

SOFIA UNIVERSITY "ST. KLIMENT OHRIDSKI "
SPORTS DEPARTMENT

**DEPARTMENT OF INDIVIDUAL SPORTS AND
RECREATION**



Eddie Ivanov Ivanov

**PEDAGOGICAL MODEL FOR ACCELERATED PRIMARY
EDUCATION IN TAEKWON-DO FOR CLASS I-IV STUDENTS**

ABSTRACT

of a dissertation for the award of a scientific degree

"Doctor"

Professional field:

1.3. Pedagogy of teaching physical education and sports

Sofia, 2022

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Supervisor:

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The dissertation has passed internal defense in the Department of "Individual Sports and Recreation" (Minutes № 15 of 14. 06. 2022) in the Department of Sports of Sofia University "St. Kliment Ohridski ”.

The dissertation contains 162 standard typewritten pages, of which 25 in appendices. The content is divided into an introduction, four chapters, conclusions and recommendations, contributions, bibliography and appendices. The work is illustrated with 30 tables, 22 figures and 14 appendices.

The bibliography includes 162 literary and documentary sources, of which 132 in Bulgarian, 16 by foreign authors and 15 Internet sources.

The official defense will take place on..... From hours, in the № зала hall. of Sofia University "St. Kliment Ohridski“

INTRODUCTION

Modern models for the management of physical education and sports presuppose high efficiency and productivity in ensuring the activities of all their elements. The direction in which the efforts and potential of sports specialists are directed are aimed at solving the tasks related to the development and implementation in practice of the best and most productive models for management and sports training of athletes and the training process.

In recent decades, it is noticeable at a young age from which the initial practice and systematic activities in sports in various sports and disciplines.

Sports educators are unanimous that the problems of initial training are crucial in this process and are achieved through the application of pedagogical, medical - biological, psychological and other research methods, in order to comprehensively study all the factors influencing the sport, of which in sports achievement depends to the greatest extent (Hadjiev, N. 1990).

The issues of the initial preparation of children are extremely relevant and crucial for their future development as elite athletes. This determines the way to achieve good sports results, as it significantly reduces the time, energy, financial and resources of specialized sports structures (Rachev, K. 1983).

The development of physical qualities in the structure of sports training is crucial for children and adolescents. The positive impact and practice of a particular sport is one of the most reliable ways to combat the negative consequences of these changes (Kaikov, D., Margaritov, V. 1992).

Taekwondo is one of the sports that has a positive impact on the psychophysical and moral development of adolescents. As a result of the systematic practice of Taekwondo-Do, physical qualities significant for being develop.

The urgency of the problem is the application of methodologies that contribute to the accelerated development of physical characteristics, and hence to improve the physical capacity of adolescents through the means applied in the education and training of Taekwon-Do. The development, experimentation, and implementation of such a pedagogical model will inevitably lead to the solution of these tasks.

We hope that the presented development of "Pedagogical model for accelerated initial training in Taekwon-Do for students from I - V class" will contribute to the implementation of sports training, selection and objective assessment of athletes involved in this sport.

This was the main motive for choosing the topic, which in our opinion will have a practical contribution to solving the problem of optimizing the training, development and selection of those involved in Taekwon-Do.

FIRST CHAPTER. THEORETICAL JUSTIFICATION OF THE PROBLEM

1.1 General characteristics and social significance of Taekwon-Do

What is Taekwon-Do? This is a system of skills for hand-to-hand combat and self-defense, martial arts, sports or all these skills taken together, based on the principles of maximum development and manifestation of human physical and mental abilities

What does Taekwondo Mean? Tae means foot, kick, kuon - fist, blow, and Do - system, path, way, reflection. The combination of the three concepts means a system of self-protection with legs and arms.

Taekwon-Do is defined as the Korean art of hand-to-hand combat, based on the classic fighting skills of Te Kyon and Karate, and is characterized by the use of high kicks, jumps and acrobatics. It is practiced as a sport and a means of self-defense.

As a skill for hand-to-hand combat, the individual parts of the human body are used - upper limbs, lower limbs, head, knees, elbows and the whole body.

As a martial art it is aimed at building a perfect balance and harmonizing the physical, mental and emotional qualities of the individual.

As a sport it is characterized by attractiveness and emotional charge showing the manifestation of multifaceted physical, mental, moral and volitional qualities.

As a fighting skill, it includes a rich variety of specific movements with arms, legs, head and the whole body, as well as jumps, throws, grips, knocks, keys, falls and others. It also demonstrates skills in using traditional weapons such as a stick, sword, sword, rope, knife and others, as well as breathing exercises and meditation.

A distinctive feature of Taekwondo is the diverse techniques of movement and foot play (Choi Hong Hi 1965).

1.2 Training methodologies and types of Taekwon-Do competitions

Taekwon-Do training is a pedagogical process based on didactic principles and teaching methods. The training process is associated with the mandatory assimilation of basic virtues - kindness, honor, humanity, justice, integrity, perseverance, goodwill, loyalty, respect, trust, correctness, courtesy, justice, sense of duty, responsibility, wisdom. Thus, in addition to improving strength, technique and skills, a balanced, balanced and harmonious character and way of life is built. The observance of certain principles during the training and exercises enables the trainees to use to the maximum extent undiscovered and uncontrolled psychophysical qualities inherent in the personality.

Principles that contain the following elements are used and applied in the teaching methodology: (Choi Hong Hi, 1965):

Using the power of reaction

- The understanding of the law of physics is applied that to each action as a volume corresponds equal in size and opposite in direction counteraction. Taken together, these two quantities increase the possibilities for maximum realization of the set goal.
 - The opposite and rotating movement of the different parts of the body leads to an increase in the force of the blow. For example, if one hand strikes straight forward, the other hand is pulled back. The principle of rotational motion.
 - All movements start from the center of gravity of the body. The principle of "impulse from the pelvis".
 - The movements are performed at the maximum relaxation of muscles, as at the moment of inflicting the defeat muscle strength is concentrated. The principle of the "whiplash".
 - The application of the support reaction is a pressure on a support surface, when striking with the hand or foot at the moment of contact with the intended target.
 - Transferring the center of gravity of the body down and its abrupt return to its natural position at the time of impact. The top-down principle.
 - The movement of the whole body during each movement and impact by using all its parts, connections and units. The movement starts from the support plane of the lower limbs, continues through the ankle joints, knees, thighs, hips, waist, body, shoulders, elbows, wrist and the impact plane - the fist. The same principle applies when performing leg movements. Precisely coordinated spiral, twisting movement from all parts of the body is performed. The end effect is the accumulation of force from the support upwards, using all the biomechanical motility of the whole body. The principle of "play and use the power of the whole body"
- Concentration of performance (Georgiev, M. 1996, Choi Hong Hi 1982).

Concentration is the application of physical effort to the smallest area at a specific time in a specific place. To achieve maximum effect, the movements begin by involving the abdominal muscles and the muscles of the pelvis and body, which involves the muscles of the rest of the body. The so-

called "pelvic impulse" preceding the performance of each technique is achieved. Attacking or blocking impact plates are "thrown" with a whip from the pelvis, not guided or mechanically pushed towards the target.

Equilibrium

Two types of equilibrium are nurtured - static and dynamic, which are interconnected. Equilibrium is influenced by the manifestation of three main factors - weight distribution, body position and location of the center of gravity. In order to maintain good balance of the body, the center of gravity must be designed vertically in a straight line inside the support area between the lower limbs, and the weight must be evenly distributed.

Breathing

Breathing during the performance of the forms is performed in two ways - by inhalation through the nose and exhalation through the mouth and by inhalation and exhalation through the nose. In both varieties, the exhalation of the air is emphasized by a sharp exhalation, during the execution of the final phase of the technique. This type of breathing releases extra energy by contracting the abdominal muscles.

Body mass

According to Taekwon-Do training methods, this is achieved by creating skills and habits for maximum use of one's own weight. This practically means that when performing a technique, it is "inserted" on a large part of the body mass.

The speed of execution

Increasing the speed of performing techniques in Taekwon-Do is one of the main tasks during training and coaching. It is created and developed in the initial stages of training. There is a fully developed methodology for creating, building and improving the quality of speed in Taekwon-Do, including through the use of equipment - gymnastic bats, jump rope, jigs and others.

CHAPTER TWO. RESEARCH METHODOLOGY

2.1 Scientific problem and hypothesis

After our literature review of the available scientific sources and the personal experience of the author, a discrepancy was found between the actual and desired state of achievement of Taekwondo practitioners from I to IV grade by assessing their physical development and physical fitness due to the lack of an established model for accelerated initial training and educational and training activities, and the lack of scientifically based control for assessment of their sports development.

In this context, an attempt was made to reveal the methodological approaches and the optimization of the initial training in the activities and trainings of this age group and to propose a model for accelerated effective initial training.

The developed author's pedagogical model is based on the modern tendencies for sports training, used by leading countries in this sport. The aim is to accelerate the training effects for improving the motor skills and technical training of girls and boys from I to IV class, training in Bulgarian sports clubs in Taekwondo.

Working hypothesis

We assume that the application of the developed pedagogical model for primary education in Taekwon-Do for a period of one year will accelerate the effectiveness of primary education and will increase the physical qualities and specific technical skills of girls and boys from I to IV grade.

2.2 Goals and objectives

The aim of the study is to create a pedagogical model for accelerated initial training in Taekwondo, aimed at improving the physical qualities and specific technical skills of girls and boys from I - IV class training in Bulgarian clubs.

The fulfillment of the outlined goal presupposes the solution of the following tasks:

1. Review and theoretical analysis of the specialized literature related to the training of adolescent Taekwon-Do fighters.
2. Development of a pedagogical model for accelerated primary education in Taekwondo for students from I - IV grade.
3. Approbation of the model in Taekwon-Do training for students from I - IV grade.
4. Systematization and comparative analysis of the data obtained from the study.
5. Establishing the effectiveness of the tested model for accelerated primary education in Taekwon-Do for students from I - IV grade.

2.3 Object, subject and contingent of the research

The object of the study is the initial sports training in Taekwon-Do for adolescents.

The subject of the research is the influence of a proposed pedagogical model for the accelerated initial training in Taekwondo for girls and boys (adolescents) and the improvement of their physical qualities and technical skills.

The contingent of the study are 263 children I - IV class aged 7 to 11 years, participating in primary education in Taekwondo. There were 183 boys and 80 girls, divided into two groups control and experimental. The training of the control group is carried out according to the standard methodology, and experimental - according to the specialized methodology of the pedagogical model for accelerated learning in Taekwon-Do. The subjects are children and adolescents training in nine clubs developing Taekwon-Do ITF in the country.

During the study, the participating children from each club were divided into two groups - control and experimental in equal numbers for both sexes.

2.4 Research methods

The study used tools from the following research methods:

- Research and analysis by literature sources and sites;
- Sports - pedagogical testing
- Pedagogical observation;
- Pedagogical experiment;
- Mathematical and statistical methods.

Research and analysis by literature sources and sites;

162 literary and documentary sources were studied and analyzed, of which 132 in Bulgarian, 16 and 14 websites by foreign authors.

Sports - pedagogical testing

Testing of significant motor skills associated with Taekwon-Do was performed (Table 1).

Table 1. Test battery - motor qualities

test	name of indicators and tests	unit
1	long jump from a place with both legs	cm
2	jumps with high knee lift	cm
3	300/600 m smooth running	s
4	throw a solid ball	cm

5	forward slope along Eurofit	cm
6	shuttle running	s
7	jumps over a gymnastic bench (side)	number
8	push-ups	number
9	abdominal presses	number
10	side twine	cm
11	twine left	cm
12	twine right	cm

Pedagogical observation

In the process of experimenting with the model for accelerated initial learning in Taekwon-Do, a direct monitoring of the performance of the movements in the studied students was conducted. Videos used.

Pedagogical experiment

The pedagogical experiment was conducted in order to establish the effectiveness of the model for accelerated initial training in Taekwon-Do. The pedagogical experiment was conducted with the students (grades I – IV) from the control and experimental groups. The students from the control groups are trained according to the standard Taekwon-Do methodology. The model was applied to students from the experimental groups.

Model for accelerated initial training in Taekwon-Do

The pedagogical model contains a modified methodology, which includes all pedagogical and sports technical requirements in a systematic way. In terms of content, the model includes a set of tools, including specific practical exercises to improve the significant physical qualities of students, mastering the technique, theoretical knowledge, building habits and communication behavior.

Initial Taekwon-Do training begins with the provision of information related to history and development, behavior and relationships, mastering basic techniques, mastering basic positions and starting positions, including movement, and in parallel begins with learning elements of the technique. Here, specific forms, methods and exercises related to the application of the basic principles, features and characteristics in the practice of Taekwon-Do are used and applied. Along with teaching new educational content, at the same time the already taught educational material is improved.

The practical exercises determine the methods and assistive devices used during the training to guarantee the expected results, and they are set in the normative requirements for covering the respective severity degree. The teaching of the individual elements, especially in the study of techniques, is subject to a certain sequence through exercises that have already been studied and known. And these are the implementation and mastering of basic elements of the t-shirt - in static positions, with movement, combinations of technical techniques, activities in pairs, playing with equipment and more.

Participants in the experimental groups are trained in a methodology for simultaneous training and consolidation of the acquired skills for initial training in Taekwon-Do with the use of a differentiated approach, which includes three stages. Each stage is characterized by the inclusion of a number of special exercises. After mastering basic skills, elements of the technique are studied in parallel. Technical skills are improved at the same time.

The first stage includes two sub-stages, which correspond to two stages of the simultaneous methodology for mastering the technical techniques and elements:

- preparatory exercises for training and building basic and specific skills and habits - 288 hours.

- study of basic elements of the technique in static and dynamic state - 288 hours.

The second stage includes simultaneous mastering of the methodology for studying the technique, with parallel application of a differentiated approach for achieving maximum success in the learning process - 216 hours:

- study of six basic elements of the technique.
- parallel application of differentiation of the trainees according to the degree of mastery of the separate technical elements.

The third stage of the methodology includes 216 hours

- simultaneous training in improving the technique continuing parallel use of a differentiated approach.

Mathematical and statistical methods

The summarized results of the research are processed by variation, comparative, correlation and graphical analysis. To predict the probability of reliability in the development of research indicators, the method "Difference in progress" is partially applied.

2.5 Organization of the study

The planning and implementation of the research was carried out in three main stages:
First stage - from February 2020 to December 2020.

Second stage - covers the period from January 2020 to July 2021.

Third stage - covers the period from August 2021 to March 2022.

CHAPTER THREE. ANALYSIS OF THE RESULTS OF THE SURVEY

The results of the study of the individual indicators of physical qualities after the experiment are analyzed.

3.1 Theoretical analysis of the results of the study of physical qualities

Explosive force of lower and upper limbs

The performance of Taekwon-Do fighting techniques is directly related to the explosive power of the lower and upper limbs. The purposeful exercises in the trainings, applying the experimental pedagogical model for accelerated initial training, have had a positive effect on the explosive force of the lower limbs in the first grade students (Table 2).

		Control group		Experimental group			
No	Indicator	X 1	S 1	X 2	S 2	d	P%
1.	Long jump (cm)	110,29	1,50	112,00	2,18	1,71	90,23
2.	Jump height (cm)	142,86	1,77	145,89	1,45	3,03	99,79
3.	Throwing a solid ball (m)	206,57	4,61	209,44	3,54	2,87	82,04

The students from the control group jumped on average $X = 110.29$ cm at $S = 1.5$, and the students from the experimental group - $X = 112.00$ at $S = 2.18$. The difference between the means is $d = 1.71$ cm. ($P = 90.23\%$) The guarantee probability ($P = 90.23\%$) is high, but not reliable. There is a tendency to increase the explosive power of the lower limbs in girls.

