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The Effectiveness of Applying Innovative Curriculum in Physical Education Classes

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Abstract

The aim of this research was to identify the effect of programmed classes of step aerobics in 7th grade female pupils. The research was conducted on the sample of 63 seventh-grade female pupils, divided into the experimental (n=32) and control (n=31) target groups. The effects of step aerobics were observed in the area of motor abilities (16 variables) and cardio-respiratory functions (3 variables). The step aerobics classes lasting eight weeks and conducted within regular PE classes represented the experimental factor. ANOVA 2x2 results indicate that step aerobics classes statistically significantly contributed to the improvement of 15 variables of the experimental group compared to the control group in the area of motor abilities and all variables in the area of cardio-respiratory functions. The greatest improvement was detected in non-rhythmic drumming (F=263.43; p<0.001), hand and feet drumming (F=103.83; p<0.001) and maximum oxygen consumption (F=104.29; p<0.001). Based on the obtained results, we can conclude that step aerobics classes, as an innovative programme component, have practical use in teaching aiming to distribute exercise in a precise manner and to achieve objectives and tasks of physical education.

Key words: *cardio-respiratory functions; female pupils; modern teaching; motor abilities; step aerobics.*

Introduction

Complex and versatile requirements of the social life, physical inactivity with increasing pandemic obesity, as well as chronic non-infectious diseases permanently

damaging health and the quality of life (Patton et al., 2011), among others, impose the changes and modernisation of PE classes. For this reason, PE is a burning issue from the perspective of changes in the curriculum, teaching components, physical development and physical capabilities of the contemporary school population. Therefore, one of the basic objectives of the abovementioned changes is to encourage regular physical activity, which is at the same time listed as a requirement by the European Union itself, thus trying to mitigate the negative effects on health and to improve functioning of the society (World Health Organisation - Regional Office for Europe, 2007). On the other hand, the primary objective of PE classes is to contribute to the integral development of a pupil's personality, motor abilities, acquisition, improvement and application of motor skills, habits and necessary theoretical knowledge in daily and specific conditions of work and life by means of versatile and systematic motor activities (The Rulebook on the Curriculum for 7th Grade of Primary Education, 2009). Bearing in mind the aforementioned objectives, we can conclude that PE classes in schools represent the most accessible way of encouraging pupils to engage in lifelong physical activity and lifelong fitness (Ayers & Saiscsany, 2011; Fairclough, Stratton, & Baldwin, 2002).

However, it is evident that the number of physically active children is decreasing, and during PE classes, pupils are left with too much inactive time on their hands. The results of the research conducted on ten locations in 684 primary schools in the United States of America indicate that during a PE class, pupils spend five minutes (15% of an hour) on average doing intensive activities and 12 minutes (37% of an hour) doing moderate to intensive activities, which is actually 25 minutes of physical activity per week (Nader, 2003). On the other hand, increase in the prevalence of obesity in children and adolescents in the United States of America who are living sedentary lives indicates the need to systematically and efficiently promote behaviours that will prevent the development of overweight in public schools, as well as the fact that schools should take up the leading role in providing daily and adequate amount of physical activity (Pate et al., 2006). Inactive time during PE classes and the quality of teaching are discussed in the research conducted among 7th grade pupils in Portugal. The results indicate that during their PE classes pupils had approximately 14.4 minutes of moderate to intensive activity (frequency of heart rate over 139) and 6.7 minutes of intensive activity (frequency of heart rate over 159). Moreover, in the research conclusion, it is stated that pupils should be encouraged to participate more actively in PE classes, as well as to take up an extracurricular physical activity (Wang, Pereira, & Mota, 2005). During regular PE classes, along with physical abilities, teachers should develop in pupils some other skills like self-management skills, self-assessment skills, self-monitoring skills, self-planning skills, goal setting and skills for overcoming potential obstacles. By developing such skills, pupils are encouraged to continue with active living and exercising after finishing their formal education (Corbin, 2002).

We can conclude that overall performance of PE classes does not meet the expectations, that is, that physical education is not efficient enough in achieving the basic goal and

fulfilling the set tasks. With regard to this, one of the common problems of studying technology of physical education activities is the intensification and rationalisation of the teaching process within the school system. Research results show that more modern organisation work patterns aimed at achieving optimal intensification, rationalisation and greater efficiency of physical exercises in the PE classes will enable, with their objectives and tasks, an increase in the intensity and active time during classes as well as in pupils' motivation (Bavčević, Babin, & Prskalo, 2006; Findak, Prskalo, & Pejčić, 2003). Therefore, Bavčević et al. (2006) state that civilizational changes, changes in lifestyle as well as contemporary teaching standards demand the search for optimal teaching methods and modalities, both in education in the broader sense as well as in PE classes. Consequently, we believe that a new strategy is needed, which will contribute to the achievement of objectives and tasks, and bring results in PE classes in schools, and which will help physical education contribute more efficiently and more significantly to lifelong body fitness.

