# Interactive sensor technologies in the training of athletes of the children's department of the student sports club

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PhD **V.E. Vasyuk**[1]
**Ren Yichen**[1]
PhD, Associate Professor **V.V. Bakaev**[2]
PhD **D.A. Lukashevich**[1]
**T.V. Karaseva**[2]
[1]Belarussian National Technical University, Minsk
[2]Peter the Great St. Petersburg Polytechnic University, St. Petersburg

Corresponding author: vlad.bakaev@gmail.com

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**Abstract**

**Objective of the study** was to substantiate the effectiveness of the use of interactive sensory technologies in motor-cognitive training of young athletes.

**Methods and structure of the study.** Taekwondo athletes aged 11-12 (n=45) from the children's department of the sports club of the Belarusian National Technical University took part in the scientific work. A sample of athletes was formed with a random division into the control (n=22) and experimental group (n=23). The control group trained according to the standard program using traditional training aids, and the athletes of the experimental group additionally trained twice a week for two months according to the program using training aids based on interactive sensory technologies.

**Results and conclusions.** The results of the study showed that the practice of performing training tasks in conditions close to the specifics of a sport using sensor technologies makes it possible to achieve positive changes in the development of the motor-cognitive potential of athletes at the stages of early sports improvement. The results obtained allow us to conclude that the use of sensory technologies in controlled interactions of athletes is of high practical value, which reflects significant improvements in the performance of the participants in the experiment in all key parameters characterizing the effectiveness of motor actions in test tasks with different coordination complexity.

***Keywords:*** *cognitive abilities, motor abilities, controlled training environment.*

**Introduction.** The process of training young athletes requires the creation of such conditions in which each child will be motivated to perform a variety of motor tasks that contribute to his comprehensive development, and the process itself is inspiring, interesting, exciting, fun and conducive to obtaining the maximum benefit [7]. One of the forms of achieving these goals in the digitalization of sports training is the widespread use of interactive information and measurement systems. This allows you to create a controlled training environment and conjugate to develop cognitive and motor abilities, which corresponds to the principles of the social concept of the harmonious development of the individual [1, 2].

The results of review studies covering data over the past 15 years indicate the usefulness of motor-cognitive training [4–6, 8]. At the same time, many authors agree that the effectiveness of such training when transferred to sports results strongly depends on the degree to which the training environment is representative of the conditions for the implementation of the main training and competitive activities, as well as on the accuracy of the actions required as a response [9, 10, 11]. This encourages specialists from different countries to pay even more attention to the development of motor-cognitive abilities and their impact on sports results [1, 3, 4].

The practice of performing training tasks in conditions close to the specifics of a sport will make it possible to achieve positive changes in the development of the motor-cognitive potential of athletes at the stages of early sports improvement [5].

**Objective of the study** was to highlight the issue of motor-cognitive training and the prospects for using interactive sensory technologies for their implementation, to substantiate the effectiveness of motor-cognitive training of young athletes using interactive sensory technologies.

**Methods and structure of the study.** In accordance with the goal, a pilot experiment was conducted with the participation of taekwondo athletes aged 11-12 (n=45) from the children's department of the sports club of the Belarusian National Technical University. A sample of athletes was formed with a random division into the control (n=22) and experimental group (n=23).

The control group trained according to the standard program using traditional training aids, and the athletes of the experimental group additionally trained twice a week for two months according to the program using training aids based on interactive sensory technologies. The complex of tasks developed with adjustable motor and cognitive complexity on the SpeedCourt sensor platform (Fig. 1) and the Blazepod reflex trainer (Fig. 2) was aimed at developing such qualities and abilities as dexterity, coordination, reaction, perception of information, attention, thinking, the ability to navigate in space, the speed of movement, the ability to abruptly change direction, etc.


**Figure 1.** *SpeedCourt Interactive Touch Platform*

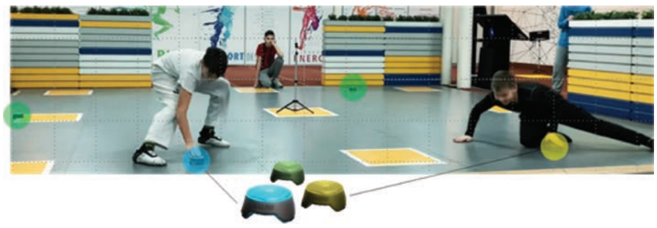

**Figure 2.** *Blazepod reflex trainer*

An interactive touch platform with sound and visual signals displayed on the screen, as well as light sensors of the reflex simulator, made it possible to form a training space for trainees and made it possible to change the configuration of exercises due to a program sequence of signals depending on the type of task and the level of complexity. At the same time, the process of completing tasks was accompanied by the registration of parameters characterizing the effectiveness of tasks (execution time or the number of effective actions), as well as additional ones that can be used for a more detailed analysis of the quality of performing these tasks (number of errors, the distance traveled, the amount of excess path , signal response time, etc.).

