics begins, all athletes must go through four mandatory stages of training, which differ in content: the initiation stage, the athletic training stage, the socialisation stage and the performance training stage. Throughout these four stages, the process of preparing and training an athlete

experiences some discrepancies in terms of expectations of the tasks to be performed and the means used to accomplish them. The pedagogical complex of training, specialisation and development of the athlete adheres to all the principles, objectives and general training tasks. Tasks related to the main aspect of training should be carried out in an equitable manner, moving from one level to another only by careful consideration of each individual, based on the needs and capabilities of the young person at that stage. The role of the coach must be very well defined and scientifically based in the training process because to a large extent the performance of athletes depends on them, therefore, there must be optimal planning of training, use the most effective tools to improve the continuum of their motor, physiological and other potential.

"*As far as the phenomenon of education is concerned, it is not sufficient to simply juxtapose ideas about education from different sources, but it is necessary to interrelate and integrate all approaches into an interdisciplinary scientific model, capable of founding a specific science of education. Without the principle of interdisciplinarity, multidisciplinarity is meaningless and ineffective*" [14].

In recent years, the idea of using contemporary principles and technologies that will provide greater efficiency for classroom instruction, raising the bar for both motor training and health improvement, has been increasingly promoted in the field of physical education and sport. Current educational technologies for students in the context of sports and physical education lessons are based on discussions of some elements of sports culture, which aim to provide physical activity for the body as a necessary requirement for maintaining and strengthening the body's health. It is considered that traditional physical education lessons do not change the physiological functioning of the body's organ systems, do not train the heart and do not reduce the presence of cardiovascular risk factors, all of which play a crucial role in determining human existence and longevity. Numerous authors have established the scientific effectiveness of physical-athletic training methods in increasing the level of physical and psychological readiness, as well as functional readiness of students in middle and higher grades. Fewer investigations are carried out in primary school [10, 1].

One of the key factors in producing actions and motor acts that require significant effort is the degree to which the qualities of willpower, perseverance and hard work are manifested. Throughout school, we will focus on at least two tasks that can be accomplished at a curricular level to develop our body's effort capacity. As a result, at times when it is possible to hold classes outside, we will consider scheduling long runs at the end of each lesson, with time allocated for them to be completed progressively. This activity will serve as preparation for the assessment test "endurance running" over distances between 600 and 1000 metres with appropriate scales for each year of study [4].

The need for intensification, personalisation and diversification of physical education lessons has been highlighted by many studies in the literature. Effective methods have been used to optimise physical development. One of them proposed by renowned authors such as Moroșan, R and Moroșan, I. 2022, and reinforced by other studies is the circuit training method. These methods help to improve health and to spend time in the most useful and enjoyable way possible [11].

One of the most common forms of physical education activities are games. Despite the fact that they seemed to aim only at the fun-recreational side, they have always included educational content. They have an educational impact on both children and adults, in all seasons and at all ages [18].

The following skills are more easily developed through educational games: self-confidence, the ability to trust others, self-control, self-evaluation, self-awareness, the ability to reflect, the ability to adapt to new situations, tolerance, observation skills, verbal and non-verbal communication skills, the ability to resolve conflicts appropriately, creativity, etc. Undoubtedly, there are challenges that athletes face when using games as a teaching method, including cognitive challenges (cognitive dissonance, comprehension, action logic, operational perception), behavioural challenges, psychosocial challenges (relationship problems, stuttering, emotional blocks, failure, etc.), tactical challenges and adaptability challenges, to name a few. Active participatory teaching strategies encourage critical thinking in students. The process of introspection is effective and newly acquired knowledge can be used to tackle new problems or situations (a work-related strategy). In this way, the athlete actively participates in the introspection process, which is enhanced when coaches draw on their own knowledge and experiences.

In general, play is a natural, enjoyable, relaxing and exciting form of activity, as well as a unique educational environment that allows children to develop on all levels - physically, emotionally, intellectually and personally - becoming skilful, courageous, quick, firm and tenacious, while encouraging creativity, imagination, concentration and social integration (as long as the rules are followed) [3].

It is important to remember the primary characteristics of games, which are determined by their nature and the age of the child, as well as the complex developmental issues that arise, especially during puberty, when learning and education (both theoretical and practical) constitute the main form of activity, preparing the individual for adequate professional performance [7].

Specialists in the field are of the opinion that new approaches to the preparation process of secondary school students are currently needed for an effective preparation for sports reserves [3, 7, 89]. The growing concerns related to contemporary theory and practice call for a scientific program

and justification of the conduct of physical education classes in schools. The problem of finding the best methods to develop the endurance of secondary school students is an undeniable fact [24].

