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IMPACT OF THE 'SHUTTLE TIME – BADMINTON' PROGRAM ON STUDENTS' PHYSICAL FITNESS

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ABSTRACT
BWF's "SHUTTLE TIME" badminton training program was approved for seventh-grade students. The PURPOSE of the study was to trace its effect on the development of students' motor abilities: speed, endurance, upper limbs' explosive power, and agility.
The research covered fourteen boys and nine girls, aged 13-14, students from 119 Secondary School "Acad. Mikhail Arnaudov", Sofia city.
The methodology was applied to the elective subject 'Racket sports' in the education program of 'Physical education and sport' in two school terms—36 school classes.
The data were traced using the system for assessing the students' physical fitness in the Republic of Bulgaria at the beginning and end of the 2022/23 school year.
The statistical methods used for data processing were Variation analysis and Student's paired-sample t-test. The following RESULTS were obtained:
The boys' endurance and agility indicators showed an increase with a significant effect size (Cohen d up to 0.8), and the upper and lower limbs' explosive power indicator and speed indicator had a large effect size (Cohen d over 0.8).
In girls, a large effect size (Cohen d over 0.8) was achieved in indicators for endurance, agility, and upper limbs' explosive power, and a significant effect size (Cohen d up to 0.8) was obtained in the indicators for speed and lower limbs' explosive power. The results were statistically significant, with a guaranteed probability: P (t)≥95%.
The applied program has a significant impact on agility and endurance and a lesser impact on the upper and lower limbs' explosive power and speed.

Key words: model, education, badminton, motor abilities

INTRODUCTION

School education in the Republic of Bulgaria is structured in stages and levels. We focus on the lower secondary stage of primary school - from grades V to VII. Within the subject 'Physical Education and Sport,' students are trained in the techniques and tactics of major sports. According to the National Educational Standard, by the end of this stage, a student must acquire skills in three mandatory areas and one elective area of the curriculum in physical education. The elective areas include racquet sports, specifically badminton, which is the focus of this study. The number of classes under the curriculum is as follows: for grade VII – 72 classes per year, with elective areas comprising 25% of the lessons for the respective grade (1, 2).

Badminton, as an elective sport within the context of racket sports, is characterized by interval-based and variable physical activity, requiring students to master various technical skills. It helps master essential qualities such as speed (in reaction, movement, and racket swing), dynamic strength, flexibility, anticipation, motor coordination, precision, ability to focus, and operational thinking under increasing fatigue and psychological stress (as seen in competitions) (3-7). Throughout the educational process, critical personal qualities such as self-control, self-regulation, courage,

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decisiveness, and others essential for achieving victory and goals are cultivated. Players' movements are distinguished by high coordination complexity, involving combinations of movements in all directions, lunges, sudden starts, jumps, and stops, combined with various body bending and twists, while simultaneously performing complex shuttlecock strokes with different speed and power, all of which contribute to competitive effectiveness (8-10).

Badminton is an accessible sport for everyone who practices it, without restrictions on age, gender, or ethnic background. It is a social and unifying sport, safe and suitable for training at all levels and systems, like the one examined in this study—the school education system, specifically focusing on the effect of badminton on students' motor skills.

Personal qualities – moral and willpower (courage, determination, perseverance, etc.) and moral virtues (ethical standards of behavior – honesty, tolerance, integrity, etc.).

In 2012, the Badminton World Federation (BWF) developed a specialized badminton program called 'Shuttle Time,' aimed at training physical education teachers (11). Since 2021, the Bulgarian Badminton Federation (BFB) has successfully conducted free training sessions under the program, reaching over 350 teachers nationwide. The main goal of the program is to promote badminton among students. Methodical guides have been developed to assist physical education teachers, containing lesson plans on various topics. The program has been tested at 119th Secondary School 'Mihail Arnaudov' in Sofia with students aged 13-14.

The study aims to track the effect on motor skills development: speed, endurance, upper and lower limbs' explosive power, and agility in students at the beginning and the end of the 2022/2023 school year.

The research focuses on motor skills: speed, endurance, upper and lower limbs' explosive power, and agility, which determine the students' physical fitness.

The subject of the study is the influence of the 'Shuttle Time' Program on the student's physical fitness development level.
The study's participants include 14 boys and 9 girls, aged 13-14, from the 119th Secondary School 'Mihail Arnaudov' in Sofia. These students took an elective course in 'Racket Sports' (Badminton) as part of the 'Physical Education and Sport' curriculum during the 2022/2023 school year.

