



**NATIONAL SPORTS ACADEMY „VASIL LEVSKI“  
DEPARTMENT „SNOW SPORTS“**

**ELENA PIRINOVA DURCHOVA**

**OPTIMIZATION OF THE SHOOTING PREPARATION FOR  
BIATHLON ATHLETES AT THE AGE OF 9-11.**

**SUMMERY  
OF THESIS**

for acquisition of an academic degree “**DOCTOR**”  
in the scientific major „*Theory and Methodology of Sports Science*”,  
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**Supervisor:**

Associate Prof. Krustio Todorov Zgurovski, Doctor

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The dissertation thesis has been discussed and granted access to a defence session at an extended meeting of Department “*Snow Sports*” of the National Sports Academy “Vasil Levski”, which has taken place Dec.16, 2021.

The thesis consists of ? pages, of which? figures , ? tables and a List of ? written sources.

The defence session of the Doctor’s thesis will be held March 17, 2022 at 13:00 at the Meeting Hall of the NSA “Vasil Levski”, Students’ Town, at an open session of an Academic Jury of:

1. Ass. Prof. Pavel Simeonov Yordanov, Doctor
2. Ass. Prof. Sasho Panchev Yordanov, Doctor
3. Prof. Yulia Georgieva Mutafova- Ziberska, Doctor
4. Ass. Prof. Ognyan Kirilov Tishinov, Doctor
5. Ass. Prof. Ventsislav Ivanov Gavrailov, Doctor

The materials concerning the defence are available to whomever it may concern in room 401 of the NSA “Vasil Levski”.

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## **General Characteristics of the thesis**

The present thesis consists of an Introduction, four chapters, a list of references and applications. The main content has been spread over 110 pages, the results have been visualised by figures and tables. The list of references includes 168 scientific methodical sources.

**INTRODUCTION** – describes the topicality of the theme in the development of present day sport, specifically in biathlon.

## **CHAPTER ONE**

**A historical review and a theoretical analysis are provided considering the main trends and results in the realm of biathlon.**

*“Biathlon is a sport which demands combining the qualities of endurance and speed in cross-country skiing with precision, calmness and punctuality at performing shooting.” (IOC).*

Over the last few years in biathlon, as in most of the sports, the sports results regarding the two components - cross-country skiing and shooting have increased drastically, the available material and technical devices have improved and new ones have been introduced, facilitating the sports success. New, shorter disciplines have appeared and the number of the classical long ones has been decreased.

Apart from the world championships for men and women, over the last 15 years the world federation calendar features annual world and European races and bowls for youths, and also a Children olympic festival for kids aged 16-18. This is a proof about the development of the sport itself and about the tendency to an early sporting specialization which can be observed in other sports as well. The children's competitions have undergone changes too, in most of the countries the summer races, which used to include running and shooting, are now held with the sport specific rolling ski. This demands that from a very early age the training process should consist of activities according to the specific demands of the sport regarding shooting and the cross-country skiing.

Respectively the age for participation in competitions has also fallen down. Children between 7 -10 years are participants in the first age group in the biathlon races. There are special shooting areas for the younger of age and the training

process is held not with the typical small size rifles but with an air gun, coordinated with the construction of the biathlon rifles.

On the basis of the improved results worldwide, the decrease of the sport specialization age and the implementation of new means for preparation at the conditions of lower physical activity among children, there are a few unresolved questions about the methods of preparation at the youngest age groups. There is a large number of research in the area of professional sport, but the means and methods forming the main qualities of shooting at the young ages are still unclear. In the hereby thesis the shooting preparation is being surveyed with children biathlon athletes, which is fundamental for the future quality of shooting, respectively - the sports results.

Starting with the modern shooting technique, the impact of outer factors on shooting and the age specifics of the 9-11 year olds, we have researched the means for improvement of the quality of attention and the influence of the "Skatt" shooting simulator over the shooting performance at the appointed age.

## **CHAPTER TWO**

### **PURPOSE TASKS AND METHODICS OF THE RESEARCH**

#### **2.1. Purpose of the research:**

The purpose of the undertaken research is to optimise the shooting preparation for the 9-12 year old biathlon athletes by applying modern and accessible means and methods.