It was found that the explosive force of the lower limbs, measured by the test high jump in the studied students from the experimental group due to the applied effects of the pedagogical model has improved by $d = 3.07$ cm at $P = 99.79\%$. The very high guarantee probability expresses the effectiveness

of the applied means of influence in the Taekwon-Do trainings of the students from the experimental group. An increase in explosive force and upper limbs was reported. The difference between the mean values between the two studied groups was $d = 2.87$ cm at $P = 82.04\%$. Although the difference is not significant, there is a tendency to improve the explosive power of the upper limbs.

More strongly and reliably, the model indicated an effect on the explosive force of the lower limbs, measured by the height jump test.

The applied pedagogical model in the process of the trainings had a slightly stronger influence on the studied students from the experimental group of the first grade (Table 3).

Table 3. Values of explosive power of boys from first grade - KG and EG

		Control group		Experimental group			
№	Indicator	X 1	S 1	X 2	S 2	d	P%
1.	Long jump (cm)	104,62	3,44	105,96	3,84	1,34	77,27
2.	Jump height (cm)	142,43	1,91	145,50	2,13	3,07	99,99
3.	Throwing a solid ball (m)	210,10	3,36	212,08	2,55	1,99	97,045

The specialized exercises for the development of the explosive force of the lower and upper limbs are applied in the trainings. It was found that with a high guarantee probability ($P = 99.99\%$) is the difference between the mean values between the height jump of the experimental and control group ($d = 3.07$). By 1.34 cm and the difference between the mean values of the long jump between the two groups ($P = 77.27\%$). The applied pedagogical model had a stronger effect on the explosive force of the upper limbs, measured by the test of throwing a solid ball 1 kg, where the difference $d = 1.99$ cm is significant $P = 97.05\%$. The model also had a smaller effect on the explosive force of the lower limbs, measured by a jump in length from a place ($P = 77.27$).

In summarizing the analysis of the research results, the effectiveness of the pedagogical model is proved. The model had a stronger effect on the experimental group of first graders. The experimented pedagogical model had a stronger impact on the second grade students (Table 4).

Table 4. Values of explosive power of girls from second grade - KG and EG

		Control group		Experimental group			
№	Indicator	X 1	S 1	X 2	S 2	d	P%
1.	Long jump (cm)	113,00	4,43	115,78	1,72	2,78	80,70
2.	Jump height (cm)	150,17	3,43	153,67	1,32	3,50	98,50
3.	Throwing a solid ball (m)	215,50	2,88	222,44	3,00	6,94	99,90

The reliability of the difference between the average values of the explosive force of the upper limbs between the control and experimental group, measured by throwing a solid ball ($P = 99.90\%$), is very high. With $d = 6.94$ cm the result is better in the experimental group compared to the control group. The explosive force of the lower limbs, measured by the high jump test, is greater by $d = 3.50$ cm. It is higher in the experimental group compared to the control group ($P = 98.50\%$). There is some improvement in the explosive force in the experimental group, measured by the long jump test ($d = 2.78$), but it is not significant ($P = 52.44\%$).

The experimented pedagogical model had a very strong impact on the explosive forces of the lower and upper limbs and in the experimental group of second graders. The differences between the average values of the explosive force of the lower limbs between the two groups, measured by a height

jump (d = 2.60) cm and the explosive force of the upper limbs measured by throwing a solid ball (d = 3.07 cm) are significant P = 99.95% (Table .5)

Table 5. Values of explosive power of boys from second grade - KG and EG

		Control group		Experimental group			
No	Indicator	X 1	S 1	X 2	S 2	d	P%
1.	Long jump (cm)	105,85	2,62	106,71	2,29	0,87	80,00
2.	Jump height (cm)	150,12	2,42	152,71	1,76	2,60	99,05
3.	Throwing a solid ball (m)	213,58	2,67	216,64	2,21	3,07	99,95

This confirms the assumption of the effectiveness of the experimental pedagogical model. The model had a weaker effect on the explosive force of the lower limbs, measured by a jump in length from a place (P = 80.00%). The model had a stronger impact on second-graders than first-graders.

The experimental groups, as it was emphasized, train according to the methodology of the pedagogical model. As a result of the applied means and methods of the pedagogical model, the studied physical qualities of the experimental groups of the third grade students have rapidly developed.

It was found that the pedagogical model had a positive effect on the explosive forces of the lower and upper limbs in third grade students included in the experimental group (Table 6).

Table 6. Values of explosive power of girls of third grade - KG and EG

		Control group		Experimental group			
No	Indicator	X 1	S 1	X 2	S 2	d	P%
1.	Long jump (cm)	118,42	1,44	118,64	2,66	0,22	18,90
2.	Jump height (cm)	163,83	2,29	165,91	2,02	2,08	96,80
3.	Throwing a solid ball (m)	222,08	1,88	226,27	2,53	4,19	99,99

The experimented pedagogical model had a positive effect on the explosive force of the lower and upper limbs in the third grade students of the experimental group. On average, the difference between the mean indicators (d) of the high jump was 2.08 cm higher in the experimental group compared to the control group at P = 96.80%. This high guarantee probability indicates that the applied pedagogical model has influenced the improvement of the explosive power of the lower limbs. The distance when throwing a solid ball increased by 4.19 cm, which indicates an increase in the explosive power of the students in the experimental group (P = 99.99%). It was found that the effectiveness of the specialized exercises had a different effect on the studied students from the experimental group.

The effectiveness of the experimented pedagogical model has strongly influenced the development of the explosive force of the lower and upper limbs in third grade students. Significant changes have occurred in all three indicators of explosive forces (Table 7).

Table 7. Values of explosive force of boys from third grade - KG and EG

		Control group		Experimental group			
No	Indicator	X 1	S 1	X 2	S 2	d	P%
1.	Long jump (cm)	109,90	2,84	113,83	4,50	3,93	99,90
2.	Jump height (cm)	160,81	2,25	163,17	2,50	2,36	99,80
3.	Throwing a solid ball (m)	218,19	1,69	221,33	5,16	3,14	98,90

The result in the performance of the jump test height of the experimental group improved by 2.36 cm compared to the control group ($P = 99.80\%$). With a high guarantee probability is the difference between the average indicators of throwing a solid ball in the control and experimental groups of schoolgirls of 3.14 cm, the difference is significant ($P = 98.90\%$). As a result of the application of the model, the explosive force of the lower limbs has significantly increased ($P = 99.90\%$).

In the summary of the analysis of the reliability of the differences between the average indicators of the explosive forces of the lower and upper limbs, measured by the tests with long jump, high jump and throwing a solid ball, it is established that the applied pedagogical model in Taekwon-Do training is had a stronger impact on the results of the students, compared to the results of the third grade students of the experimental groups.

The experimented pedagogical model also had a positive effect on the students from the experimental group of fourth grade. The model had a stronger effect on the explosive force of the lower limbs, measured by the test long jump from a place and high jump. By 5.38 cm their result was better than the long jump ($P = 99.10$) and by 2.31 cm by the high jump (99.90%) compared to the control group. (Table 8).

Table 8. Values of explosive power of girls from fourth grade - KG and EG

		Control group		Experimental group			
No	Indicator	X 1	S 1	X 2	S 2	d	P%
1.	Long jump (cm)	134,15	6,16	139,54	1,85	5,38	99,10
2.	Jump height (cm)	173,85	1,72	176,15	1,07	2,31	99.90
3.	Throwing a solid ball (m)	238,23	4,55	248,54	1,90	10,31	99.98

The pedagogical models had a very strong influence on the explosive force of the upper limbs, measured by throwing a solid ball. With 10.31 cm they threw the ball farther compared to the control group ($P = 99.98\%$). It is known that as the speed of movement of the limb increases, a lot of energy is released during the impact. The striking effect also increases significantly. Given that Taekwon-Do works mainly with the lower limbs, it is necessary to devote more time to the priority improvement of their explosive power.

It is noteworthy that the students are more interested in Taekwon-Do. The students in the experimental group from the fourth grade showed better results than the students.

The reliability ($P = 99.99\%$) is very high when covering the high jump test. The difference between the mean values of the pointers of the control and experimental groups is $d = 3.35$ cm (Table 9).

Table 9. Values of explosive force of boys from fourth grade - KG and EG

		Control group		Experimental group			
No	Indicator	X 1	S 1	X 2	S 2	d	P%
1.	Long jump (cm)	116,50	2,96	116,40	3,02	-0,10	8,10
2.	Jump height (cm)	169,00	2,09	172,55	1,85	3,55	99.99
3.	Throwing a solid ball (m)	235,94	4,66	238,95	2,91	3,01	97,90

The students from the experimental group jumped higher compared to the students from the control group ($P = 99.99\%$). The development of the explosive force of the lower limbs is associated with the improvement of the technique in conducting martial arts in Taekwon-Do. The explosive force of the upper limbs also increased ($d = 3.01$) at $P = 97.90\%$. Surprisingly, in the students of the experimental group, along with the high results of the explosive force of the lower limbs, measured by a jump in height, and the

explosive force of the upper limbs, measured by throwing a solid ball, are almost identical to the control group ($P = 8.10\%$). The students from the control group showed slightly better results due to the applied specialized tools in taekwondo training. Both groups have improved performance in the long jump test.

The model has a greater impact on third-graders and fourth-graders in the experimental groups. They also open up opportunities for improving the pedagogical model.

Speed

In the experimental study, speed was measured by the jump test over a gymnastic bench. The obtained values for the speed examined with the test "jump over a gymnastic bench" for girls are presented in Table 10.

Table 10. Speed values for girls from I to IV class - KG and EG

Girls from first to fourth grade							
		Control group		Experimental group			
Class	Indicator	X 1	S 1	X 2	S 2	d	P%
First class	Jump over gymnastic bench (s)	10,43	0,98	10,89	0,78	0,46	68,80
Second class	Jump over gymnastic bench (s)	13,83	0,75	15,00	1,32	1,17	92,60
Third class	Jump over gymnastic bench (s)	20,42	1,98	21,55	2,02	1,13	81,00
Fourth class	Jump over gymnastic bench (s)	25,92	1,89	26,92	1,80	1,00	82,00

The values obtained for the speed tested with the test "jump over a gymnastic bench" in boys are presented in the table. 11.

Table 11. Values for speed of boys from I to IV class - KG and EG

Boys from first to fourth grade							
		Control group		Experimental group			
Class	Indicator	X 1	S 1	X 2	S 2	d	P%
First class	Jump over gymnastic bench (s)	10,00	1,05	10,88	0,99	0,88	99,37
Second class	Jump over gymnastic bench (s)	13,27	1,66	14,86	1,65	1,59	99,90
Third class	Jump over gymnastic bench (s)	19,81	1,60	21,25	1,82	1,44	99,20
Fourth class	Jump over gymnastic bench (s)	24,00	1,78	24,95	1,79	0,95	89,00

The difference between the mean values between the jump over the gymnastic bench in the girls of the control and experimental groups after the experiment was 0.46. The same is not reliable ($P = 68.80\%$). In the boys from the first grade the difference between the average values of the jumps is 0.88 and is significant ($P = 99.37\%$).

Systematic training, which included new specialized exercises, affected the speed of the second grade girls. In the boys from the experimental group, the jump speed was 1.17 better than the jump speed of the girls from the control group ($P = 92.60\%$).

The performance of specialized exercises by the pedagogical model had a positive effect on the development of the speed of jumping on a gymnastic bench and in the second grade students. The difference of 1.59 is significant ($P = 99.90\%$). The changes in the speed of performing the jump test over a

gymnastic bench in the girls and boys of the third grade are positive. In girls, the speed increased by 1.13 at $P = 81.0\%$. There is no reason to say that the girls in the experimental group are faster when jumping on the gym bench. It can be assumed that their speed will develop progressively.

The model had a stronger effect on the experimental group in boys in the third grade. They completed the test in 1.44 seconds, faster compared to the boys in the control group. The difference in the mean values has a high guarantee probability ($P = 99.20\%$), which shows that the specialized exercises of the experimented model had the strongest impact on increasing the speed of students.

It was found that there were no significant changes in the speed of girls and boys in the fourth grade. In female students, the confidence between the control and experimental groups was $P = 82\%$. In all probability, some of the tools used in Taekwon-Do training were also used in the training of the model. The students in the experimental group jumped over the gymnastic bench faster than the students in the control group. The difference of 0.95 is not significant ($P = 89\%$), which is not due to the impact of the pedagogical model.

Summarizing the differences between the average values of the speed when jumping over a gymnastic bench, it can be seen that the pedagogical model had a stronger influence on the boys than on the girls from the experimental groups. Pupils from the experimental groups generally have better speed. It is proven that the pedagogical model is more effective than the standard methodology of taekwondo training.

Endurance

Endurance was measured with the 300 m running test for girls and boys from I, II, III class. The endurance of the girls and boys from IV class was measured with the 600 m running test.

The obtained values for endurance, tested with the test "300 m" in girls are presented in table. 12.

Table 12. Values for endurance of girls from I to III class - KG and EG

Girls from first to third grade							
		Control group		Experimental group			
Class	Indicator	X 1	S 1	X 2	S 2	d	P%
First class	300 m (s)	115,43	2,37	115,44	1,24	0,02	13,63
Second class	300 m (s)	107,50	2,17	103,67	3,00	-3,83	98,10
Third class	300 m (s)	95,67	2,77	94,82	1,94	-0,85	59,10

The obtained values for the endurance tested with the test "300 m" in boys are presented in table. 13.

Table 13. Values for endurance of boys from I to III class - KG and EG

Boys from first to third grade							
		Control group		Experimental group			
Class	Indicator	X 1	S 1	X 2	S 2	d	P%
First class	300 m (s)	102,81	4,63	103,08	4,51	0,27	15,80
Second class	300 m (s)	104,50	5,68	108,64	5,14	4,14	99,30
Third class	300 m (s)	96,71	2,43	94,96	1,88	-1,76	99,10

There were changes in the first grade girls from the control and experimental group. This is primarily due to systematic and consistent work in compliance with the requirements of the training methodology. Both girls and boys in the first grade did not experience significant changes in endurance in the application

of the experimental pedagogical model. This change is not reliable, but expresses a certain tendency for some positive change in endurance.

The situation of endurance in the second grade is different. The pedagogical model had a positive effect on the endurance of the girls from the experimental group. They ran the control distance 3.83 s faster than the control group ($P = 98.1\%$).

It was found that during the experimental period, the participants from the control group in the second grade, which trains according to the standard Taekwon-Do program, ran the control distance faster by 4.14 s compared to the boys from the experimental group. This difference from the average values of the time for running the distance of 4.14 s has a high reliability ($P = 99.3\%$). This shows that the exercises applied in Taekwon-Do training had a stronger effect on the accelerated development of endurance.

The experimental pedagogical model had a positive effect on the speed of the third grade boys participating in the experimental group. They ran the control distance faster than the students in the control group by 1.76 s at $P = 99.1\%$. The positive effect of the model is also proved by the lower standard deviation (S) in the experimental group compared to the standard deviation of the control group.

Interesting regularities were revealed, found with a change in the indicators of quality endurance in the studied students from the control and experimental group of fourth grade, which was measured with the test running at a control distance of 600 m.

It was found that the girls from the experimental group ran a little faster than the distance of 600 m from the girls from the control group. The difference of 1.23 s is not significant ($P = 72.2\%$) (Table 14).