In developing endurance, of all types of games, we will focus on physical games, as they help students develop their skills and qualities. Physical games also encourage cooperation, teamwork and group integration, while respecting the rules of the game and the leader by making them responsible, imposing discipline and encouraging altruism [4].

Plyometric training in athletic training can also be referred to as plyometric training, which consists of fast and powerful movements preceded by preloading with counter movements that create stretching and shortening cycles that result in an increase in muscle strength. In addition, the authors also described plyometrics as activities that allow a muscle to reach maximum strength in the shortest possible time. Other authors describe plyometrics as "jump training" or a specialized high-intensity training technique that is used for strength development [13].

According to the experts, the training process is a comprehensive system in which specific features are developed at each stage of the athletes' training, and pedagogical activities are complemented by various features. In this respect, the specificity of training means is used which influence the direction of athletes' training or the specificity of sports training. Its phases, the application of the training "goal" are tasks expressed in terms of the age of the athlete, taking into account the anticipated results and sufficient physical preparation [1].

The second chapter is entitled Methodological foundations of the development of resilience in secondary school students and contains information related to the opinion of specialists in the field, the training program and information related to research methods, samples, tests and measurements applied, as well as information related to the organization of research.

We started from the ***hypothesis*** that by designing and implementing a program aimed at the development of endurance and based mainly on movement games, optimally correlated with the fundamental means for its development - aerobic running, we will contribute to the efficiency of the methodology for the development of this quality and, implicitly, to the increase of the functional capacities of the body of children in full development, which influence it.

Our main aim was to identify the causes of the insufficient development of the motor quality endurance in secondary school students and to make the training process more efficient with regard to their development in extracurricular activities through the use of movement games and specific means. And the main ***tasks*** were, to analyze the structure and content of the training process with focus on the Endurance Running events; to optimize the structure and content of the training methods used in the training of female secondary school students in a yearly cycle in extracurricular activities; to present the experimental argumentation of the effectiveness of the training methods applied in a

yearly training class to female secondary school students in extracurricular activities (case study). The main objectives of the present thesis were: to review the literature on the aspects of resistance development in secondary school students; to develop and implement the resistance development program in secondary school students based on the predominant application of movement games; to evaluate the level of development and physical training of secondary school students; to experimentally argue the effectiveness of the developed experimental program based on the predominant development of resistance based on movement games.

The experiment took place over one school year, in four separate phases:

Phase I (period 2019 - 2020) included:

- selecting the research topic and drawing up the work plan;
- study and review the literature on the development of endurance in secondary school students by means specific to athletics in extracurricular activities;
- study of the school curriculum for Physical Education and Sport for grades V - VIII, of the contents and methodological suggestions contained therein in order to analyze the content elements aimed at addressing and achieving our proposed objectives;
- development of the theoretical-scientific idea of the doctoral thesis;
- establishing and identifying the purpose and the subjects that were going to address new means of developing resilience in extracurricular activities.

Phase II (period 2020 - 2021) included:

- the implementation and use of some methods of recording the level of endurance development at the beginning, in the middle and at the end of the experiment to follow if there are changes regarding this aspect;
- development and implementation of the questionnaire for physical education teachers regarding the topic of interest discussed throughout the present research study;
- the development and implementation of a preliminary study for secondary school students (7th grade);
- carrying out the experiment, which consisted in the application of the following tests: anthropometric measurements (height, body weight and chest circumference); Spirometry tests; OBLA stress test; Lactate Test - Lactate Analysis and Endurance Assessments: Cooper Test (adapted for 6 minutes) and 800m Endurance Run.
- the development of the experimental program with movement games and specific means for endurance development in secondary school students.

Phase III (period 2021 - 2022) included:

- application of initial, intermediate and final testing to both research groups (experimental and control): anthropometric measurements (height, body weight and chest circumference); Spirometry tests; OBLA stress test; Lactate Test - Lactate Analysis and Endurance Tests: Cooper Test (adapted for 6 minutes) and 800m Endurance Run.
- the application of the training program that included the proposed means as an independent variable. The experimental group followed the program from the school curriculum and a unique program proposed by us as part of extracurricular activities. The control group followed the program from the school curriculum and also included means from the program proposed by us as part of extracurricular activities.