#### **2.2. Main tasks of the research:**

1. Selecting accessible means and methods for the initial shooting preparation in the stated age.
2. Reaserching the oppinion of experts about the shooting preparation in the appointed age.
- 3.Examining the effectiveness of the "Skatt" simulator in the process of shooting preparation in the appointed age.
4. Selecting and using suitable for the age means of improving attention quality.
5. Defining the impact of the cognitive exercises on the attention development in 9-11 year old biathlon athletes.

### **2.3. Theme, object and subject of the research**

#### **Object :**

The object of the research are the modern training means and methods for shooting preparation in biathlon.

#### **Theme :**

The theme of the research is the initial shooting preparation, its specific features, the factors and means for education at the age of 9-11.

#### **Subject of the research:**

The subject of the research are kids between 9 and 11 years of age. Girls and boys from the Bansko 2019 Club of Biathlon have been researched, eight in number. They have started training at the same time. Before joining the biathlon trainings, they haven't been involved in any other kind of sport.

### **2.4. METHODS AND METHODOLOGY OF THE RESEARCH**

According to the stated purpose and tasks of the research, we have applied the following methods.

#### **Method for theoretical research and analysis:**

1. Bibliographical analysis of the specialised literature;
2. Systematic and structural analysis of the base shooting preparation according to the age and biathlon specifics.

#### **Method of empirical results:**

Estimating the effectiveness of the cognitive training in children biathlon athletes.

1. Purpose-driven systematic direct **observation** in the natural conditions of the activity.

Reporting the results from the cognitive games after each training session. The games have been purposefully selected and coordinated with the age and the

specifics of the sport. We used “*Lumosity games*”, which have been designed specially for researching and improvement of the attention quality.

## 2. Testing the attention quality.

In order to define the impact of the cognitive training, a testing of the qualities was involved before introducing the games in the educational - training process and 6 months later. The testing has been provided through:

Standard methods for psychodiagnostics, described by K. Mechkov (1995) in the part considering the psychodiagnostics of attention:

- **Subtraction** by 7 from 100 backwards. The researched individual works mentally and speaks out, the psychologists marks their time, the correct answers and the mistakes. The test refers to the attention concentration.

- **Test of Bourdon** - 1. A Single Symbol Testing. It examines the range of attention. - Searching for two digits by switching. It examines the switching of attention. In both cases the amount of work is fixed, time is considered as well as the mistakes and the correct answers.

- **Tangled lines** – test of Platonov. Time of performance is recorded as are the number of correct and wrong answers. The fragmentation of attention is examined. (K. Mechkov, 1995).

In all these cases a coefficient is estimated, correlating punctuation and speed of performance, by the number of correct answers divided by time.

## 4. Measuring the shooting parameters with the “Skatt” shooting simulator.

To detect the influence of the “Skatt” shooting simulator for the quality of shooting elements in the base preparation of 9-11 year olds training biathlon.

## 5. Survey

The survey carried out with the experts in biathlon in the country let us determine the means and methods and the importance of the shooting preparation at the stated age. The survey is anonymous, it consists of 8 closed and 1 open end items.

## Methods for mathematical statistical processing of the received data and results summary:

1. Variation analysis: – determining the exponents:  $\bar{x}$  – average

arithmetical rate,  $v$  – coefficient of variation ;  $s$  – standard deterioration, average mistake of the standard deterioration.

2. Unparametric test of Wilcoxon (Wilcoxon Signed Ranks Test) for dependent extracts.

3. Statistical methods in MS Excel.

## **2.5. CONTINGENT AND STAGES OF RESEARCH**

### **Contingent**

The contingent of the research are the children at the age of 9-11 - 5 girls and 3 boys. Each of the children took up biathlon at a different moment of the year, previous to the research. The children are the main part of the children's team of biathlon of "Bansko 2019" Biathlon Club.

### **Stages**

Stage 1.

Research and written sources: on the modern development of shooting in biathlon, the shooting preparation, the means and methods used at the beginning of the educational process in the base shooting preparation for children.

Participation in scientific conferences and international trainers seminars directed to the acquisition and selection of modern means and methods of shooting preparation in biathlon.

Selecting the means and methods, suitable for the initial shooting preparation for children 9-11y.