Table 14. Values for endurance of girls and boys from IV class - KG and EG

Girls and boys fourth grade							
Class / Gender	Indicator	Control group		Experimental group		d	P%
		X 1	S 1	X 2	S 2		
IV class Girls	600 m (s)	166,46	3,04	165,23	2,59	-1,23	72,20
IV class Boys	600 m (s)	185,72	3,95	187,35	4,44	1,63	75,70

Most likely, with a longer application of the model, the warranty probability (P%) will also increase. There are fundamental differences in endurance testing in fourth graders. During the experimental period, the endurance of the students in the experimental group was expected to improve, but a decrease of 1.63 s was found compared to the students in the control group. Despite this fact, the difference between the mean values of speed in the two groups is not significant ($P = 75.7\%$).

It is noteworthy that the students in both the control and experimental groups ran the control distance of 600 m faster than the students ($P = 99\%$). It was found that the students showed greater interest in the martial arts and sports Taekwon-Do. The number of practitioners in our country is relatively much larger than that of students. Here it is important to note that sports experience and the duration of training over time to one degree or another have a positive effect on the development of endurance.

Summarizing the analyzed test results, it is found that the pedagogical model has a certain impact on the quality of endurance on the participants in the experimental groups.

Flexibility

One of the main physical qualities that appears as an important factor in the realization of the movements of Taekwon-Do techniques is flexibility. Martial arts masters pay great attention to the development of flexibility.

In the process of Taekwon-Do training, in their content, volume and intensity, which include specialization exercises of the pedagogical model, the flexibility of first grade students has improved. Various changes have been identified in this studied indicator. The measured flexibility of the students

from the experimental group from the first grade is higher by 2.19 cm compared to the flexibility of the students from the control group. This difference is not significant ($P = 69.95\%$) (Table 15)

Table 15. Values for flexibility of girls from I class - KG and EG

№	Indicator	Control group		Experimental group		d	P%
		X 1	S 1	X 2	S 2		
1	Slope on "Eurofit"(cm)	113,14	4,30	115,33	3,84	2,19	69,95
2	Side twine (cm)	50,29	4,19	51,78	2,86	1,49	56,17
3	Twine left (cm)	49,57	4,54	46,00	2,29	-3,57	90,78
4	Twine right (cm)	49,43	3,99	45,56	1,59	-3,87	95,62

Although the difference in flexibility between the control and experimental groups is not significant, a positive trend for its development has been established. The situation is similar with flexibility in lateral twine, where the differences between the mean values between the control and experimental group is 1.49 cm at $P = 56.17\%$. There is a tendency for positive change and development in the side twine, applying tools and methods of the pedagogical model. In the left twine the difference of the average indicators between the two groups is -3.57 cm at $P = 90.78\%$. The greatest increase in flexibility, measured with the right twine, was in the girls from the experimental group. With -3.87 cm it is larger than the girls from the control group at $P = 95.62\%$. The reliability of flexibility improvement is an indicator of the effectiveness of the pedagogical model.

Flexibility changes were also found in students in the experimental group from the first grade. The flexibility in the students from the experimental group was lower by 0.8 cm compared to the control group at $P\% = 43.05\%$, ie. the difference is unreliable (Table 16).

Table 16. Values for flexibility of boys from I class - KG and EG

№	Indicator	Control group		Experimental group		d	P%
		X 1	S 1	X 2	S 2		
1	Slope on "Eurofit"(cm)	109,24	5,40	110,04	3,97	0,80	43,50
2	Side twine (cm)	51,10	3,46	49,75	4,11	-1,35	75,46
3	Twine left (cm)	48,52	3,75	48,63	2,12	0,10	8,63
4	Twine right (cm)	49,48	3,14	48,58	2,30	-0,89	72,12

At the end of the experiment, some changes in the flexibility were revealed, measured by the tests lateral twine, left and right twine of the students from the control and experimental group. It was found that the flexibility in the side twine of the experimental group was -1.35 cm less than in the control group at $P = 75.46\%$, ie, the difference in flexibility between the two groups was insignificant. In the flexibility measured by the right twine test, a decrease of -0.89 cm was found at $P = 72.12\%$.

There is reason to believe that the flexibility measured by the Eurofit slope test in the girls in the experimental group of the second grade has significantly improved as a result of the applied impact of the pedagogical model. It increased by 2.78 cm at $P = 96.1$ (Table 17)

Table 17. Values for flexibility of girls from II class - KG and EG

№	Indicator	Control group		Experimental group		d	P%
		X 1	S 1	X 2	S 2		
1	Slope on "Eurofit"(cm)	114,33	1,63	117,11	2,62	2,78	96,10
2	Side twine (cm)	39,67	2,07	37,67	2,87	-2,00	83,30
3	Twine left (cm)	44,17	1,17	41,67	2,83	-2,50	93,70
4	Twine right (cm)	43,83	0,75	41,33	2,65	-2,50	95,60

In the lateral twine, the flexibility increased by -2.0 cm at P = 83.3%. The situation is similar with the flexibility in the left twine, where the improvement by -2.5 cm at P = 93.7%. Only for the flexibility of the right twine, a significant improvement of -2.5 cm was reported at P = 95.6%. Most likely this is mainly due to strikes with the right lower limb.

In the students from the experimental group of the second grade the flexibility is lower by 2.70 cm than the students from the control group. This difference is confirmed by the high guarantee probability P = 99.7%. The pedagogical model influenced the flexibility of the students from the experimental group (Table 18).

The applied means of influencing the model have had a positive effect on the flexibility of the side, left and right twine. The flexibility of the side twine improved by -2.48 cm at P = 99.5%. This very high guarantee probability is an indicator that the improvement of flexibility is primarily due to the application of the pedagogical model (Table 18).

Table 18. Values for flexibility of boys from II class - KG and EG

№	Indicator	Control group		Experimental group		d	P%
		X 1	S 1	X 2	S 2		
1	Slope on "Eurofit"(cm)	113,73	3,52	116,43	2,78	2,70	99,70
2	Side twine (cm)	46,65	1,96	44,18	2,71	-2,48	99,50
3	Twine left (cm)	43,92	2,24	42,11	2,28	-1,82	99,50
4	Twine right (cm)	44,04	2,44	41,93	3,34	-2,11	98,90

The pedagogical model has also had a positive effect on the flexibility of the left and right split in the second grade boys. It can be argued that the applied pedagogical model is effective in influencing the flexibility of second grade boys.

The pedagogical model did not have a significant effect on the flexibility measured by the Eurofit slope test in third grade girls by 6.05 cm. This flexibility is at a lower level compared to that of students training according to the standard methodology (P = 99.8%). In the lateral split, the flexibility improved by -4.1 cm at P = 99.7%, which is due exclusively to the pedagogical model (Table 19).

Table 19. Values for flexibility of girls from III class - KG and EG

№	Indicator	Control group		Experimental group		d	P%
		X 1	S 1	X 2	S 2		
1	Slope on "Eurofit"(cm)	124,50	3,18	130,55	1,75	6,05	99,80
2	Side twine (cm)	34,92	1,62	30,82	2,48	-4,10	99,70
3	Twine left (cm)	41,75	1,60	39,36	1,75	-2,39	99,70
4	Twine right (cm)	41,17	1,75	39,82	1,47	-1,35	94,00

The flexibility of the left split has also been greatly influenced by the impact of the model. At -2.39 cm she had higher indicators, compared to the flexibility of the girls from the experimental group, compared to the girls from the control group (P = 99.7%). At the confidence limit (P = 94%) is the difference (d = -1.35 cm) between the average values of flexibility in the right twine.

The impact of the applied pedagogical model on the flexibility of third grade students is smaller. The flexibility measured by the Eurofit slope test was 4.52 cm better in the control group than in the experimental group (P = 99.95%). At the same time, the flexibility of the side twine of the experimental group was better by -3.15 cm compared to the flexibility of the control group (P = 98.7%). (Table 20).

Table 20. Values for flexibility of boys from III class - KG and EG

	Control group	Experimental group		
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No	Indicator	X 1	S 1	X 2	S 2	d	P%
1	Slope on "Eurofit"(cm)	125,00	2,70	129,54	2,21	4,54	99,50
2	Side twine (cm)	35,19	2,25	32,04	2,73	-3,15	98,70
3	Twine left (cm)	40,67	4,00	40,50	2,27	-0,17	13,80
4	Twine right (cm)	40,29	3,39	40,63	2,67	0,34	29,10

No significant differences were found in the mean flexibility in the left and right splits of the boys in the experimental and control groups. The differences are very small and are unreliable (P = 13.8% and P = 29.1%).

It was found that the pedagogical model did not have a POSITIVE impact on the flexibility of fourth grade students. (Table 21).

Table 21. Values for flexibility of girls from IV class - KG and EG

No	Indicator	Control group		Experimental group		d	P%
		X 1	S 1	X 2	S 2		
1	Slope on "Eurofit"(cm)	135,54	1,76	137,23	1,24	1,69	99,10
2	Side twine (cm)	18,77	1,09	16,62	1,39	-2,15	98,40
3	Twine left (cm)	32,38	3,15	30,46	5,14	-1,92	73,60
4	Twine right (cm)	32,31	2,81	32,00	4,47	-0,31	16,40

Trends for the development of flexibility in the left splint with a longer application of the pedagogical model have been revealed. The difference between the average indicators of this flexibility is -1.92 and is not significant (P = 73.6%). The flexibility in the right twine in the two studied groups is almost the same. The difference of their average values is -0.31 cm at P = 16.4%.

The regularities are similar for the fourth grade boys. The students in the control group had more flexibility than the boys in the experimental group (d = 1.99 cm) at P = 98.9% (Table 22).

Table 22. Values for flexibility of boys from IV class - KG and EG

No	Indicator	Control group		Experimental group		d	P%
		X 1	S 1	X 2	S 2		
1	Slope on "Eurofit"(cm)	133,61	2,35	135,60	2,21	1,99	98,90
2	Side twine (cm)	20,39	2,91	14,85	1,73	-5,54	99,40
3	Twine left (cm)	30,28	3,12	29,00	4,00	-1,28	71,70
4	Twine right (cm)	32,00	2,70	29,80	4,29	-2,20	93,50

The pedagogical model has had the greatest impact on flexibility, measured by a side sword. With -5.54 cm the flexibility of the students from the experimental group improved at P = 99.4%. The flexibility in the right twine increased by -2.2 cm at P = 93.5%. There is a possibility for a progressive increase in the flexibility of the right twine with a longer application of the pedagogical model.

In summarizing the analysis of the results of the application of the pedagogical model in the Taekwon-Do trainings, positive changes in the flexibility were found in the girls and boys from the experimental groups of I, II, III and IV grade. The pedagogical model had a stronger effect on the flexibility of the boys from the 2nd grade and the girls from the 3rd grade, and less so to the boys from the 1st grade.

Dynamic force

The dynamic strength of the upper limbs and abdominal muscles is of great importance when performing the individual techniques in Taekwon-Do training and competitions. The dynamic strength of the abdominal muscles play a major role in the conduct of the match. The obtained values for dynamic strength of girls from CG and EG, examined with the tests "push-ups" and "abdominal presses" are presented in (Table 23)

Table 23. Values for dynamic strength of girls from I - IV class - KG and EG

Girls		Control group		Experimental group			
Class	Indicator	X 1	S 1	X 2	S 2	d	P%
First class	Push-ups (number)	11,86	0,69	11,44	1,01	-0,41	62,70
	Abdominal presses (number)	15,14	1,07	15,78	0,83	0,63	79,80
Second class	Push-ups (number)	17,17	2,23	22,00	3,54	4,83	98,90
	Abdominal presses (number)	19,00	1,10	20,33	1,00	1,33	97,00
Third class	Push-ups (number)	25,92	1,00	27,64	2,25	1,72	96,50
	Abdominal presses (number)	26,92	2,02	30,18	1,47	3,27	99,90
Fourth grade	Push-ups (number)	34,00	2,45	34,92	1,38	0,92	74,90
	Abdominal presses (number)	30,08	0,86	32,85	2,38	2,77	99,90

The obtained values for dynamic strength of the boys from CG and EG, examined with the tests "push-ups" and "abdominal presses" are presented in (Table 24).

Table 24. Values for dynamic strength of boys from I - IV class - KG and EG

Boys		Control group		Experimental group			
Class	Indicator	X 1	S 1	X 2	S 2	d	P%
First class	Push-ups (number)	11,33	1,06	11,13	0,95	-0,21	50,90
	Abdominal presses (number)	14,81	1,69	16,21	1,32	1,40	99,60
Second class	Push-ups (number)	16,15	1,29	15,68	1,68	-0,48	74,90
	Abdominal presses (number)	16,65	1,20	18,00	1,63	1,35	99,90
Third class	Push-ups (number)	18,67	1,32	19,79	1,22	1,13	99,50
	Abdominal presses (number)	19,95	1,32	20,88	1,60	0,92	95,80
Fourth class	Push-ups (number)	23,61	1,69	26,25	2,10	2,64	99,70
	Abdominal presses (number)	22,61	2,57	26,05	1,70	3,44	99,80

The first-grade girls from the experimental and control groups performed almost the same number of push-ups at the end of the experiment. The difference of -0.41 supports is unreliable ($P = 62.7\%$). The girls in the first-group experimental group did 0.63 more abdominal presses than the girls in the control group. This difference is unreliable ($P = 79.8\%$). The experimented pedagogical model had very little effect on the development of the abdominal muscles. There was no significant difference in the number of push-ups between the experimental and control groups in the first-grade boys at the end of the experiment. The difference of -0.21 is not significant ($P = 50.9\%$).

The boys from the experimental group in the first grade showed better dynamic strength in performing abdominal presses compared to the control group. The difference of 1.4 has a very high guarantee probability ($P = 99.6\%$). The pedagogical model has had a positive effect on the dynamics of the abdominal muscles.

With the application of the pedagogical model in Taekwon-Do training, the dynamic strength of the upper limbs and abdominal muscles in the girls from the experimental group of the second grade has increased. They performed 4.83 more push-ups compared to the control group ($P = 98.9\%$). The students

from the experimental group performed more with 1.33 abdominal presses compared to the girls from the control group ($P = 97\%$).

The applied specialized exercises of the model had a slightly weaker effect on the dynamic strength of the upper limbs in the second grade students ($P = 74.9\%$). The improvement in their dynamic strength is unreliable.

The experimental pedagogical model had a positive effect on the dynamic strength of the abdominal muscles of the second grade students, in whom it increased significantly ($P = 99.9\%$). The specialized exercises of a pedagogical model have had a positive effect on the dynamic strength of the upper limbs and abdominal muscles in third-grade girls.

The dynamic strength of the upper limbs of the third graders in the experimental group has improved. The impact of the model on the dynamic force of the abdominal muscles is greater and more positive. The girls from the experimental group did 3.27 more abdominal presses than the girls from the control group at $P = 99.9\%$.

Despite lower differences between the mean values of push-ups and abdominal presses of the students from the experimental and control groups, they are significant. The percentages of the guarantee probability are high. For push-ups it is $P = 99.5\%$, and for abdominal presses - $P = 95.8\%$. The assumption is confirmed that the application of the specialized exercises of the pedagogical model in taekwondo training improves the dynamic strength of the upper limbs and abdominal muscles.

Positive trends for increasing the dynamic strength of the upper limbs in girls from the experimental group of fourth grade were revealed. The guarantee probability of the differences between the average values of the push-ups of the students from the experimental and control groups is $P = 74.9\%$.

The dynamic force of the abdominal press increased in the girls from the experimental group as a result of the applied pedagogical model in Taekwon-Do training ($P = 99.9\%$). The model had a stronger effect on the dynamic strength of the abdominal muscles of the girls in the experimental group.