Phase IV (period 2022 - 2023) included:

- centralization of the data obtained following the application of the questionnaire;
- statistical-mathematical analysis, interpretation of the data obtained from the samples used in both the initial and final stages in both groups included in the research, comparison of the results obtained by the experimental group with those of the control group and graphical representation of the evolution of this process;
- formulation of conclusions and recommendations.

In order to carry out the research, we used the following **tests:**

1. Anthropometric measurements (height and body weight) :

Objective: to determine the height and weight of subjects.

Materials required: individual worksheets, scales, tape measure.

Conduct of the test:

1.1 Height (from the standing position): subjects were positioned next to a wall, in the standing position, without shoes, with their backs against it and their heads in the anatomical position. Using a tape measure, subjects were measured and the distance from the ground to the top of the head was noted on individual charts.

1.2 Weight: To perform this measurement subjects are placed on a scale in the sitting position without shoes. The results are recorded in their individual records.

1.3 Chest circumference: A centimetric tape/flexible metric ruler was used for this measurement. Subjects were in the sitting position and the tape was placed horizontally around the chest about 3 cm above the nipples. Subjects were dressed in a tank top or thin T-shirt. Chest circumference was measured in normal position, in maximum inspiration and in maximum expiration and the 3 values were recorded determining the chest elasticity by subtracting the chest circumference value in

maximum inspiration from the maximum expiration value. These were recorded in centimeters and in 0.5 cm subdivisions [17].

2. Exercise test with spirometry

Objective: to determine general respiratory capacity.

Materials required: individual sheets, Defiro medical device.

Conduct of the test: Using the Defiro Spirometer medical device which is designed to test forced vital capacity. Subjects performed a deep inspiration, sealed their lips around the mouthpiece and expelled all air as forcefully as possible.

Analysis of the results: The exhaled gas turned into a rotating air stream after which it passed through the turbine and then caused the blade to rotate. The results obtained, expressed in percentages, were recorded [11].

3. OBLA effort test

Objective: to analyse anaerobic and aerobic endurance performance; to analyse physiological test parameters 'peripheral blood lactate concentration, heart rate and ventricular factors 'oxygen uptake' and 'carbon dioxide release'.

Materials required: Cyclus2 cycloergometer device, stopwatch, Repco monitor.

Conduct the test: After a pre-determined effort preparation, subjects pedal on the Cyclus 2 cycloergometer keeping a constant cadence of 70 - 75 rpm. The test started at 70 Watt resistance, then increased every 20 seconds by 15 Watt.

Analysis of results: the test was stopped when the subject was no longer able to maintain the set cadence and the wattages reached were recorded, expressed as a percentage according to the preset device protocol [18].

4. Lactate test - Lactate analysis:

Purpose: To establish aerobic threshold and effort zones.

Materials required: individual sheets, lactate analyser - Lactate Plus medical device.

Sample design: For this test, blood samples were collected from the subjects using the lactate analyser (Lactate Plus medical device) and the lancet that pierces the skin of the finger.

Analysis of results: Two blood samples were taken, the first sample at the end of the OBLA test and the second sample after 2 minutes of rest. The results obtained, expressed in mmol/l, were recorded [2].

5. Endurance tests: (under running conditions):

5.1 Cooper test (adapted for 6 minutes)

Objective: to determine the distance covered in 6 minutes.

Materials required: 400 m synthetic circular athletics track, whistle, stopwatch, individual sheets.

Test: subjects ran at a steady pace on a 400 m athletics track, the course being very well measured. The distance covered by each subject was measured for 6 minutes. The results recorded were recorded in their individual records. Before the test, the subjects were instructed on the importance of maintaining a constant pace, taking into account their individual characteristics, as well as measuring the distance covered and comparing the results with a table defining the values they should achieve. Subjects knew at all times how many minutes had elapsed and how many were left until the end of the test.

Analysis of results: When the 6 minutes were up, subjects were warned by a beep and allowed to stop where they were when they heard the beep. Recorded in minutes and seconds [8].

5.2 800 m endurance run

Objective: to determine the time needed to complete the 800 m distance at a sustained tempo.

Materials required: 400 m circular synthetic running track, whistle, stopwatch, individual sheets.

Conduct of the event: subjects covered the 800 m distance as fast as they could. At the end of the test, the time obtained by each subject was recorded.

Analysis of results: Subjects were placed in two sets at the start. The recorded results were recorded in their individual records. Time was recorded in minutes and seconds.