- "Skatt" Shooting simulator
- Games for attention qualities improvement.

Stage 2

Examining the impact of the "Skatt" shooting simulator for the technique of performing the shooting elements.

It has been held throughout a calendar year - January 2018 - January 2019. It took place indoors following the technical demands of the simulator. The three boys



and five girls were split into groups based on gender. The "Skatt" research consisted of three stages:

#### 1. January/ February

At this first stage the children were introduced to the options, the characteristics and the way of operation of the "Skatt" shooting simulator. It was a trial period and there were no expectations considering the technique of the shooting elements.

#### 2. June/July/ August

The "Skatt" trainings were held twice every week. In biathlon these are the main months for intensive summer preparation and August is pre-competition month for the summer competitions of the 9-11 year olds.

#### 3. October / November / December/ January

At this stage of the research, the work with the simulator was once a week because of the busy school schedule of the children. It's the period of intensive winter preparation and January is pre-competition month before the winter season competitions.

#### Survey:

Before the beginning of the second stage of the work with the simulator, a survey was assembled, which was used to enquire the Bulgarian trainers and experts from the NSA "Vasil Levski" about the importance, the means and methods of the shooting preparation at the stated age. The survey was completed in May.

Selecting the means for attention quality improvement.

The games were selected from the site [www.limocity.com](http://www.limocity.com), they were oriented to the specifics of the age and the sports features.

The games have been involved during the educational-training activities with the shooting simulator.

#### Testing the attention quality

In order to test the influence of the cognitive training over the qualities of the attention, before adding it to the training process, a psychological testing of these qualities was carried out, so that they would be improved:

- Attention concentration
- Range/Span of attention
- Switching: flexibility of attention

There have been two testings - at the beginning of June, before the integration of games in the training and at the end of November.

### STAGE 3

Analysis of the received data from the "Skatt" Simulator

Processing and analysis of the cognitive training results.

Processing and analysis of the attention testing data.

## **CHAPTER THREE**

### **RESULTS AND ANALYSIS OF THE RECEIVED DATA**

#### **Characteristics of the initial shooting preparation for the 9-11 year old biathlon athletes**

To make the best choice of means and methods, suitable for the appointed age, it is important to know the contents of the initial biathlon shooting preparation and the main means and methods used. Present day written sources have been researched ( Palakarski, 2016; Zubrilov, 2010, 2013; Romanova 2016 and others) and a general characteristics has been formed.

The process of the initial shooting preparation is directed to the longterm development of the shooting skills of the athlete, which should provide better results in the future. The correct shooting methodics could be carried out only through detailed knowledge of the factors and mechanisms for high achievements in the biathlon shooting.

According to the sports theory developed by V.S.Kallerom and N. V. Platonov, the training undergoes five phases which are combined into three stages. At the age 9-11 the first stage of shooting preparation takes place, it's purpose is to acquire and develop the correct and sustainable shooting habits. *„The better the quality of the shooting base, the higher the chances of future excellent achievements.“* (R.A. Zurilov, 2013). The author devides this first stage into two phases:

First - forming of a general idea about the motor activities and education.

Second - Forming initial skills.

The main methods used by most of the trainers for primary education is the complete segmentation method. Which means that the biathlon athlete gets acquainted with the shooting technique on the whole and after that they study in detail the separate elements of the technique.

The next training stages depend on the way the base of shooting preparation is set up at that initial stage.

The initial education should be structured according to the basic needs of quality performance of actions. An important part of the initial shooting preparation of the shooter is for them to be introduced to the meaning of the terms used throughout the processs, to have common knowledge about the specifics of the

work and the function of the separate parts of the gun, the rules at the shooting track and using a shooting rifle.

## **Basic technical devices for education and initial shooting preparation for 9-11 yo.**

Air rifle.

Many different technical devices have become popular increasing the speed and improving the process of education, maintaining the precision of the technical preparation that have a positive impact for the sports results. Such are laser complexes, computer programmes and the newly implemented pneumatic rifles for biathlon.

Specifically designed for biathlon training are the pneumatic guns : „*Biathlon-luftgewehr B96*“, „*Feinwerkbau P75*“ , „*Anschutz 2027*“, „*LGB1 STEYR Biathlon*“ and others.