The dynamic strength of the upper limbs and abdominal muscles in the boys from the experimental group of IV class has significantly increased.

With 2.64 push-ups, the boys from the experimental group did more compared to the control group at $P = 99.7\%$. The dynamic strength of the abdominal muscles in the students from the experimental group also increased. They perform an average of 3.44 abdominal presses compared to students in the control group ($P = 99.8\%$).

In summary, the analysis of the changes in the average values of the indicators of push-ups and abdominal presses in the students of the experimental and control groups of I, II, III and IV class, it is established that as a result of the applied pedagogical model their dynamic strength has significantly increased. of chasing limbs and abdominal muscles. The model had the strongest influence on the boys from IV grade.

Tables 25 and 26 present the average values of the results obtained for girls and boys according to all criteria and indicators in the study.

Table 25. Mean values of the obtained results in girls

Girls	Control group				Experimental group			
	class I	class II	class III	class IV	class I	class II	class III	class IV
Jump length	104,62	105,85	109,90	116,50	105,96	106,71	113,83	116,40
High jump	142,43	150,12	160,81	169,00	145,50	152,71	163,17	172,55
Smooth running 300 m	102,81	104,50	96,71	185,72	103,08	108,64	94,96	187,35
Throwing a solid ball 1kg	210,10	213,58	218,19	235,94	212,08	216,64	221,33	238,95
Slope on Eurofit	109,24	113,73	125,00	133,61	110,04	116,43	129,54	135,60
Side twine	51,10	46,65	35,19	20,39	49,75	44,18	32,04	14,85
Twine left	48,52	43,92	40,67	30,28	48,63	42,11	40,50	29,00
Twine right	49,48	44,04	40,29	32,00	48,58	41,93	40,63	29,80
Jumps over the gym. bench	10,00	13,00	20,00	24,00	9,00	15,00	21,00	25,00
Push-ups for 30s	11,00	16,00	19,00	24,00	10,00	16,00	20,00	26,00

Fodder presses for 30s	15,00	16,50	20,00	22,50	13,00	18,00	21,00	26,00
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Table 26. Mean values of the results obtained in boys

Boys	Control group				Experimental group			
	class I	class II	class III	class IV	class I	class II	class III	class IV
Jump length	110,29	113,00	118,42	134,15	112,00	115,78	119,00	139,54
High jump	142,86	150,17	163,83	173,85	145,89	153,67	166,00	176,15
Smooth running 300 m	115,43	107,50	95,67	166,46	115,44	103,67	94,00	165,23
Throwing a solid ball 1kg	206,57	215,50	222,08	238,23	209,44	222,44	226,00	248,54
Slope on Eurofit	113,14	114,33	124,50	135,54	115,33	117,11	131,00	137,23
Side twine	50,29	39,67	34,92	18,77	51,78	37,67	31,00	16,62
Twine left	49,57	44,17	41,75	32,38	46,00	41,67	40,00	30,46
Twine right	49,43	43,83	41,17	32,31	45,56	41,33	39,00	32,00
Jumps over the gym. bench	10,00	14,00	20,50	26,00	11,00	15,00	21,00	27,00
Push-ups for 30 s	12,00	17,50	26,00	35,00	12,00	21,00	27,00	35,00
Forage presses for 30 s	15,00	19,00	27,00	30,00	16,00	20,00	30,00	33,00

III. 2. Graphic analysis of the results of the study of physical qualities

The obtained results of the research are processed on variation, comparative and correlation analysis. The comparative annals revealed the positive changes of the measured physical qualities in the students. It should be noted that the studied students in the period of their physical growth naturally increase their physical capabilities. Graphic analysis through different images gives a greater opportunity for interpretation and perception of information. From the graphical analysis in the present study, images are applied, which are presented as plot diagrams and in particular as bar charts.

The results of the studied physical qualities are presented in bar diagrams of the girls and boys from the control and experimental group from I - IV grade after the pedagogical experiment.

It can be seen from Figure 1 that in all classes the average values of the high jump in the girls training according to the methodology of the pedagogical model are higher than the students training according to the standard methodology. Therefore, the methodology is effective for the accelerated development of the explosive force of the lower extremities. (Fig. 1).

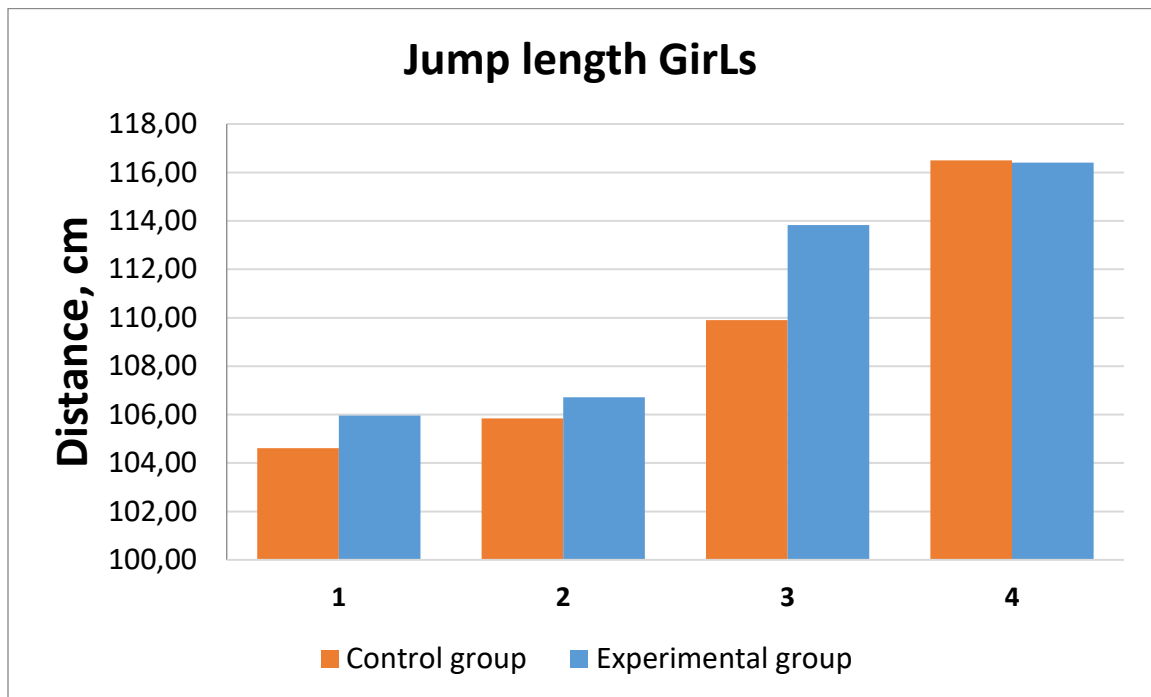


Figure 1. Results of a long jump in girls from KG and EGot I to IV grade

In the jump in height, an increase in the results was observed in both groups of boys, as it was evenly relative to each other, but with a slight advantage for the experimental group (Fig. 2).

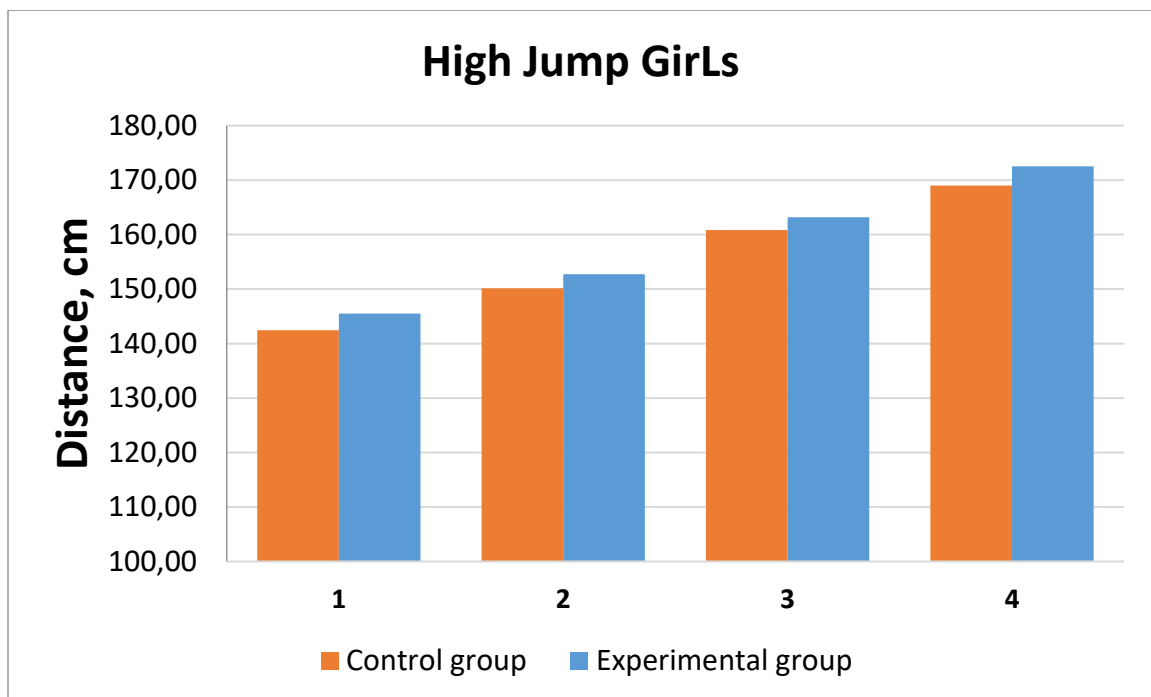


Figure 2. Results of high jump in girls from KG and EGot I to IV class

One of the factors influencing the duration of the match with the opponent is endurance. It is noteworthy that in the first and second grade the students from the experimental group ran the set distance of 300 m faster for I - III grade and 600 m for IV grade compared to the students from the control group (Fig. 3).

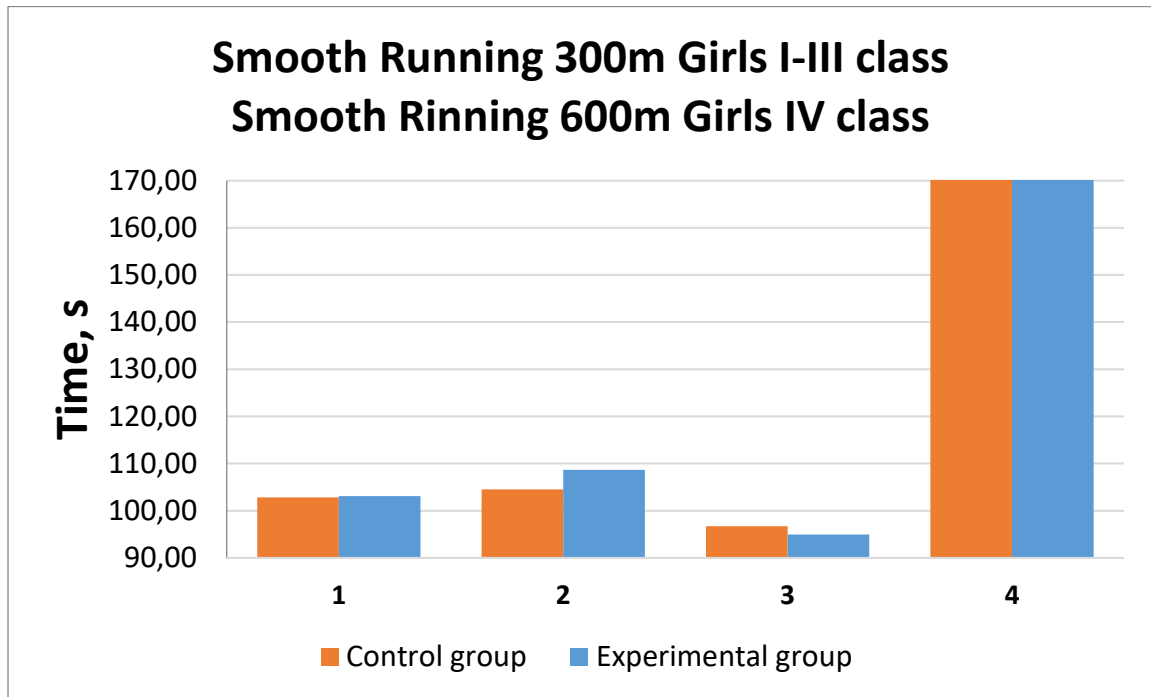


Figure 3. Results of the endurance test at 300 m and 600 m in girls from KG and EGot I to IV class

In FIG. 4 presents the results of throwing a solid ball in girls from first to fourth grade. The figure very clearly shows the stronger impact of the methodology of the pedagogical model on the explosive force of the upper limbs, measured by the test of throwing a solid ball 1 kg. The buoyancy force was uniformly similar in both the students in the experimental group and the students in the control group.

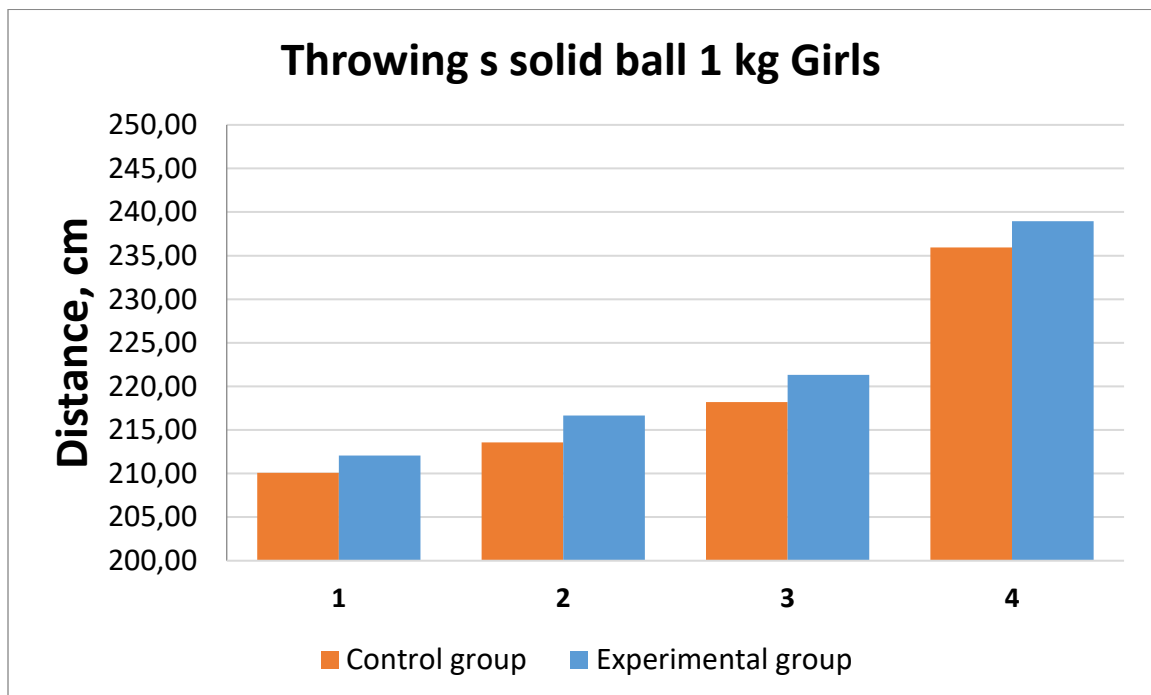


Figure 4. Results of throwing a solid (medical) ball in girls from KG and EGot I to IV class

The high percentages of the guarantee probability (P%) is a proof of the effectiveness of the methodologies of the pedagogical model. When analyzing the results of the measured flexibility of the

students from the control and experimental groups of the first, second, third and fourth grade, it is established that their flexibility has increased.