As for the ***organization and conduct of the research***, it was carried out with students from Liteni Secondary School, Iasi and "Titu Maiorescu" Secondary School in Iasi, and the tests were held at the Preventis Iasi Medical Centre and at the "Emil Alexandrescu" Iasi Stadium (400 m circular track). The endurance tests (800 m run and 6-minute adapted Cooper test) were held at the "Emil Alexandrescu" Stadium Iasi (400 m circular track) and the OBLA exercise test was held at the Preventis Medical Centre Iasi.

The experiment ran from September 2021 to June 2022 for a training period of 10 months. Two groups of subjects were included in the research, 7th grade students, aged 13 - 15 years and divided as follows: an experimental group, which included 15 subjects (female gender) and a control group consisting of 15 subjects (female gender). All subjects had normal biological development according to the data presented in Anexa 1,tables 1.1. and Anexa 2, tabel 1.1. of the PhD thesis.

Experimental program for the development of enduranceabel 1.2. in secondary school students by applying the means of athletics in extracurricular activities - experimental group - annual planning

of the optimization of endurance in secondary school students by learning cycles includes the structure of the training process in an annual training cycle of secondary school students, organized by macro-cycles, and took into account the periods, the type of training/stages, the months in which the experiment took place, the total number of training sessions, the macro-cycles of training, as well as means for increasing the level of general physical training and means of resistance development were included. Means to increase the level of general physical fitness and to develop endurance were also included. In addition to this program, we also proposed an experimental program with a contour of dynamic movement games for resistance development, which contains carefully selected and described movement games, place where it can be carried out, methodical indications, dosage and mechanical materials. The contents of the programmes are also organised by different periods, e.g. pre-competitive, competitive, maintenance, compensation/transition.

In order to make the study complete and to have an objective starting point, we analyzed the ***opinions of specialists in the field of physical education and sport*** regarding the teaching contents included in the school curriculum in physical education and their effectiveness in the development of basic motor skills in secondary school students. To this end, the research was carried out on a sample of 98 experts in the field (37 female gender, 61 male), including both rural (42 professors) and urban (56 professors). The research was based on the application of a questionnaire, using Google Forms, and was based on questions that were designed and delivered in a way that took into account the experts' views and made them useful. This is especially true for identifying and highlighting the problem under study. The questionnaire aimed both to highlight the proportion of hours allocated to developing resilience in school and the current level of development of resilience. The questionnaire included 13 items, and the instruments used to assess resilience in secondary school students were: evaluation of expert responses: informational interview.

The second chapter also includes a ***preliminary study*** that was carried out to highlight the level of development of general resistance in secondary school students (7th grade). The results obtained by the students lead us to propose a special training programme to improve their general resistance. We consider this aspect important because the development of this quality depends on the cardio-respiratory and functional health of the school population. We also propose that through training programmes we implement the skill of practising these exercises independently after the completion of formal studies.

The study involved 10 schools, 35 teachers, 320 female students in grade 7. Approximately 10% (about 35 girls) scored 10 and above; 70% (about 220 girls) scored between 6 and 7 and 20% (about 35 girls) scored 5 and below.

As a conclusion to this chapter, we stress that in order to optimise the performance of athletes, the specific methodology needs to be clear, with achievable goals, in order to increase performance potential and achieve the desired results. We stress the need to develop the motor quality of endurance among secondary school pupils in extra-curricular activities. The information obtained and presented in this chapter leads us to appreciate that specialists believe that extracurricular activities have a beneficial impact on the development of endurance among secondary school pupils. A special training programme with exercises that target and develop general motor skills, somatic-functional motor skills, optimal health, psychological preparation and specific motor skills are key points in achieving the best performance.

The third chapter, Experimental substantiation of the effectiveness of the content of the program for the development of resistance in secondary school students, by applying the means of athletics in extracurricular activities, illustrates the effects and results obtained from the application of this program. This chapter captures the influence of the experimental program on resistance in middle school students. The results obtained are also presented statistically.

In order to determine the effectiveness of the resistance development program and the effectiveness of the training obtained in secondary school students by applying movement games during one school year, we analyzed the interdependencies between the level of resistance development and the control tests applied to assess it. I present the results in the following table.