**Fig. 1. Pneumatic rifle “STEYR”.**

The source of energy for providing a shot with this kind of gun is the compressed air. The pneumatic sport rifles are size 4,5 , the barrel energy is not more than 7,5 J. At this stage this kind of gun with the stated parametres could be used without a license and doesn't require a police registration.

Advantages of the air rifle:

1. Lighter construction, being easier to use with children - youth groups at initial shooting preparation.
2. Weaker recoil compared to the small size rifle.
3. Lower prices of the shots.
4. Short distance of the range of the shot.

5. Doesn't require control from institutions.

The modern samples of pneumatic rifles for biathlon are easier for the athlete in the transition to a small size gun for the next age group.

The air rifles developed for biathlon have got common features. They can be realoded many times without changing the gas tank. At each bottle there is a nanometer or pressure marker which shows the present moment pressure, the maximum being 200 bar. When it is under the shooting minimum (50bar), the gas tank should be replaced.

### Shots.

The most widely used shots in biathlon are the ones for “*Diabolo*” pneumatic gun. The firm produces a large number and different in shape shots. They look like small cones with hollow bodies with a wider and thicker ‘head’. Often the name 'cups' is used for the shots. There are several different types, the cone body being the common feature, the 'heads' are different.

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Fig. 2. The most common shots.

Despite the common features, the "head" is considered of great importance. Some authors think that some of the shots are more precise at long distances than others, they have different sustainability and a change of flight at shooting when there is wind.

### Support.

The main device for facilitating shooting is the so called "support" or "stand". It carries the weight of the gun and thus the shooter doesn't have to think about

supporting the rifle and can concentrate on the performance of the shooting elements. At a further stage this function is carried out by the harness.

The support is used both during training and at competition for the group ages up to 10y. Various types of supports have been used in sports practice - made of different materials (most often wood or metal) and at different levels.



Figure 3. Support at 5 levels.

### **Common and specific means as part of the initial shooting preparation**

For shooting preparation in biathlon, common and specialised training means have been used.

Specailized training means are all shooting exercises with guns, lazer simulators and other computer programmes fitting the biathlon shooting specifics. Such are the lazer complexes of the brands T., *Anschutz*, *HoRa 2000*, *Larsen* and *Ижмау*. Although there are minor differences among them, they all have been designed according to the biathlon specific features. The “Skatt” shooting simulators the most commonly used one. In the researched sources we didn't come across any information about its use in the shooting preparation for children at the appointed age, and the commentaries about its use in the process of initial shooting preparation were contradictory.

Common training means are the ones taken out from other sports which have proved effective in skills development, needed for biathlon. These are balance exercises, coordination, rythmics, differenciation and others. With children it is very important to use games that are not only fun and attractive to them but that will also improve their shooting qualities. Such games are:

Table tennis and badminton - for reactivity and concentration

Football, handball, volleyball - coordination, and decision making

Computer and video games - concentration.

The computer and video games must be very carefully selected by the trainer according to the stated purposes and they should be reduced in the daily routine due to the possibility of misuse on behalf of children. The games should be previously researched before being involved in the training process.

In order to optimize the shooting preparation for the biathlon athletes at the age of 9-11 yo, we studied the influence of a specialized means for shooting in biathlon and a common feature for the development of attention quality.

Out of all the studied specialized shooting means, coordinated with the age specifics of the children, we chose to implement the "Skatt" simulator in the preparation of 9-11 year old children and to survey its impact for the technique of performing the elements of shooting at the initial shooting preparation.

Out of the various common means used in shooting preparation, we chose to test the impact of the cognitive training with games from [www.Lumocitygames.com](http://www.Lumocitygames.com) over the attention qualities, needed for biathlon shooting.

### **Researching the impact of the “Skatt” shooting simulator for the technique of shooting in biathlon at the initial preparation for ages 9-11.**

The use of the shooting simulator removes the requirement for a certain activity to be carried out at a shooting track, which simplifies the organization of the training and reduces the need for certain equipment items referring to maintenance of the targets, guns, etc. Also the "Skatt" simulator is one of the main specific means used for the shooting preparation for the elite biathlon athletes.