The Eurofit Slope test is used to determine flexibility. In FIG. 5 presents the results for the girls from the two studied groups.

As can be seen, the students from the experimental group, who train according to the methodology of the pedagogical model, have more flexibility than the students from the control group, who train according to the standard methodology.

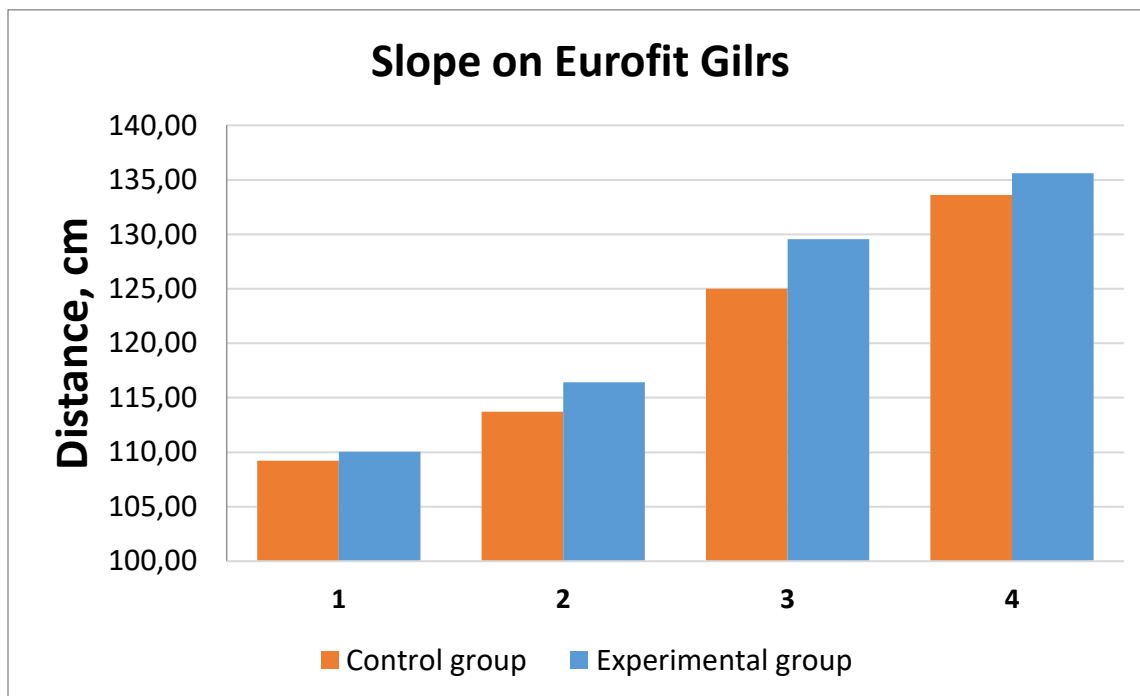


Figure 5. Results of the test "Eurofit slope" measuring flexibility in girls from KG and EGot I to IV class

Hence the conclusion that the methodology of the pedagogical model is more effective than the standard methodology.

The flexibility measured by the lateral twine test also increased progressively in parallel with the age of the first to fourth grade students (Fig. 6).

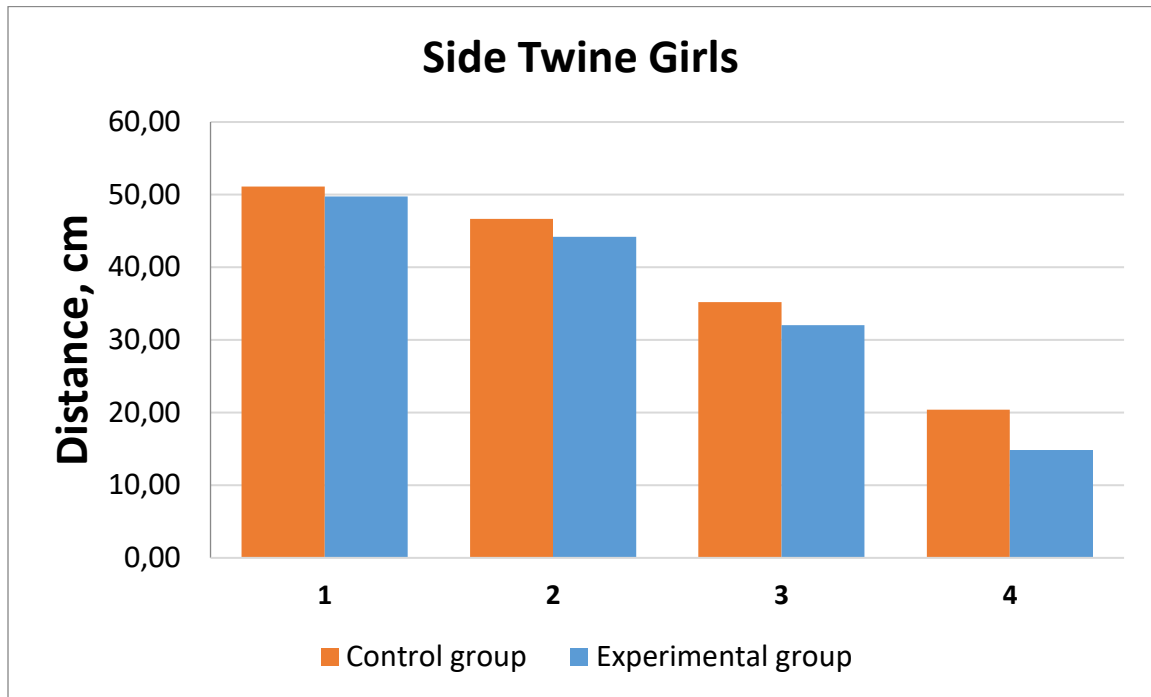


Figure 6. Results of the test "Side twine" measuring flexibility in girls from KG and EGot I to IV class

Higher values of the mean values of flexibility were reported in the students from the experimental groups compared to the students in the control group. It is natural to say that the methodology of the pedagogical model is more effective than the standard methodology.

It was found that the flexibility measured with the left twine in the taekwondo training of the studied students from first to fourth grade has improved. (Fig.7).

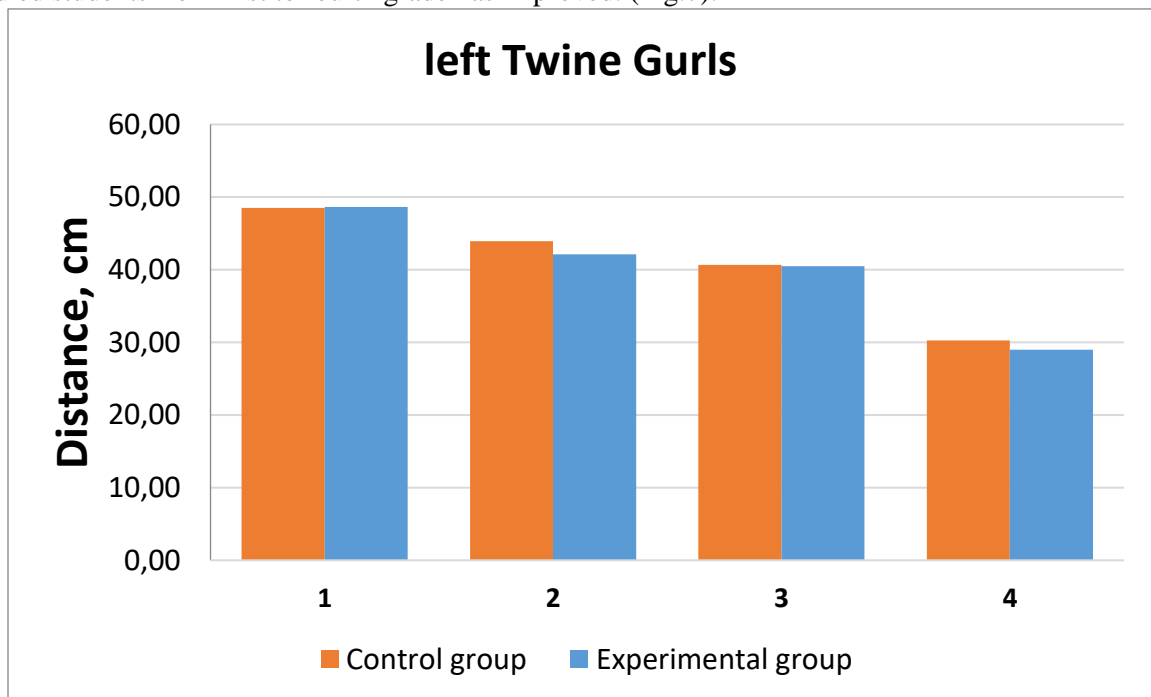


Figure 7. Results of the test "Left twine" measuring flexibility in girls from KG and EGot I to IV class

There was an improvement in flexibility in the left twine of the students and the control group. The standard methodology has also had a positive effect on their flexibility.

A similar positive trend in the flexibility gap is observed when measured with the right twine test. The assumption that the applied pedagogical model has had a positive effect on improving flexibility is confirmed (Fig. 8).

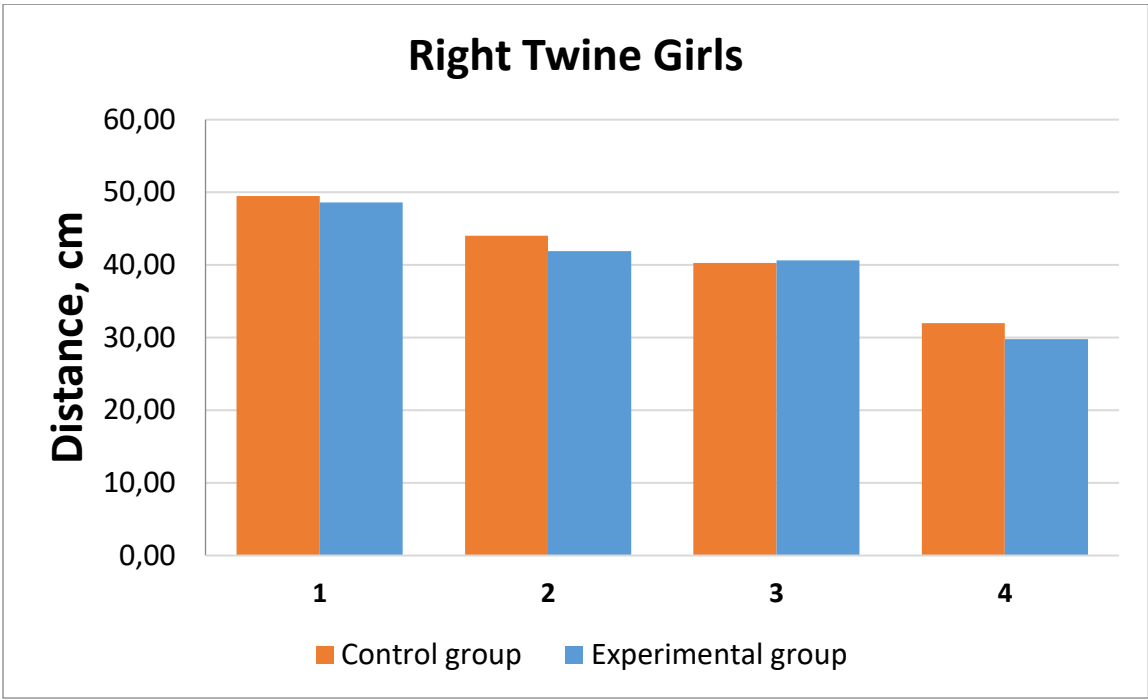


Figure 8. Results of the test "Right Twine" measuring flexibility in girls from KG and EGot I to IV class

It can be summarized that the improvement of the flexibility of the students from the control group proves the positive impact of the standard methodology. By summarizing the analyzed results of the research on flexibility, the effectiveness of the pedagogical model is proved.

The effectiveness of the applied methodology of the pedagogical model is proved by the speed, measured by jumps over a gymnastic bench. Speed was measured using the "Jumps over a gymnastic bench" test (Fig. 9).

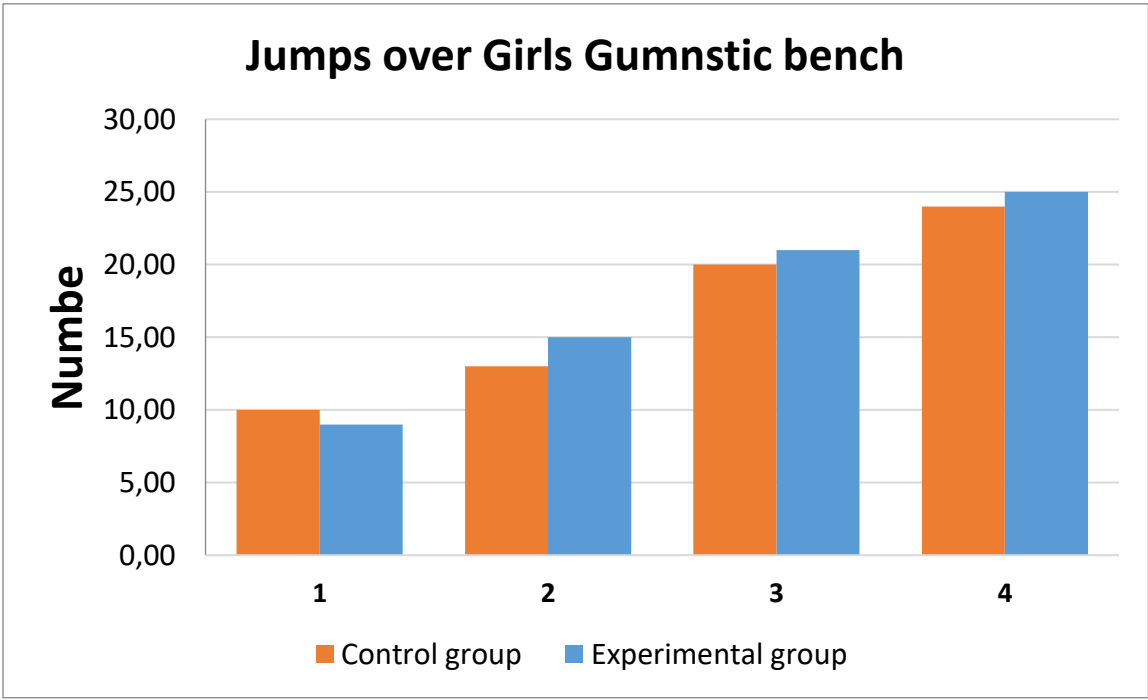


Figure 9. Results of the test "Jump over a gymnastic bench" measuring speed in girls from KG and EGot I to IV class

It is noteworthy that the students in the control group of the first grade have more flexibility compared to the students in the experimental group. This trend is also revealed in fourth grade students. Improvement in flexibility was also reported among students in other classes, which confirmed the effectiveness of the model.

The applied special methodology of the pedagogical model has had a positive effect on the development of dynamic strength in students from first to fourth grade. It was measured by performing the push-up tests for 30 seconds, and abdominal presses for 30 sec. In FIG. 10 presents the results of the test "Push-ups". The push-ups are performed for 30 s and their number is counted.