Table 1. Correlation analysis between the level of physical and functional development and training and the level of development of special endurance (800 m running) in secondary school students (13-15 years old)

Crt. no.	Tests used	Pearson correlation coefficient (r)
1.	Onset of blood lactate accumulation (OBLA, %)	-0,859
2.	Adapted Cooper test (m)	-0,861
3.	Lactate concentration (mmol/l)	0,199
4.	Lactate concentration 2 minutes after exercise (mmol/l)	-0,568
5.	Height (cm)	-0,115
6.	Weight (kg)	0,335
7.	Body mass index (kg/m2)	0,266
8.	Chest circumference in inspiration (cm)	-0,228
9.	Chest circumference at expiration (cm)	0,118
10.	Forced vital capacity (%)	-0,354
11.	Forced expiratory volume in one second (%)	-0,428
12.	Maximum expiratory flow (%)	-0,495
13.	Forced exhalation rate in one second (%)	-0,463

**Note: The critical value of the correlation coefficient r at the 5% level (P=0.05) for 30 participants is 0.361*

Following the analysis of the results obtained in the Initial 800m Endurance Running Test, it can be determined which of the tests used are informative for this research study. It was found that there is a strong, negative correlation between the results obtained in the 800 m Endurance Running test and those obtained in the OBLA - Onset of Blood Lactate Accumulation Test (r=-0.859) and the adapted Cooper Test (r=-0.861). Also, a negative, medium to strong correlation was observed between the results obtained in the 800 m Endurance Running test and lactate concentration measured 2 minutes after exercise (r=-0.568). These results suggest that the aforementioned tests are informative for the purpose of the research. In other words, the results from the OBLA Test, **Adapted Cooper test** and lactate concentration measured 2 minutes after exercise are associated with those obtained in Endurance Running - 800 m. Subjects who perform well on the OBLA Test, the adapted Cooper Test and lactate concentration measured 2 minutes after exercise are broadly the same as those who perform better on the 800 m endurance run. Last but not least, a statistically significant correlation, but not as strong as those mentioned above, was observed between the results in Endurance Running - 800 m and Forced Expiratory Volume in one second (r=-0.428), Peak Expiratory Flow (r=-0.495) and Speed of a Forced Expiration in one second (r=-0.463). The other variables analysed did not exceed the critical threshold of ±0.361. This is natural, especially for height, weight, body mass index, chest circumference in inspiration and chest circumference in expiration. There is no physiological basis for considering that these measurements are (or should be) correlated with the results in the 800 m Endurance Running event.

All the results obtained by the experimental and control group for each test (initial, intermediate and final) are detailed in the PhD thesis.

The general ***conclusions and recommendations*** reveal the main scientific results identified on the basis of which some recommendations have been issued.

CONCLUSIONS AND RECOMMENDATIONS

1. Following the analysis of specialized literature, we found that specialists in the field argue and support the importance of school physical education as the only discipline aimed at the health of the school population from a formative and informative aspect. Harmonious physical development and maintaining health, primary objectives in school physical education, are obtained from an alignment of didactic methods and means of action in accordance with the growth and development indicators of students at different ages.
2. Specialists in the field point out that the optimization of the methods of development of motor skills must be continuously updated, because the health of the school population and future members of society depends on the skills acquired in the training framework.
3. The current level of development of motor qualities, in general, and of endurance capacity, in particular, is not optimal. This aspect was determined from the assessments at the class level, in general, as well as the results obtained within our investigative approach in the preliminary pedagogical experiment.
4. The development of endurance as a motor quality is not an easy process and for this reason the traditional means (running) are not easily accepted by the students, which is why we proposed the use of other means of action (games, relays, etc.) in the implementation of the experimental program.
5. Following the evaluation of the opinions of the specialists, it was found that they are aware of the need for continuous re-adaptation and optimization of teaching methods that facilitate the development of each motor quality and especially endurance.
6. As a result of the investigative approach, it was found that in order to make the training program more efficient, it is necessary to "assemble" several means of action, in order to develop the students multilaterally. Thus, in addition to running and movement games, which constitute the basic means of action in our experiment, those for the development of strength, speed and skill that will be used in terms of combined motor qualities are also necessary.
7. The experimental program can be adapted to the physical education lesson, taking into account the elements of dosage, density, effort parameters, etc., but it is mainly designed for extracurricular activities for secondary school students.
8. It was found that the subjects in the experimental group in our investigation developed better endurance than the subjects in the control group and implicitly the results in the school competitions were significantly better.