In order to study the impact of the "Skatt" simulator for the shooting at the 9-12 age group, trainings with the simulator were involved in the preparation of the children's biathlon team "Biathlon Club Bansko 2019" for a period of 1 year. Because of the constant flow of kids at these age groups, we were able to record the annual results of 8 children (3 boys and 5 girls), there have been breaks in the competitions and restorations microcycles.

At the rest of the time the trainings with the "Skatt" were carried out once or twice a week (following the schedule). As it was mentioned in the first chapter of the thesis, the period between 9-12 years of age combines the first two age groups - girls and boys (9 and 10y) and girls and boys junior (11-12y). The first age group

of boys and girls shoots point blank (using a support), and the second age group shoots with a harness. At the time of our study the 9-10 yo shot with a support, and the 11-12 yo with a harness, the shooting preparation, including the simulator trainings were done with a “*Steyr*” air rifle.

Immediately before working out with the simulator, the children were split into two groups - boys and girls, one of them started working with the gun and the other one played games for concentration improvement in a different room. It is important to mark that immediately before the launching of the "Skatt" simulator, each child had to perform a couple of „*Blanc Shooting*“ to enforce the concentration and after each shooting the groups would analyse the data from the simulator (for feedback). The study was carried out indoors, without physical treatment before the shooting.

For estimating the increase of certain quality characteristics of the shooting technique we had three trainings a month, randomly chosen (1 at the beginning, 1 in the middle and 1 at the end of the month).

The received data have been processed through the variational analysis and assessment of the normal statistical distribution. Due to the large amount of data, the average square value  $S$  and the coefficient of variation have not been displayed. The low values of the variation coefficient between 5% and 30% show that the statistical distribution is of normal ratio. The comparative analysis has been made by the Student's criterion of dependent excerpts, since identical groups of people have been studied. The increase  $d$  has been reported. Coefficient  $t$  is estimated through the Student criterion, the guarantee presumption  $P_t$  represents the coefficient  $\text{sig}$  from the statistical programme *SPSS according to the formula*  $P_t = (1 - \text{sig}) \cdot 100$ . The value at which  $\text{sig}$  reaches 0,05, represents  $P_t = 95\%$ . Because of this, it is more convinient for our conclusions to apply the indicator  $P_t$ . If the guarantee presumption is more than 95% we could confidently reject the zero hypotesis and to assume the alternative option for the availability of important results in the research of the thesis that the applied trainings during the study period have achieved satisfactory results.

Table 1.  
Comparative analysis of Skatt - January/February.

Indicators SKATT	Result	Average time of shot	Stability of time intervals b/n shots	<b>Distance from centre to centre of the two</b>	Average stability. Control of shot up to the moment
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				<b>furthest shots</b>	of its performance .
January I	21,39	1,04	64%	30%	2%
February	21,20	0,91	55%	22%	2%
increase d	-0,19	-0,13	10%	7%	0,00%
increase d[%]	-0,88	-12,45	-15,39%	-24,15	4,65%
t	,050	,981	2,027%	3,045	,168%
Pt[%]	3,9	64,1	91,8%	<b><u>98,1%</u></b>	12,9%

In table 1 the results of the training during the first two months of work with the simulator have been compared. The statistically important values are obvious at the indicator of distance from centre to centre of the two furthest shots, where Pt = 98,1%. This is a criterion about the grouping of shooting - all 5 shots are close to each other and in proximity to the target centre. Performing group shooting is possible only at the same breathing out, checking and processing of the trigger with each shot.

Table 2.  
Comparative analysis of Skatt - June/July/August

Indicators SKATT	Result	Average time of shot	Stability of time intervals b/n shots	Distance from centre to centre of the two furthest shots	Average stability. Control of shot up to the moment of its performance .
June	24,05	0,76	52%	15%	3%
July	20,92	0,86	52%	18%	3%
August	32,10	0,96	68%	26%	8%
increase d	8,05	0,20	16%	11%	5%
increase d[%]	25,07	20,63	23,57	41,09	62,53
t	-,60	,06	-,26	-1,23	-1,23
Pt[%]	42,41	4,36	19,53	72,51	72,56

The data of table 2 include the results of the three summer months - June, July

and August when the training is most intensive for the yearly training process in biathlon. The received results show a consistent increase, no statistically important differences have been detected. There is no increase of time, only a slight growth (- 0.20 s), which could be explained with the fact that for beginners in biathlon it is characteristic to improve precision on the expanse of time of shooting. With the advance of preparation and sports experience, after precision has been précised, the speed of shooting improves.