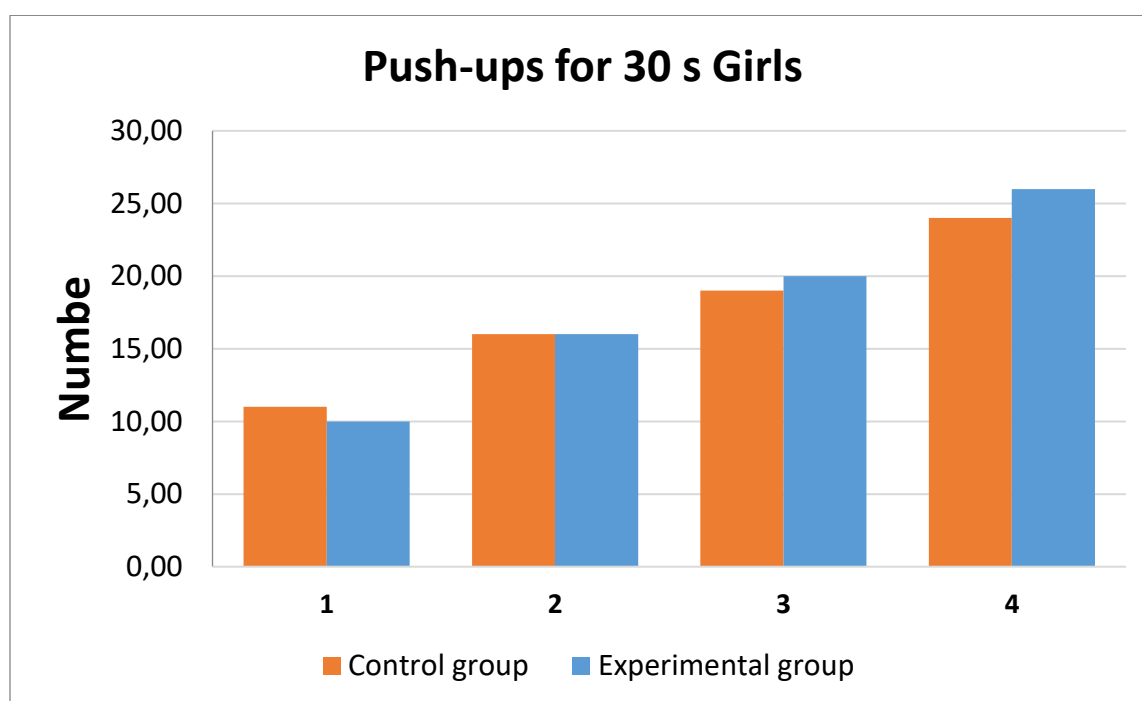


Figure 10. Results of the test "Push-ups for 30 s" measuring the dynamic force in girls from KG and EGot I to IV class

As a result of the systematic implementation of the specialized exercises from the methodology of the pedagogical model, the dynamic strength of the upper limbs has improved.

In FIG. 11 presents the results of the test "Abdominal presses". Abdominal presses are performed for 30 s and their number is counted.

The tendencies of the development of the dynamic force in the female students in both tests are similar.

In the generalization of the analysis of presented images of the development of the studied physical qualities, directly related to the techniques for fighting in taekwondo, the effectiveness of the pedagogical model is proved.

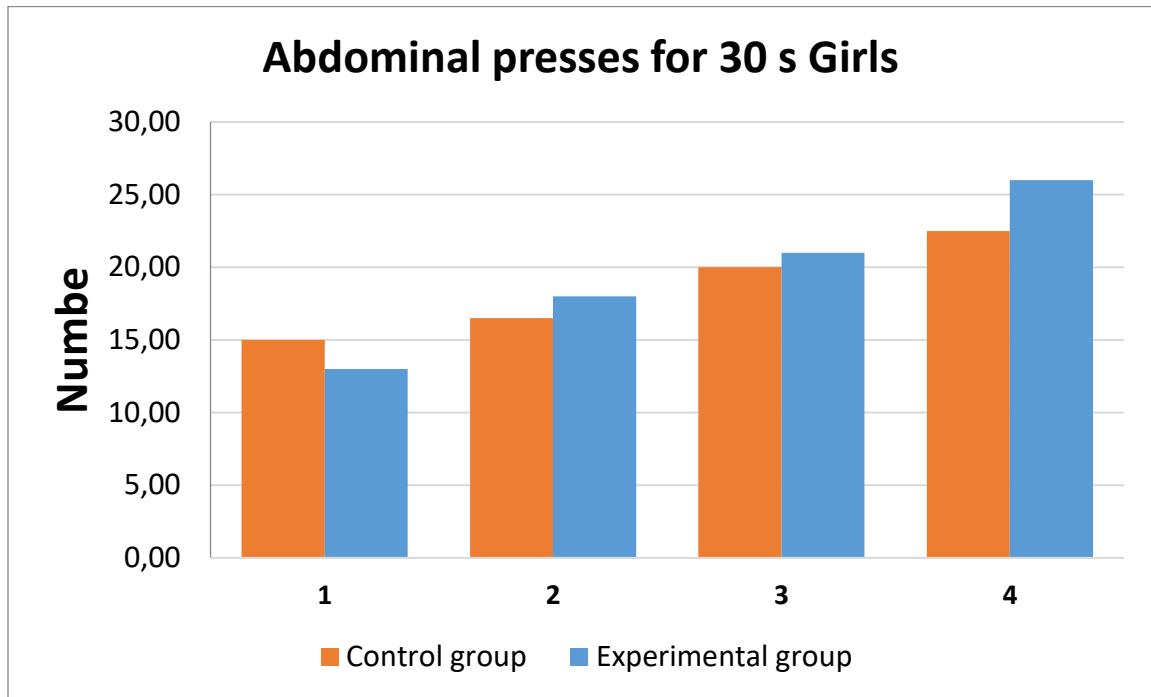


Figure 11. Results of the test "Abdominal presses for 30 s" measuring the dynamic force in girls from KG and EGot I to IV class

The specialized methodology of the pedagogical model has had a positive effect on the development of the dynamic strength of the abdominal muscles. She indicated a greater impact on the dynamic strength of the abdominal muscles of first and fourth grade students. The standard methodology has also had a positive effect.

A bar chart for the development of the explosive force of the long jump in students from first to fourth grade is presented. The tendency of the development of the students from the first to the fourth grade is reflected (fig. 12).

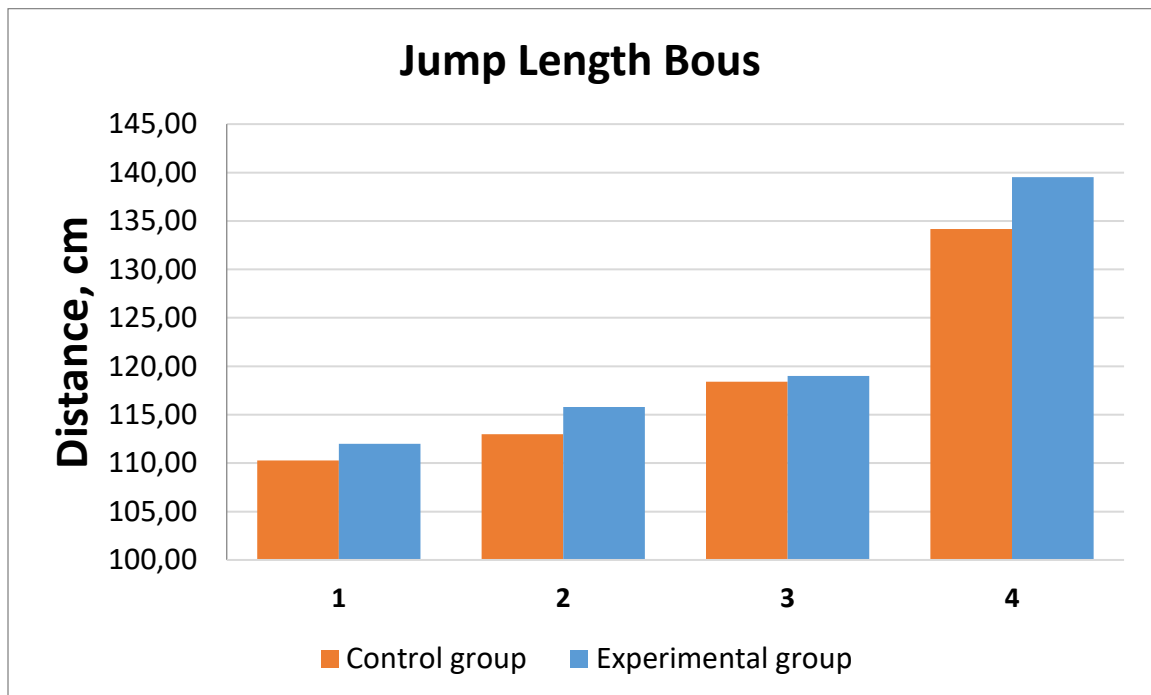


Figure 12. Results from a long jump in boys from KG and EGot I to IV grade

The explosive force of the moments, measured by a jump in length from a place, increases with their growth. Most of the differences from the mean values of the long jump from place between the control and experimental group are significant. The warranty probability is greater than 95%. The pedagogical model has shown a much stronger impact on fourth graders.

It was found that with the application of the pedagogical model in taekwondo training the explosive power of the upper limbs has increased, measured by the test height jump in students, which is an indicator of the effectiveness of the applied impact (Fig. 13).

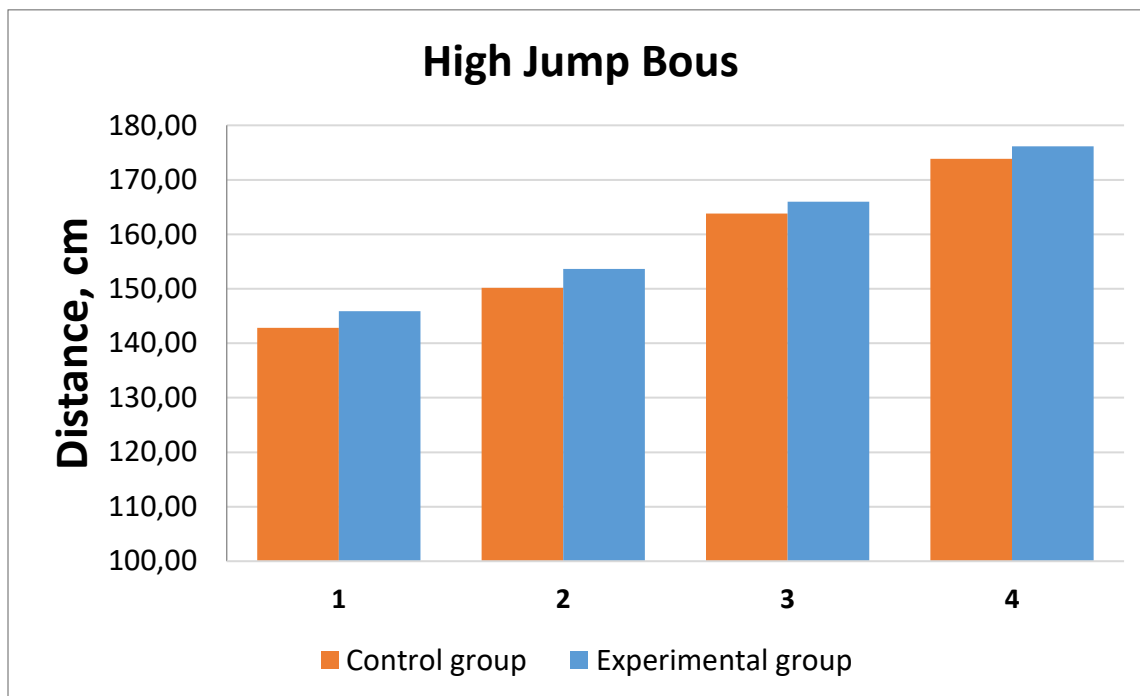


Figure 13. Results of high jump in boys from KG and EGot I to IV class

The measured explosive force of the lower limbs in the experimental groups at the end of the experiment in all classes is greater than the control group. This difference expresses the positive impact of the applied pedagogical model.

Of interest is the dynamics of endurance development, which was measured with the running test 300 m for first, second and third grade and 600 m for fourth grade. Fig. 14 shows the development of the endurance of the studied in the students from the control and experimental group.

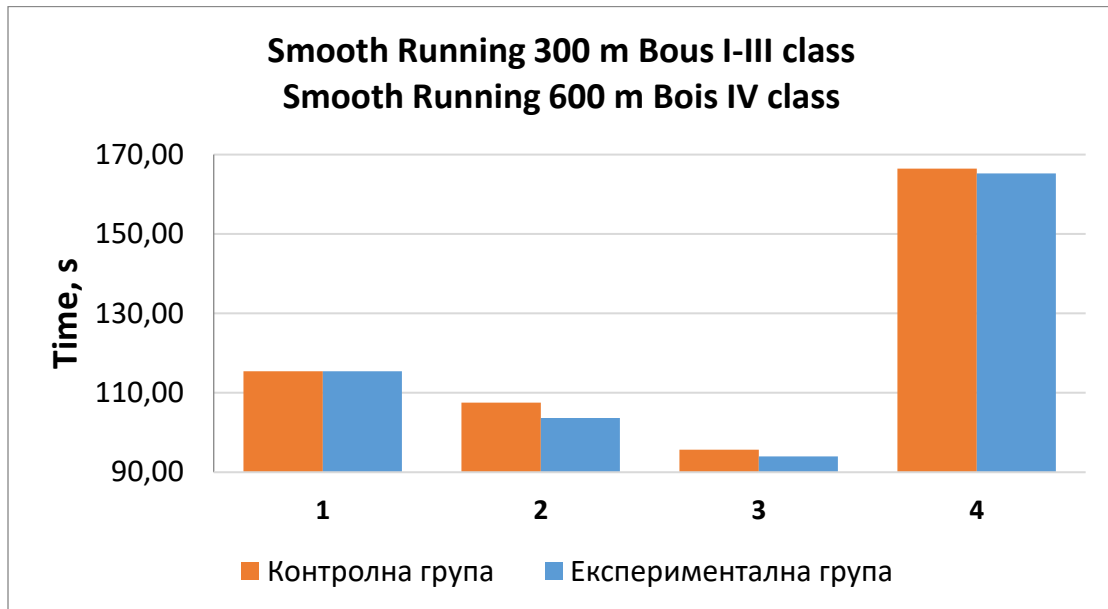


Figure 14. Results of the endurance test at 300 m and 600 m in boys from KG and EGot I to IV class

The boys from the experimental group in the second and fourth grade ran the control distance of 300 m and 600 m, respectively, faster than the students from the control group. This is due to the applied impact of the pedagogical model. There has been a progressive improvement in students' endurance.

The explosive force of the upper limbs was measured by the ball-throwing test. Taekwon-Do trainings, which include specialized exercises of the pedagogical model, have also had a positive effect on flexibility (Fig. 15).