Various unpredictable situations that arise in the process of performing exercises, multilevel motor-cognitive tasks, in which the trainees immersed themselves in a controlled training environment, made it possible to simultaneously diagnose and develop both cognitive and motor abilities.

Tasks in the experimental group were built with an increasing level of complexity, while it was possible to move to a higher level only after reaching a certain threshold result.

In accordance with the designated goal, the athletes of the experimental group performed six training tasks on the SpeedCourt interactive sensor platform:

1) Tapping test. It is necessary to perform the maximum number of movements (running in place) in 3 seconds.

2) Brainmath. It is necessary to strive to make a decision in the shortest period of time, avoiding mistakes, and solve 15 simplest mathematical examples in the shortest time.

3) Reaction test. It is necessary to quickly respond to the signal that lights up on the screen and click on the corresponding cell on the platform with your foot (reaction speed for six signals).

4) Starrun. It is necessary to strive to overcome the distance in the shortest time, running segments from the central zone to the peripheral ones, which light up in a random order.

5) ColororWord. Strive to make a decision in the shortest possible time (comparison of information in the cells with the conditions and search for the desired zone on the site), avoiding mistakes, and make the maximum number of effective actions in 60 seconds. The search for the target zone is determined by a cell that specifies the type of criterion by which it must be found: a specific color, or a letter.

6) Chasenext 100. It is necessary to strive to overcome a distance of 100 m in the shortest time, quickly responding to signals indicating the current and next zones on the site to which you need to move.

The Blazepod reflex trainer was also used in the Reactivekicks challenge, in which the athletes tried to deliver the maximum number of accurate kicks in 15 seconds to the sensors attached to the blower, responding only to the target signals of red and yellow.

All of the above tasks simultaneously acted as test tasks to assess the training effect before and after the study. In addition, in athletes of both groups, using the NS-Psychotest hardware-software complex, a simple visual-motor reaction was recorded and the Romberg test, the Target test and the Evolvent test were performed using a stabilometric platform. At the same time, athletes of the control group did not use tasks with interactive tools based on sensory technologies in training.

**Results of the study and their discussion.** The results of pedagogical testing of taekwondo athletes

*The results of pedagogical testing of the participants of the experiment*

| Tasks | | | CG | | | EG | | |
|---|---|---|---|---|---|---|---|---|
| | | | Before | After | Dynamics, % | Before | After | Dynamics, % |
| Reactivekicks, number of strokes | | | 14,5 | 15,2 | 4,8 | 12,2 | 13,9 | 14,4** |
| SVMR, ms | | | 241,5 | 240,2 | -0,5 | 257,5 | 235,3 | -8,6** |
| The "Romberg" sample | CEF, % | OE | 69,7 | 73,5 | 5,5* | 77,1 | 80,7 | 4,6* |
| | | CE | 56,2 | 60,3 | 7,2* | 61,5 | 65,8 | 7,0* |
| The "Target" test | CEF, % | | 57,0 | 62,5 | 9,6* | 65,1 | 74,9 | 15,0** |
| The "Evolvent" Test | CEF, % | | 28,1 | 32,7 | 16,5** | 27,9 | 34,3 | 22,8** |
| Tappingtest, number of movements | | | 32,6 | 31,9 | -2,4 | 31,4 | 34,9 | 11,5** |
| Reactiontest, ms | | | 794,9 | 836,9 | 5,3 | 860,2 | 812,4 | -5,6* |
| Starrun, s | | | 28,5 | 27,5 | -3,5 | 28,4 | 26,2 | -7,6* |
| Brainmath, s | | | 59,6 | 41,2 | -30,8** | 44,3 | 36,9 | -16,8** |
| ColororWord, number of actions | | | 14,2 | 16,1 | 13,0* | 13,1 | 18,5 | 40,8** |
| Chasenext 100, s | | | 52,9 | 45,5 | -14,2** | 48,2 | 43,1 | -10,7** |

Notes: CEF - the coefficient of the equilibrium function; OE - open eyes; CE - closed eyes; * - statistically significant differences at p≤0.05; ** - statistically significant differences at p≤0.01.

aged 11-12 in the control and experimental groups are presented in the table.

The test results demonstrate that the athletes of the experimental group show significant improvements in results in all controlled parameters. The conclusion about the presence of significant differences in key parameters was made on the basis of statistical analysis using Student's t-test for dependent samples for each of the groups that took part in the experiment. It is impossible not to note a more significant increase in indicators among the participants in the experimental group. This allows us to conclude about the high practical value of using interactive sensory technologies to create a controlled training environment that allows assessing and developing the motor-cognitive abilities of trainees.

**Conclusions.** The practice of performing training tasks in conditions close to the specifics of a sport using digital technologies and sensory approaches makes it possible to achieve positive changes in the development of the motor-cognitive potential of athletes at the stages of early sports improvement. Purposeful tasks with increasing difficulty of their implementation allow counteracting the achievement of automatism by an athlete in solving specialized tasks and contribute to the development of the ability to control their actions and reduce the time of cognitive information processing in conditions of more complex motor tasks.

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