Table 3.

Comparative analysis of Skatt- October/November/December

Indicators SKATT	result	Average time of shot	Stability of time intervals b/n shots	Distance from centre to centre of the two furthest shots	Average stability. Control of shot up to the moment of its performance.
October	31,83	0,86	48%	21%	7%
November	29,30	0,90	66%	25%	4%
December	35,98	1,33	80%	46%	10%
January II	35,43	1,67	92%	62%	11%
increase d	3,6	0,8	4%	4%	5%
increase d[%]	10,2	48,3	47,6	65,5	43,0
t	,41	-2,52	,97	-3,01	-1,02
Pt[%]	30,3	<b><u>96,0</u></b>	63,5	<b><u>98,0</u></b>	65,8

The results (tab. 3) include four months – October, November and two winter preparatory, pre-competition months – December and January. The increase of the distance from center to center of the two furthest shots is statistically important (Pt 98%), which is evidence for improvement of grouping. On the other hand to have a good group, it means that the technique of elements performance has been well acquired. In this table we can report the statistically important improvement of shooting time (Pt 96%). We witness an increase of 10,2% over the precision of shooting. The stability of time intervals between the shots in January reaches almost 92%, which, compared to October (48%), is an incredible achievement, considering that the maximum result is 100%. All these improvements in the reported characteristics witness for the improvement of precision, grouping and

time for shooting, which are important for shooting performance and vital for future shooting abilities.

Table 4.  
Comparative analysis of Skatt – January1/January2

Indicators	I	II	d	d[%]	t	P[%]
<b>result</b>	33,11	23,69	9,4	28,5	2,7	<b><u>96,9</u></b>
Average time of shot	1,44	1,23	0,2	14,8	0,8	52,4
Stability of time intervals b/n shots	47%	71%	-24%	-51,5	-1,2	73,2
Distance from center to center of the two furthest shots	53%	43%	10%	19,1	0,8	90,8
Average stability. Control of shot up to the moment of its performance.	29%	14%	16%	52,8	1,6	81,9
Result	35,26	19,58	15,7	44,5	3,9	73,2
Average time of shot 2	1,43	0,94	0,5	34,2	1,9	90,2
Stability of time intervals b/n shots/2	64%	61%	3%	4,3	0,2	90,8
Distance from center to center of the two furthest shots /2	50%	38%	12%	23,9	1,2	66,0
Average stability. Control of shot up to the moment of its performance.2	36%	128%	-92%	-259,2	-0,7	41,9
Result 3	29,01	20,66	8,4	28,8	1,5	83,0
Average time of shot 3	1,36	0,95	0,4	30,3	2,8	<b><u>97,4</u></b>
Stability of the time intervals b/n shots /3	38%	61%	-23%	-62,1	-1,0	87,2

Distance from center to center of the two furthest shots /3	63%	28%	34%	54,9	3,4	26,1
Average stability. Control of shot up to the moment of its performance .3	21%	13%	9%	40,5	0,7	64,1

In the table we can see that one of the most important indicators “*Result*”- The result of the group of shots to the center of the target at the first pt is 96.9%, at the second one it’s 99.4%, and at the third 83%. With the first two attempts the statistically important difference is been recorded. This indicator reports high grouping of the shots which is evidence for a well acquired shooting technique. Statistically important improvement of the indicator for average shot time „ Time” is detected at the third training– pt 97.4%, the previous two also report increase but it is not that high and is not statistically important.

For us what is incredibly important is the improvement on annual basis of the two essential shooting factors – precision and time. It proves the effectiveness of the “Skatt” simulator for the children’s age groups and is an effective means for the initial shooting preparation with 9-11 year olds.