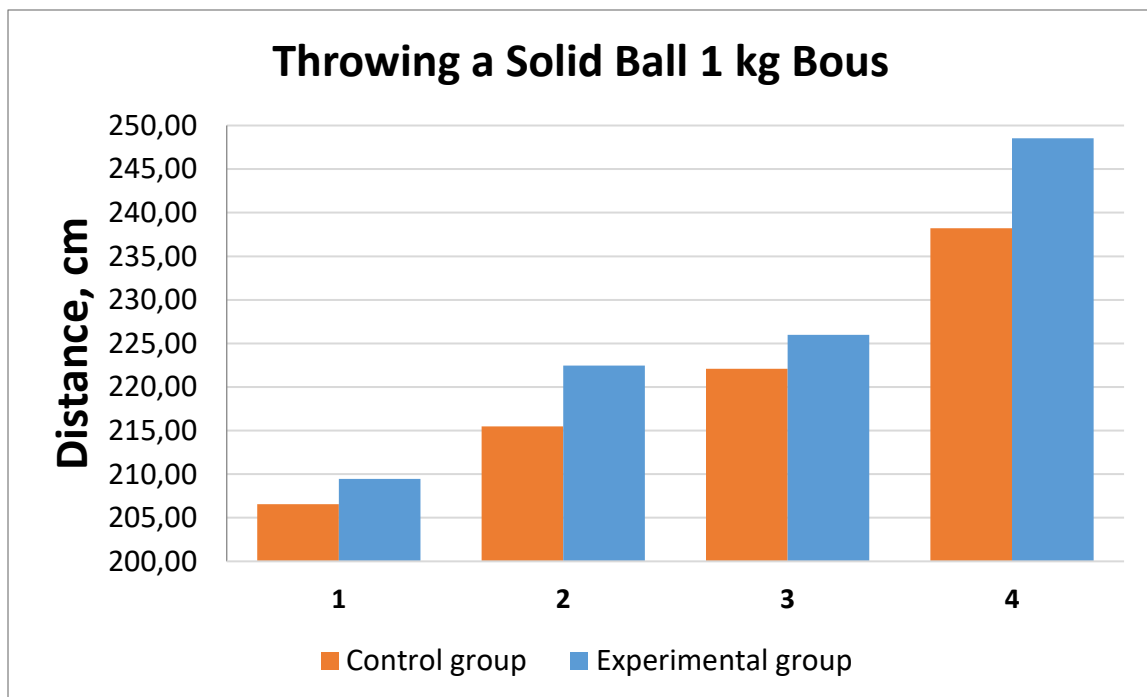


Figure 15. Results of the test measuring the explosive force in boys from KG and EGot I to IV class

Flexibility is measured with the Eurofit slope test. As can be seen from fig. 16 Taekwondo-Do trainings, in which certain means of the pedagogical model are applied and the flexibility is improved. It tends to develop faster.

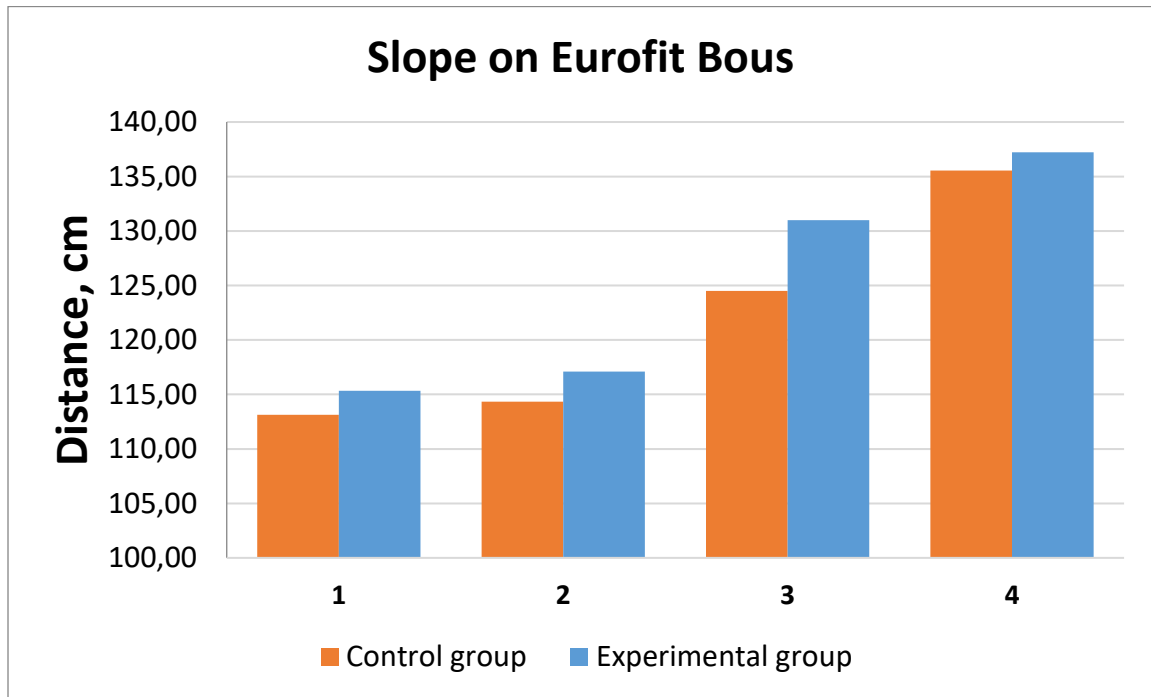


Figure 16. Results of the test measuring flexibility in boys from KG and EGot I to IV class

The flexibility of the students in the control and experimental groups, also measured by the "lateral twine", "left and right twine" tests, improved during the experimental period. In the standard trainings the flexibility of the students from the control group also developed, but to a lesser extent compared to the experimental group (Fig. 17).

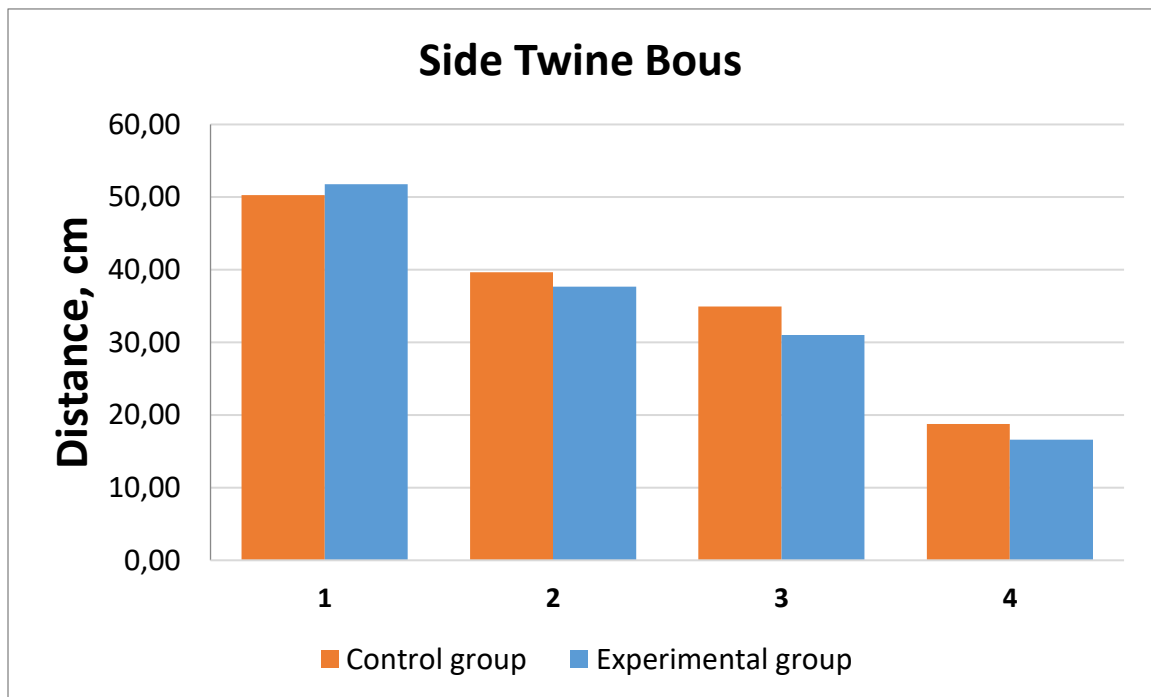


Figure 17. Results of the test "Side twine" measuring flexibility in boys from KG and EGot I to IV class

The flexibility measured by the left sword in the studied students developed very smoothly (Fig.

The flexibility of the students from the control and ex-experimental group increased with their growth.

The trainings of the students from the control group according to the standard methodology in certain periods had a greater impact compared to the impact of the pedagogical model. Conditions are being created for improving the model.

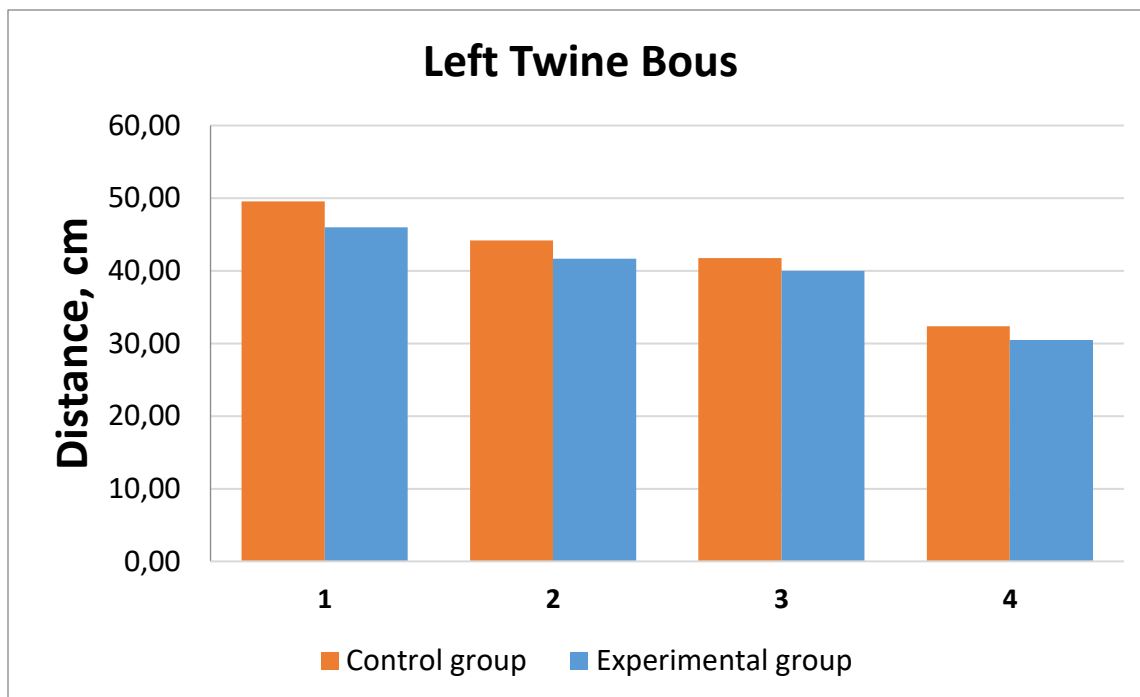


Figure 18. Results of the test "Left twine" measuring flexibility in boys from KG and EGot I to IV class

The flexibility measured with the right twine also marked improvement in both the experimental and control students (Table 19).

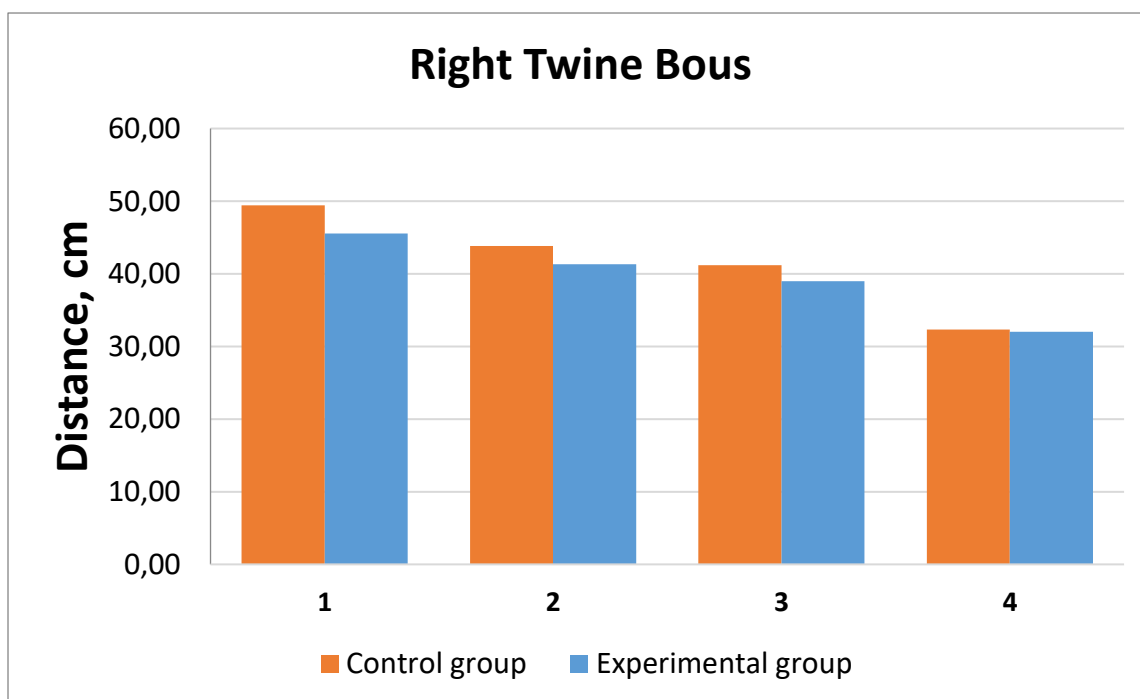


Figure 19. Results of the test "Right Twine" measuring flexibility in boys from KG and EGot I to IV class

It was found that the exercises of the pedagogical model applied in taekwondo training had a positive effect on the right twine.

In the analysis of the results of the research it was established that with the application of the pedagogical model in the trainings of the students from the experimental group the speed has improved (Fig.20).

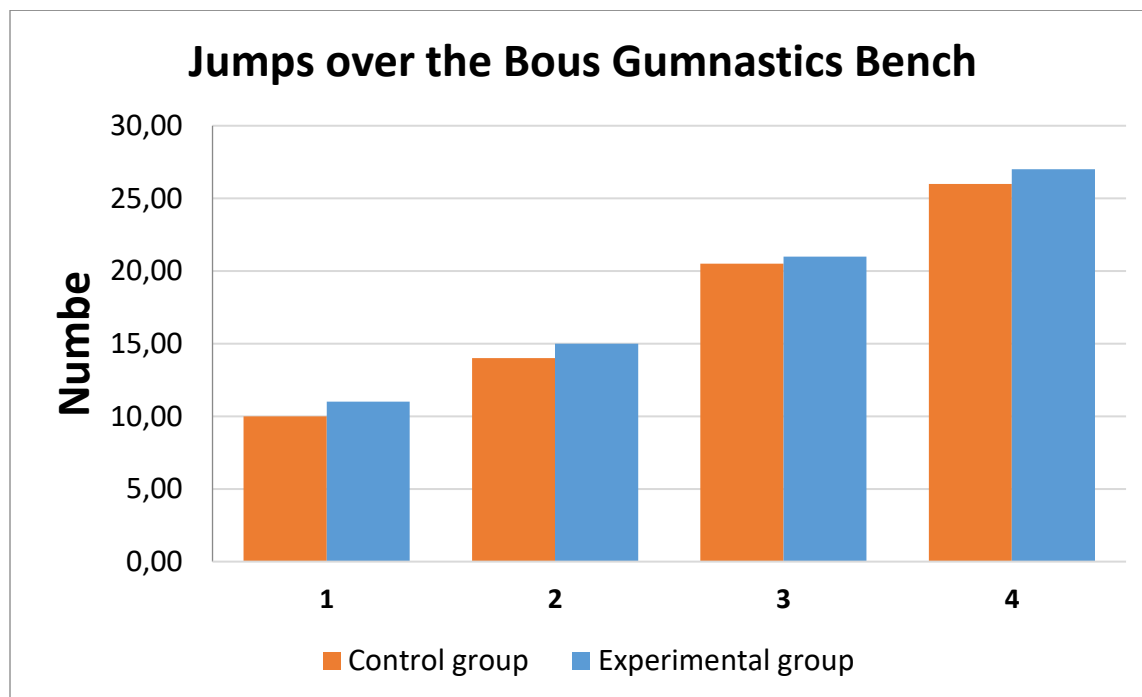


Figure 20. Results of the test measuring speed in boys from KG and EGot I to IV class

The speed of the students from the control group also improved as a result of the application of the standard methodology. The pedagogical model has had a stronger influence on speed compared to the standard methodology.