9. Following the analysis of the competition calendar, we found that the students from the rural environment obtained better results than the students from the urban environment, a fact that can also result from the degree of involvement in organized extracurricular activities or that manifests itself according to the needs imposed by the community and / or family.
10. The comparative analysis of the results obtained by students in the evaluations of the National School Evaluation System in the discipline of Physical Education leads us to note that in the urban environment the best results are for strength and speed, and in the rural environment, endurance is the motor quality that predominates in the evaluation hierarchy.
11. During the implementation of the experimental program, three training lessons per week were planned. These included running, games, as well as resistance strength and speed exercises. Their effectiveness was demonstrated in the results obtained in the assessment, but also in school competitions.
12. The peculiarity of the subjects' training program is that it was implemented according to the planning model from sports training, thus, the school year was structured in 3 stages: preparatory (adaptation), pre-competitive and competitive; the means were adapted to the age and level student preparation.
13. Looking at the factor analysis, we found that the weighting of the means used in the development of endurance at this age depends on the results obtained in resistance tests as follows: 30% on strength, 10% on strength–speed and 60% on aerobic resistance.
14. Regarding the means of action used to develop endurance, the greatest weight is held by long-term running (aerobic regime), which is recommended to be performed at a varied tempo, depending on the objective set in the training and the stage of preparation.
15. Following the study and the investigative approach that were carried out, we can affirm that the proposed goal and objectives were met and the hypothesis was validated.

Having analysed the above, we can issue a set of ***recommendations:***

1. To train the appropriate teachers in the application of attractive means and to facilitate their participation in various refresher courses, conferences and congresses.
2. Include movement games in the Physical Education and Sport Programme for secondary school pupils.
3. We recommend that, in addition to the methods used by us, the appropriate means of recovery should be used (vitaminisation, swimming, massage, sauna, etc.).

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ANNOTATION

Tihulcă Constantin "*Developing endurance in secondary school students through the application of means specific to athletics in extracurricular activities*": PhD thesis in education sciences, Chisinau, 2024

Structure of the thesis this paper contains annotations in the following two languages: Romanian and English. Also, the work includes an introductory part, three chapters, general conclusions and recommendations, bibliography (200 sources), 35 appendices, 114 pages of contents, 32 figures and 10 tables. The research results were published in 7 scientific articles.

Key words secondary school students, means of athletics, strength development, recreational activities, movement games, extracurricular activities.

The purpose of the research it consists in identifying the causes of the insufficient development of the motor quality of resistance in secondary school students and the efficiency of the training process regarding its development in extracurricular activities through the use of movement games and specific means.

The tasks of the research are analysis of the structure and content of the training process with a focus on endurance running events; optimization of the structure and content of the training methods used in the training of female secondary school students in an annual cycle in extracurricular activities; presentation of the experimental argumentation of the effectiveness of the training methods applied in an annual training class for female secondary school students in extracurricular activities (case study).

The objectives of the research are:

1. Analyzing the specialized literature regarding the aspects of resistance development in secondary school students and identifying the level of resistance development and general physical development in secondary school students;
2. Elaboration and implementation of the resistance development program for secondary school students based on the predominant application of movement games;
3. Evaluation of the level of development and physical training of secondary school students by applying the questionnaires of physical education and sports teachers from the city and county of Iași; setting the stages of the study;
4. Experimental argumentation of the effectiveness of the elaborated program, based on the predominant development of resistance within movement games.

Scientific novelty and originality it consists in analyzing the impact of movement games introduced in the specially designed curriculum and used in extracurricular activities aimed at developing resistance in secondary school students. In this sense, we developed a program that demonstrated the usefulness of developing resistance in secondary school students in extracurricular activities.

The results obtained that contribute to the solution of important scientific problems consist in the improvement and efficiency of the means of resistance development by implementing a program that contains a systematic and staged resistance development program using movement games, with the aim of improving sports performance.

The theoretical significance consists in the theoretical argument regarding the importance of including movement games in the development of resistance in secondary school students, in the school curriculum and in physical education and sports classes.

The applicative value represents a key component of the work and is represented by the fact that the research results can be applied as a standard method by physical education and sports teachers in practical lessons for secondary school students, but also by coaches in athletics clubs.

Implementation of scientific results. The results obtained were implemented in physical education and sports lessons for secondary school students from the following schools: Liteni Secondary School and "Titu Maiorescu" Secondary School Iași, as well as in other schools: Ciortești Secondary School, Iași and Commander Alexandru Theoretical High School Cătuneanu, Lunca Cetățuii, Iași, with the aim of determining the situation of the research topic and the validation of the experimental program for the development of resistance in secondary school students by applying the means of athletics, within extracurricular activities.

TIHULCĂ Constantin

DEVELOPING ENDURANCE IN SECONDARY SCHOOL STUDENTS THROUGH THE APPLICATION OF ATHLETICS IN EXTRACURRICULAR ACTIVITIES

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