### **Studying the impact of cognitive exercises for attention development with young biathlon athletes, aged 9-11.**

We have described in detail the importance of attention qualities in Chapter One of the thesis and have reported games as a common means for shooting preparation for the 9-11 age. In order to research the cognitive training from [www.Lumosity.com](http://www.Lumosity.com) for the attention qualities with the young biathlon athletes, we studied the same 8 children, aged 9-11, 5 girls and 3 boys from the biathlon team *Biathlon Club Bansko 2019*. They participate in an experimental training by using cognitive online exercises to develop attention qualities and speed of information processing. The experiment was carried out indoors without physical pressure during the months June – November 2018. The games were involved in the shooting trainings with the “Skatt” simulator. The children played two of the cognitive exercises form the site [www.Lumosity.com](http://www.Lumosity.com) twice, as in each training, the previously selected games were changed. We have chosen five different

games that were categorized for: concentration, switching, attention fragmentation, speed and information processing. After each game has been played, the results are recorded which refer to a number of points at the site. The exercises are for fixed time and the results reports the correct actions and mistakes of the player.

Table 5.

Comparative analysis of the cognitive training results with *Lumosity games*

№	Упражнение	Результат Начало <i>Mean</i>	Результат Край <i>Mean</i>	Тестовая статистика	Стандарти- зирана тестовая статистика	Значимость $\alpha$
1.	<i>Lost in migration</i>	9395.71	12857.14	28000	2.366	<b>0.018</b>
2.	<i>Playing Koi</i>	22014.14	30008.57	28000	2.366	<b>0.018</b>
3.	<i>Trouble brewing</i>	17684.29	22185.71	21000	2.201	<b>0.028</b>
4.	<i>Train of thought</i>	11487,14	15254,290	21000	2.201	<b>0.028</b>
5.	<i>River ranger</i>	12140.00	18708.57	18000	1.572	0.116

The analysis shows that the results for four out of five exercises have improved statistically, all of them being directed to the attention qualities development. The first exercise develops the attention concentration, the second – switching, the third and fourth – fragmentation of attention.

To assess the impact of the cognitive training for the attention of the training children, we studied its characteristics before and after application of the „LUMOSITY” games. The first testing was carried out at the beginning of June, the second one – at the end of November, both being supervised by a licensed psychologist who used the standardized methods of psychodiagnostics, described by Mechkov (1995) in the part considering psychodiagnostics of attention. The same 8 young biathlon athletes have been tested, aged 9-12, 5 girls and 3 boys, who have taken part in the experimental training by using the cognitive online

exercises for attention quality development and speed and information processing and who have also work with the “*SKATT*” shooting simulator. The experiment on attention quality improvement was carried out from June – November because that is the main preparatory period for the biathlon athletes at the stated age. The psychodiagnostics methods used are as follows:

1. Subtracting by 7 from 100 backwards. The tested person works mentally and speaks out, the psychologist records time, correct answers and mistakes. The test refers to attention concentration.
2. Test of Bourdon– 1. Single Symbol Sample. It examines the range of attention.
3. Searching for two numbers by switching. It examines the switching of attention. In both cases the amount of work is fixed, time is recorded, as well as the mistakes and the correct answers.
4. Tangled lines – test of Platonov. Time of performance and the number of correct and wrong answers is recorded. It examines the fragmentation of attention. (K. Mechkov, 1995).

In all these cases a coefficient is figured out, which compares precision and speed of performance – the number of correct answers divided by time.

The received results have been processed with the statistical process pack of programs *SPSS 21*, the subprograms for descriptive statistics and the non-parametric methods for comparison of dependent extracts.

Table 6.

Comparative analysis of testing 1 and 2 of attention quality.

<b>Indicators</b>	<b>I research</b>	<b>II research</b>	<b>d</b>	<b>d[%]</b>	<b>t</b>	<b>Pt[%]</b>
<b>Concentr. success.</b>	69,8	85,8	16,0	22,9	-3,0	<b>98,0</b>
<b>Concentr. corr. answ.</b>	94,8	104,2	9,5	10,0	-2,8	<b>97,2</b>
<b>Concentr. wr. answ.</b>	10,3	1,0	-9,3	-90,2	1,1	90,0
<b>Concentr. time</b>	231,8	185,5	-46,3	-20,0	1,2	72,5
<b>Range success</b>	79,9	102,6	22,8	28,5	-2,5	<b>96,0</b>
<b>Range corr. answ</b>	94,5	94,0	-0,5	-0,5	0,2	18,5
<b>Range answ.</b>	5,5	6,3	0,8	14,5	-0,4	60,0
<b>Range time</b>	287,8	220,8	-67,0	-23,3	1,6	85,7