A progressive increase of the dynamic strength of the studied students from the control and experimental group is revealed. It was found that with each year of growth of students increases the dynamic strength (Fig. 21).

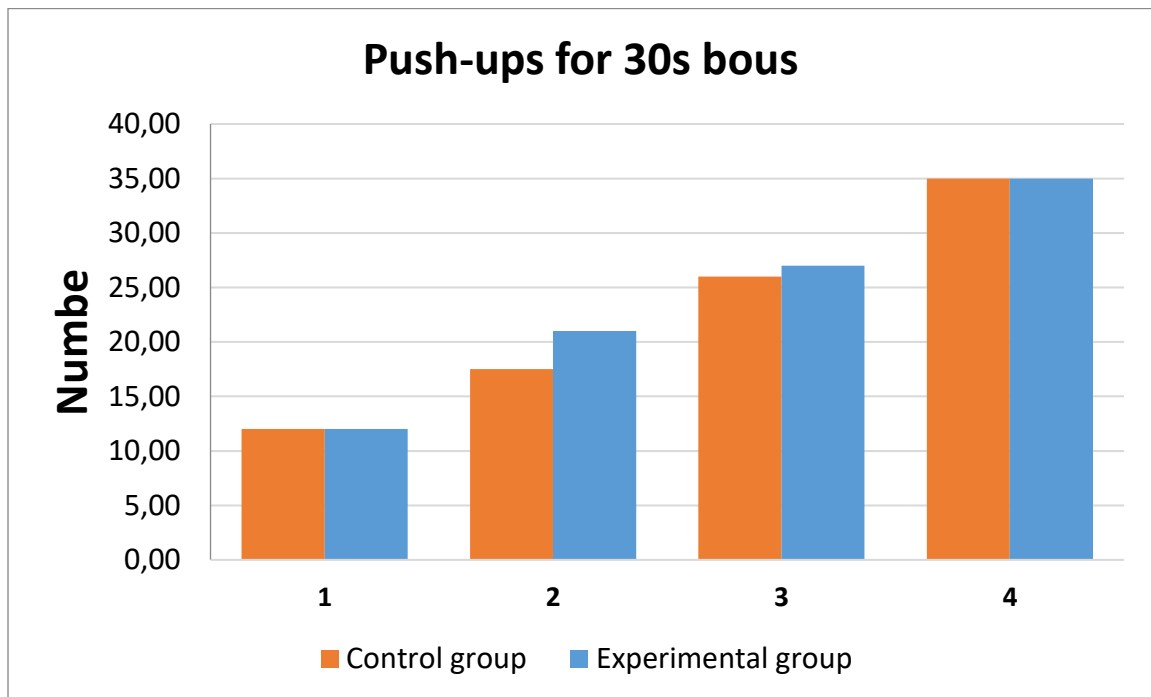


Figure 21. Results of the test "Push-ups" measuring the dynamic force in boys from KG and EGot I to IV class

The dynamic strength of the studied students, measured with the tests of push-ups for 30 s and abdominal presses for 30 s, gradually increases every year. As students grow, so does the effectiveness of the impact of the pedagogical model. This trend of increasing dynamic force is accelerated when the boys perform the abdominal press test (Fig. 22).

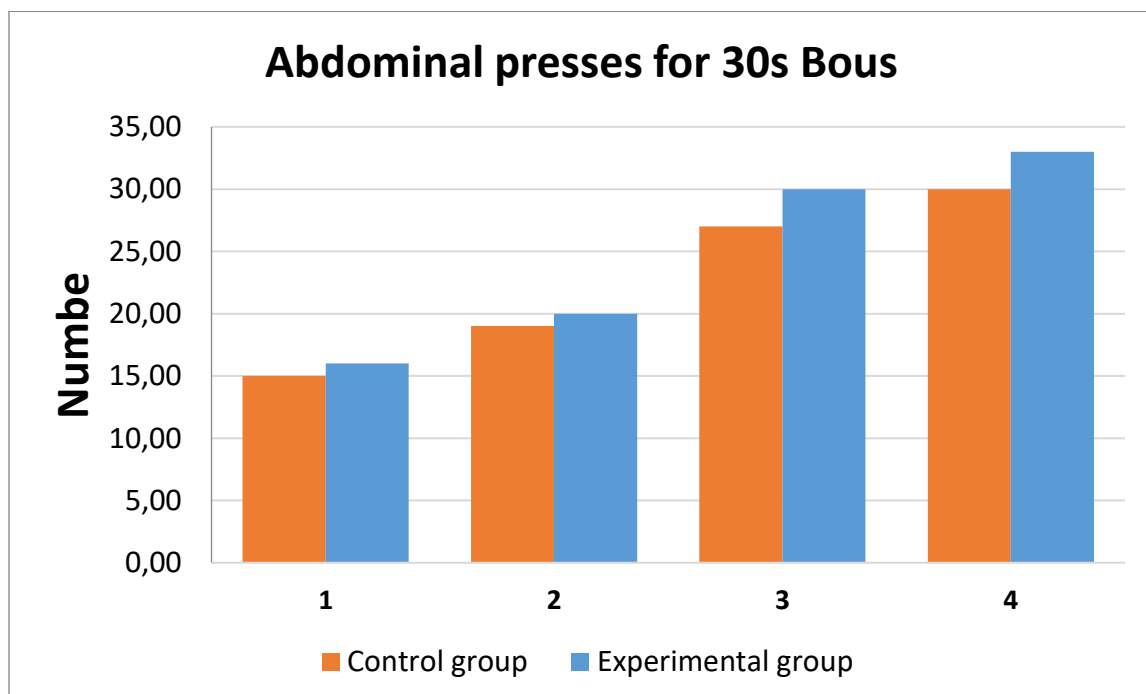


Figure 22. Results of the test "Abdominal presses" measuring the dynamic force in boys from KG and EGot I to IV class

In summarizing the analysis of the changes in the studied physical qualities of the students from the control group, training taeshuendo according to the standard methodology and the students training according to the methodology of the pedagogical model, it was found that during the growth of the students the indicators of the measured physical qualities increase. The methodology of the pedagogical model has had a greater impact on the measured physical qualities.

III.3. Established dependencies between the studied physical qualities

From the obtained results of the research, processed by the mathematical-statistical method of correlation analysis, the interrelations between the studied physical qualities in the students from the experimental and control groups from first to fourth grade before and after the experiment were established. One of the main physical qualities, occupying a central place in the physical capacity of the Taekwon-Do athlete is the explosive power of the lower and upper limbs, which is measured by three tests - long jump, high jump and throwing a solid ball. A significant correlation was found between the explosive force between the lower and upper limbs $R = 0.54$ ($D = 29\%$) in students in the first grade of the control group and $R = 0.61$ ($D = 37\%$) in students in the experimental group. The specified coefficients of determination (D) ripen the mutual definiteness between the two physical qualities. Explosive forces have developed in the process of Taekwon-Do training. Their mutual determinism of these two forces is - for the control group $D = 29\%$ and for the experimental group $D = 37\%$. In the experimental group of first class, a moderate correlation was found between the long jump and the high jump $R = 0.55$ ($D = 30\%$). The correlations of both the second grade students and the students from the control and experimental groups increased slightly.

In the second grade, higher correlation coefficients were found in the students from the experimental group $R = 0.57$ ($D = 31\%$). The mutual determinism of the relationship between the dynamic force measured by the push-ups test and the explosive force of the lower limbs, measured by a length jump, is $D = 31\%$ at $R = 0.56$. All these interrelations are regular and are largely due to the applied methodology of the pedagogical model. Very large correlation values were revealed for first, second, third and fourth grade students from the control groups between the indicators of flexibility measured by slopes on "Eurofit", side twine, left and right twine. In the students from the control group of the first grade between the left and the right split the correlation is $R = 0.66$ ($D = 44\%$), and in the experimental group it has increased to $R = 0.90$ ($D = 81\%$). It should be noted that both methodologies have had a positive impact on the flexibility of female students. It should be noted here the much stronger impact of the methodology used by the pedagogical model. A similar pattern of positive impact of the pedagogical model is revealed in the second and third grade students. In the second class in the control group the correlation is $R = 0.84$ ($D = 71\%$), and in the experimental group it is higher $R = 0.88$ ($D = 74\%$). The standard methodology had a positive impact on the development of flexibility of students in the control group of third grade. The correlations between the flexibility measured by the Eurofit slope tests are similar.

They are weaker for the students of the studied groups from the first and second grade. Correlations between second-graders between the dynamic force measured by the solid ball throw test and the explosive force of the lower limbs measured by the long jump test increased. The calculated correlation is $R = 0.6$ ($D = 45\%$). This correlation is weaker in the students of both the control group and the students in the experimental group.

It should be noted that the methodology of the pedagogical model includes specialized exercises for the development of explosive forces of the lower and upper limbs. In all likelihood, the intensity of their implementation is lower. This correlation is greater in third grade students in the experimental group, where $R = 0.78$ ($D = 61\%$). It decreased in fourth grade students to $R = 0.71$ ($D = 50\%$). The differences in the determinations of 11% show a certain downward trend, but it does not significantly affect the physical capacity of students. The relationships between these two physical qualities are similar for third and fourth grade students, both for the experimental and control groups.

An important place in the overall physical training of students practicing Taekwon-Do is speed. Speed was measured by the jump test over a gymnastic bench. To a large extent it is affected and influenced by the explosive force of the lower and upper limbs. In the process of Taekwondo training, the inclusion of specialized exercises from the pedagogical model has strengthened the relationship between

these two physical qualities. High values of correlations between the speed and explosive force of the lower extremities and the dynamic force, measured by jumping over a gymnastic bench in the students from the experimental group of second, third and fourth grade, were revealed. In the second class the correlation is $R = 0.78$ ($D = 61\%$). In the third grade it increased to $R = 0.86$ ($D = 74\%$). In the fourth grade it decreased to $R = 0.81$ ($D = 66\%$). The correlations between the dynamic force and the explosive force of the lower limbs, measured by the height jump test, are similar. The correlation values between the speed and the explosive force of the lower limbs are slightly lower in the students from the experimental groups of II, III and IV grade. The tendency of the dynamics of the changes in the strength of the correlations in them is the same as in the students. They obey the same laws for the development of physical capacity associated with these qualities. The differences in the correlations between the speed and the explosive force of the lower limbs in the students of II, III and IV grade do not have a significant influence on the state of the physical capacity of the students. They give more information about the level of improvement of the structure of physical capacity in the studied students. It is highly probable that students with higher correlation coefficients between the speed and explosive power of the lower extremities have greater opportunities to improve their abilities and mastery. Therefore, the applied methodology of the pedagogical model creates favorable conditions for accelerated development of the physical capacity of the students.

One of the main factors in the structure of the physical capacity of Taekwondo practitioners is the dynamic force. Dynamic force measured with push-up tests for 30 s. and abdominal presses for 30 s correlated with the explosive force of the upper limbs $R = 0.77$ ($D = 59\%$), with the speed measured by 300 m running $R = 0.63$ ($D = 40\%$.) in third graders of the experimental group. The correlations of the second and fourth grade students are also weaker, but reliable. The interconnection for the quick execution of the push-ups for 30 s and the throwing of a solid ball of 1 kg is logical. When the push-ups are performed quickly, the explosive force of the upper limbs also develops.

Running is associated with the movements of the upper limbs. This dependence has been known since ancient times. Aristotle said that when a person runs, he also works with his hands. In second and third grade students, these dependencies have different values. The state of the interrelationships of these physical qualities is similar in the control groups of the students.

During training and especially during competitions, strong blows are often inflicted on the abdomen. To one degree or another, the blows to the abdomen and kidneys have a negative effect on the psychophysical condition of the athletes. Therefore, it is necessary to improve the endurance of the abdominal muscles. Different power relationships of the speed when performing abdominal presses for 30 s with the endurance $R = 0.48$ ($D = 23\%$), measured by running at 300 m (600) m and the flexibility $R = 0.41$ ($D = 16\%$) were revealed, measured with the test slopes on "Efrofit" in third grade students of the experimental group .

When running, the abdominal muscles tense up and have some effect on endurance. When performing the slopes on "Efrovit" also to some extent, the abdominal press is loaded. The correlations between the studied physical qualities in the studied students from the control and experimental groups are similar. The correlations vary in strength, but the trend continues.

Summarizing the brief analysis of the relationships between the studied physical qualities in the students of the experimental and control groups from first to sixth grade, it is established that the applied methodology of the pedagogical model has had a positive effect on the accelerated development of their physical qualities. The standard methodology has also indicated a positive effect on physical properties. However, the methodology of the pedagogical model has a stronger impact on the accelerated development of students' physical qualities compared to the standard methodology. It is more effective than the standard methodology.

Conclusions and recommendations

Based on the analysis of the applied pedagogical model, aimed at accelerated primary education in Taekwon-Do students from I to IV grade, the following conclusions and recommendations can be made:

1. The study of the available literature on the subject found that the research in this direction is insufficient and needs to be supplemented.

2. The analysis of the methods and means of training in Taekwondo revealed that there are reservations in optimizing the training effects and improving the quality of initial training in adolescent taekwondo fighters.

3. In order to improve the quality of management of the Taekwon-Do training process for adolescents (boys and girls from I - IV grade) an original model for accelerated initial training with a one-year training cycle has been developed and experimentally tested.

4. The structure and content of the applied model follow methodical and didactic logic and cause positive changes in all aspects of the preparation of the experimental group, with a strong focus - accelerated initial training in Taekwondo in adolescents.

5. The applied model of initial training in Taekwon-Do has had a positive impact on the development of the explosive force of the lower and upper limbs and the dynamic force in girls and boys.

6. The endurance, speed and flexibility of taekwondo fighters have improved.

7. The accelerated development of the basic physical qualities of taekwondo fighters significantly improves the study, mastery, improvement and application of combat techniques.

Recommendations

1. To continue the research aimed at studying the history of Taekwon-Do and enriching the teaching methodology.

2. To study the effectiveness of the pedagogical model for accelerated initial training in TaekwoDo for the mental and moral development of practitioners of this martial art.

3. On the basis of the revealed regularities from the scientific research to improve the pedagogical model for accelerated initial training in taekwondo of students I - IV grade.

4. To publish the methodology of the pedagogical model for accelerated initial training and to acquaint the clubs and sports pedagogical staff conducting the training and the training process in Taekwon-Do with it.

5. To organize training of coaches and sports pedagogical staff in Taekwon-Do, in order to get acquainted with and practical application of the pedagogical model for accelerated initial training.

Yields

The scientific contributions are on a theoretical, practical and applied level.

The history, essence and content of Taekwon-Do are supplemented, based on the studied literature and the experience of highly qualified masters in Taekwon-Do and other martial arts.

Developed and tested model for accelerated initial training in taekwondo for boys and girls from I to IV grade - a comprehensive training program for training.

The analysis of the obtained results proves the effectiveness of the created pedagogical model for accelerated initial taekwondo training of boys and girls from I to IV grade. The model has a high practical realization.

The developed pedagogical model contributes to the physical capacity of students and at the same time is effective for improving technical training.