The research tasks include:
1. Determining the level of motor skills development: speed, endurance, upper and lower limbs' explosive power, and agility, according to the assessment system established by the Ministry of Education and Science for assessing the students' physical abilities from first to twelfth grade.
2. Implementing the 'Shuttle Time' Program within the elective course 'Badminton' as part of the 'Racket Sports' curriculum in 'Physical Education and Sport' for the participants in the study.
3. Investigating the program's impact on the student's physical fitness in the experimental study.

METHODS

The following research methods were used: pedagogical experiment, sports-pedagogical testing, and mathematical and statistical methods (variation analysis, Student's paired-sample t-test)

The research methodology involved adapting and implementing the developed training program, 'Shuttle Time,' within the elective sport badminton curriculum. The structure and content of the program are presented in **Figure 1.**

The thematic plan is composed of four separate methodological units, which, according to the objectives and tasks of each lesson, include technical, tactical, physical, and theoretical preparation. The goals and content of the physical preparation and tasks are focused on developing and mastering speed (velocity, frequency of single movement, reaction), agility (change of direction, jumping-landing, balance), upper and lower limbs' explosive power, and endurance. The aim is for the students to develop skills and habits related to specific (specialized) physical preparation in badminton.

An example of a thematic plan for developing motor abilities, following the lesson objectives, is presented in **Tables 1 and 2.**