<b>Swit. success</b>	86,2	94,6	8,4	9,7	-1,2	72,6
<b>Swit. corr answ.</b>	89,3	98,3	9,1	10,1	-3,9	<b>99,4</b>

The results show a considerable increase in the general success of the test of attention concentration (pt 98%). The general success of the test of attention range (pt 96%) and a considerable increase have been reported at the number of correct answers at the test of attention switching (pt. 99.4%). Respectively there is increase of different aspects for each of the studied attention qualities, so we can state that a positive impact has been achieved through the undertaken experiment for each of the appointed qualities

## **CONCLUSIONS AND RECOMMENDATIONS**

1. The recent years in biathlon development show that the reserves about the sports effectiveness increase concern the shooting preparation.

2. The physical and mental development as a process for biathlon athletes, aged 9-12 is suitable for shooting preparation prioritizing.

3. The survey research about the means and methods used for initial shooting preparation for ages 9-12, which was held among Bulgarian trainers, led to the following statements:

- Shooting preparation at the age 9-12 is a priority and important part of the preparation of the biathlon athletes.

- Shooting trainings should make up to 2-3 a week, primarily technically directed.

- The surveyed individuals realize the importance of shooting training at that age but don't have a clear concept about the methods and their adequate application to the training process.

Most of the trainers work with that age exactly, when the shooting skills are built up. These skills would later achieve shooting speed and psychological sustainability in competitions.

5. The selected specialized and common means and methods, referred to at the present thesis about initial shooting preparation, are applicable and available for the appointed age.

The data from the “Skatt” simulator research show improvement of shooting quality.

- Grouping of shooting is raised.
- Time of shooting performance is improved and the time of shooting intervals between shots is stabilized.
- Shooting precision is improved.
- The “Skatt” shooting simulator and the feedback immediately after the shots increases the interest of children and supports their active and conscious participation in the shooting trainings.
- The “Skatt” shooting simulator is a suitable device for optimization of the shooting preparation for individuals aged 9-12.

6. The undertaken pilot experiment by the use of cognitive training from [www.lumocitygames.com](http://www.lumocitygames.com) marks a positive effect on:

- attention concentration
- attention switching
- attention fragmentation

Each of those attention qualities is a factor which impacts precision – quality/effectiveness – of shooting.

- The cognitive training is a suitable means of improving attention qualities, respectively the shooting results.

7. The combined integration of the “Skatt” simulator and the cognitive training improves the quality of shooting and the attention qualities for the young athletes.

## **RECOMMENDATIONS**

Due to the received data from the undertaken research, we address the following recommendations:

1. The process of initial shooting preparation should include cognitive exercises for the development of basic attention characteristics, so hereby we recommend the integration of exercises from „*LUMOSITY GAMES*”.



2. We encourage the periodical testing of the basic attention qualities responsible for the shooting results so that shooting preparation would be followed and optimized in the long term.
3. We suggest the integration of the “*Skatt*” Shooting simulator at the initial shooting preparation stage.
4. We recommend the ongoing research of modern methods which would make a systematic methodology for the initial shooting preparation for children.
5. The designing of a specific methodology which would comply with the modern requirements of biathlon, and would be adequate to the age characteristics and would provide the future increase of shooting results.

## **CONTRIBUTION**

1. The positive impact of the “Skatt” shooting simulator has been studied and scientifically determined for the initial shooting preparation of children biathlon athletes.
2. Our piloting experiment has proven the important role of the cognitive training from [www.lumocitygames.com](http://www.lumocitygames.com) for the attention qualities with children, aged 9-11.
3. For the first time in the native practice the characteristics, means and methods for initial shooting preparation for athletes, aged 9-11, have been researched and described.
4. The combination of a “Skatt” shooting simulator and a cognitive training is a completely new approach to the acquisition and building of shooting skills with children training biathlon.