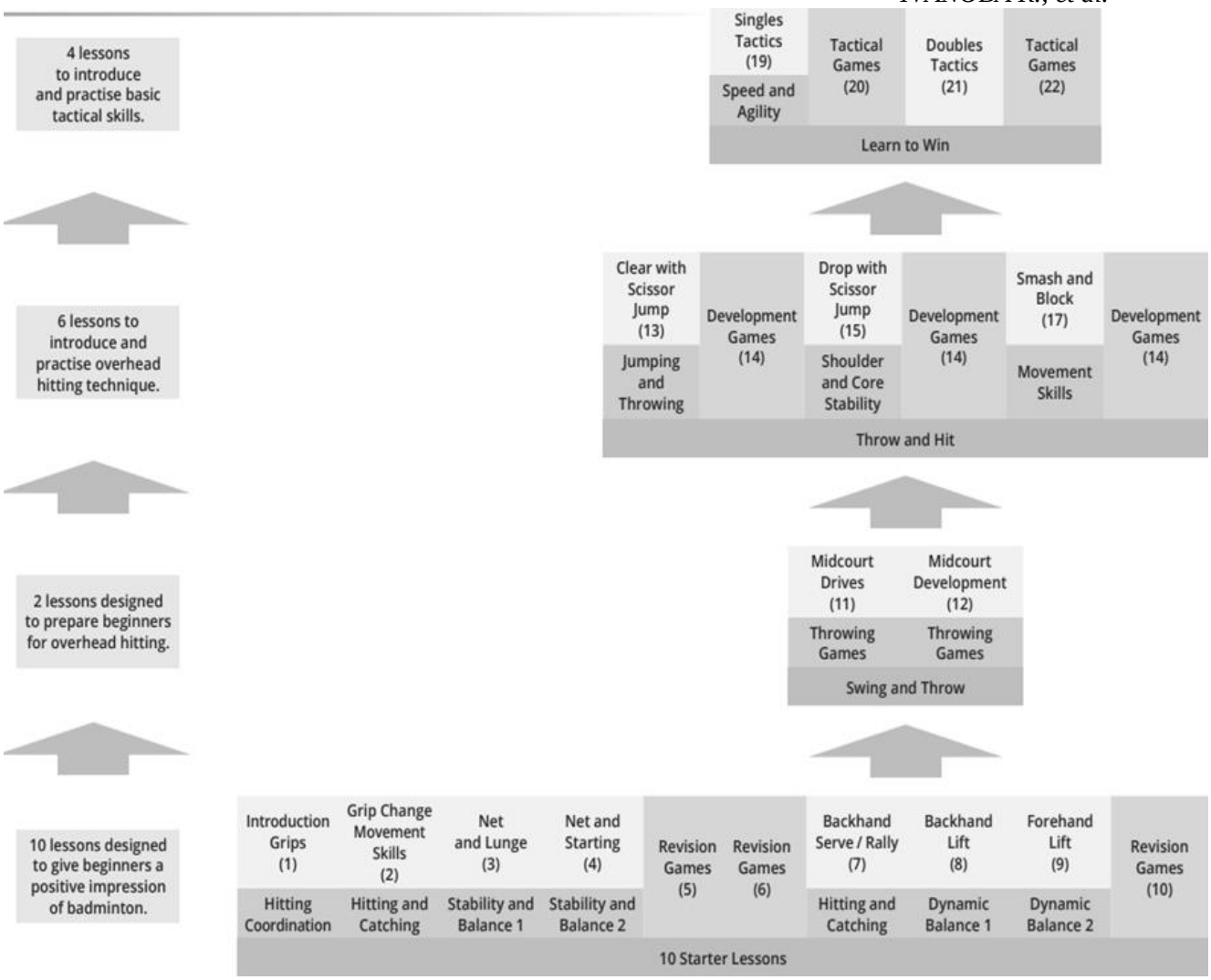

Figure 1. Program Structure

Table 1. *Development of basic coordination, stability, and balance skills*

Element	Exercise	Lesson (L) Video (V)	Teaching Hints
Sprint, stop and balance	Relay Games. Balance the racket.	L8 ▶ V1 L9 ▶ V2	• The lunge technique helps to 'stop and go'.
Dynamic balance	Retrieve a shuttle placed far in front of oneself.	L8 ▶ V2	• Repeat on opposite leg.
Change of direction and agility	Calf touching.	L9 ▶ V1	• Assists development of qualities required for effective movement skills.

As a visual aid, the program offers instructional videos demonstrating specific situations in the lesson, presented in column 3 of **Tables 1 and 2.**

Table 2. *Development of basic coordination, stability, and balance skills*

Element	Exercise	Lesson (L) Video (V)	Teaching Hints
Hand-eye coordination A 'feel' for hitting	Balloon tap.	L1 ▶ V1	• Balloons are perfect to start with because speed of flight is very low.
Chasse steps A movement – a technique in badminton	Mirror chase with throw.	L2 ▶ V1	• One foot chases the other but never quite catches up. • Low centre of gravity.
Underarm throw and catch	Leader and chaser.	L2 ▶ V2	• Throw and catch is a good preparation exercise for hitting a shuttle with a racket.
Tag game Movement, stamina and change of direction	Tag game with extra running after being tagged.	L5 ▶ V1	• Endurance and motivation to avoid being tagged.
Balance	Balance on one leg and throw and catch shuttle. Balance an upturned shuttle on your head. Jump on one leg and back.	L3 ▶ V1 L3 ▶ V2 L4 ▶ V1	• Balance is very important to control movements in badminton, for example, lunge movements and landing after jumps.
Reaction times Reactivity to start quickly in different directions	Move on the spot - "happy feet" - and start after a signal.	L4 ▶ V2	• Train this with signals using sound (clap, stamp or whistle) and / or visual aids (waving a shuttle tube or coloured cone in the air).
Stability and balance	Statue on the move.	L6 ▶ V1	• Balance and stability are important elements in controlling badminton movements.
Speed, agility and stamina skills	Relays with different challenges. Roll the dice and run.	L7 ▶ V1 L10 ▶ V1	• Tasks must be related to the abilities of pupils. • To run 'for the team' is a good motivation.

Tables 3 and 4 present an excerpt from a badminton lesson: 'Improving grip changes and footwork on the court.' Each lesson begins with the set objectives for the teacher and students, the necessary equipment, and the requirements for where the activity will occur **(Table 3).**

Table 3. *Grip Changes and Footwork*

Teacher's Goals	Pupil's Goals
The purpose of this lesson is to: • introduce the use of chasse steps as a method of moving; • develop grip changing skills.	By the end of the lesson the pupils will be able to: • demonstrate the use of chasse steps over short distances; • show the use of alternative grips in a predictable situation.
Equipment • Bean bags • Shuttles • Rackets	**Teaching Situation / Context** • Preferably the lesson should be taken inside – but it is possible to deliver this outside.

Table 4. *Grip Changes and Footwork*

Phase / Time	Activity	Main Teaching Points	Variations (↑ Harder, ↓ Easier)		Safety
Introduction (5 min)	Teacher explains and demonstrates: • chasse steps – "one foot chases the other but never quite catches up"; • feet don't have to be parallel to each other for a chasse; • the use of chasse steps for parallel, diagonal (forward and backward) movements.	Maintain straight body position (knees slightly bent / flexed) with head staying at the same height.	↑	• Execute chasse steps diagonal (forward and backward) movement (varied pace).	• Maintain safe distance between children when moving across the floor.
			↓	• Start with walking pace and slowly build up parallel movement only.	
Mirror chase (10 min) ▶ L2 – V1	• Pupils are divided into pairs facing each other. One pupil is the "leader" and the other one is the "chaser". Using chasse steps, the "leader" moves laterally and changes directions trying to escape from the "chaser". The "chaser" must follow and try to keep up with the "leader".	• Use only short distances to chasse (avoid over-chasseing) • Change roles often (30-40 sec). • Encourage straight posture with knees slightly flexed.	↑	• Chasseing parallel, diagonal (forward and backward) movement.	• Keep the group well-spaced apart. • Allocate partners in terms of skill level / ability.
			↓	• Chasseing only on parallel line.	
Mirror chase with throwing (game) (10 min) ▶ L2 – V2	• Pupils remain in pairs facing each other. One pupil holds a bean bag (or shuttle) and is the "leader". The "chaser" must follow. The "leader" throws the bean bag and the "chaser" tries to catch it and return it.	• Change roles and partners on teacher's signal. • Approximately 3 metres between partners.	↑	• Throwing with "racket arm" only.	• Keep the pairs of pupils well-spaced apart. • Allocate partners in terms of skill level / ability.
			↓	• Throw with two hands.	

In terms of structure and content, the lesson is divided into sections, each with a specific duration and organizational and methodological guidelines. There are variations of exercises that are harder and easier, which assists the teacher in selecting the appropriate resources for the specific activity. Differentiated instruction is evident, along with the individualized approach of the teacher's activities, tailored to the specifics of the working conditions and the students, among other factors.

Sports pedagogical testing was conducted at the beginning and the end of the school year. The 'System for Assessing the Motor Abilities of Students from Grades I to XII' was applied according to an established methodology (12).

RESULTS AND ANALYSIS

The following tables (Tables 5 and 6) present the data from the conducted research.

The improvement in boys regarding endurance and agility showed a significant effect size (Cohen's d up to 0.8), while the upper and lower limbs' explosive power and speed demonstrated a large effect size (Cohen's d over 0.8), as shown in **Table 5.**

Table 5. *Data from the comparative analysis in 13-14-year-old boys*

№ of Test, Indicator	n	I test		II test		Increase in results				
		□□□□	S_1	□□□	S_2	d	d%	Cohen d	t	P (t)
1. 30 m running	14	5.56	0.50	5.28	0.33	0.29	5.13	0.985	3.89	99.74
2. Long jump	14	167.29	23.40	172.29	21.16	-5.00	-2.99	1.301	4.87	99.97
3. A medicine ball throw	14	4.26	0.67	4.59	0.67	-0.34	-7.92	1.263	4.25	99.91
4. 200 m Shuttle run	14	50.16	4.69	48.94	3.83	1.22	2.43	0.757	2.83	98.59
5. T-test	14	14.75	1.17	14.61	1.23	0.15	1.00	0.783	2.93	98.83

For the girls, a large effect size was achieved (Cohen d over 0.8) in the increase of indicators: endurance, agility, and upper limbs' explosive power, and a significant effect size (Cohen d up to 0.8) was observed in speed and lower limbs' explosive power. The results are statistically significant, with a guaranteed probability of P(t) ≥ 95%, as shown in **Table 6.**

Table 6. *Data from the comparative analysis in 13-14-year-old girls*

№ of Test, Indicator	n	I test		II test		Increase in results				
		□□□□	S_1	□□□	S_2	d	d%	Cohen d	t	P (t)
1. **30 m running**	9	5.85	0.28	5.80	0.45	0.05	0.82	0.395	4.61	99.83
2. **Long jump**	9	158.11	18.89	162.00	17.39	-3.89	-2.46	0.684	1.75	97.17
3. **A medicine ball throw**	9	3.89	0.31	4.26	0.57	-0.37	-9.58	1.648	4.13	99.67
4. **200 m Shuttle run**	9	47.29	4.78	46.25	4.05	1.04	2.20	0.975	4.57	99.82
5. **T-test**	9	16.47	1.92	15.19	1.03	1.28	7.76	0.879	2.64	97.01

CONCLUSION

The obtained data indicated that the most significant changes were observed in the development of agility and endurance. At the same time, the upper and lower limbs' explosive power and speed showed fewer changes. Although the limited number of subjects (23) does not allow us to draw a definitive conclusion, considering the sensitive periods in the development of motor abilities, we suggest that the more pronounced differences in 'agility' and 'speed' are an expected natural outcome of the practical mandatory physical education training for students at the lower secondary school, in which the specialized program 'Shuttle Time' also plays a role.

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