One of the key strategies for improving the quality of PE is implementation of a well-designed curriculum aiming to maximally increase physical activities in classes and engagement of children (Emeljanovas, Mieziene, & Putriute, 2015). With regard to this, one of the ways to increase physical activity and efficiency of PE classes is the application of group fitness programmes. In fact, the research in the area of group fitness programmes shows their positive influence on mental and motor development of pupils, as well as their practical applicability in PE classes. Therefore, research results regarding the influence of a six-week application of aerobic dancing on the sample of 13- and 14-year-old female pupils in Great Britain indicate a statistically significant reduction of dissatisfaction related to the physical appearance of their bodies and improvement of their physical self-esteem (Burgess, Grogan, & Burwitz, 2006). Exploring the effects of applying the eight-week high-low aerobics experimental programme on the sample of 8th grade female pupils indicates statistically significant improvement of their morphological features and motor abilities (Mandarić, Sibinović, & Stojiljković, 2011). The research results for the population of secondary school female students indicate that application of aerobic dancing has a significant and complex impact on the development of overall coordination and coordination in rhythm, cardio-respiratory endurance, repetitive and explosive power and mobility, as well as the reduction of excessive weight and fatty tissue (Viskić-Štalec, Štalec, Katić, Podvorac, & Katović, 2007), while the application of four-month kick-aerobics programme affects the improvement of cardio-respiratory endurance, muscular strength of back extensor, upper leg muscles, arm and shoulder muscles as well as the increase in the mobility of hip joint and shoulder joint (Stojanović-Tošić, Kostić, & Đorđević, 2011).

One of the most popular group fitness programmes – step aerobics was used for research purposes. Step aerobics is a form of aerobic exercise with the use of a small bench (stepper) when a person, following the tempo of music, alternately steps up and down the stepper, making choreographically combined steps. The basic goal of

this exercise programme with music is the development of aerobic fitness, physical health, cardio-vascular fitness and body composition (Ossanloo, Zafari, & Najar, 2012). The programme structure includes movements of stepping up and down the bench, which can be classified as changing, non-changing and neutral steps. Owing to this step structure, with specific methodology being applied, it is possible to devise choreography in aerobic mode accessible to every person during the class. In addition to this, the specificity of step aerobics is in the possibility of adjusting the height of the bench to the level of physical ability of a person, which basically means that both beginners and advanced individuals can exercise at the same time.

The research in the area of step aerobics application was mostly conducted on the adult population, indicating its positive changes on motor abilities, cardio-respiratory fitness, body circumference and body composition. The research conducted on the sample of obese girls of 10.3±1.2 average age aiming to promote moderate to intensive physical activity indicates that during the step aerobics class, compared to sports skills, dancing, programmes for mobility development and children's games, up to 37% of the entire class is spent in the moderate to intensive physical activity zone (Olvera, Graham, McLeod, Kellam, & Butte, 2010). Consequently, results of the research conducted on the sample of students from the University of Gdansk indicate that ten-week step aerobics experimental programme influenced the improvement of maximum oxygen consumption and development of isometric muscular strength of elbow joint flexor and knee joint extensor (Drobnik-Kozakiewicz, Sawczyn, Zarćbska, Kwitniewska, & Szumilewicz, 2013). After increasing the height of platform, statistically significant increase in the pulse frequency under stress and intensity of exercise was detected in the research conducted on the sample of students from the Siberian Federal University (Bryukhanova, Bulgakova, Mokrova, & Bogashchenko, 2013). The results of the research conducted with the aim of determining the effects of step aerobics programme application on motor abilities, body circumference and body composition of young women indicate the existence of statistically significant effects on all three observed areas (Nikić & Milenković, 2013). On the other hand, the research results pertaining to the application of the 12-week step aerobics programme for physically active female participants indicate statistically significant changes on cardio-respiratory fitness, muscular strength of lower extremities, dynamic balance and agility (Hallage et al., 2010). The experimental step aerobics programme lasting eight weeks influenced the reduction of body mass and changes in body composition in physically inactive female participants (Arslan, 2011).

Popularity of step aerobics, easy planning of classes for working with individuals of different levels of physical abilities, as well as the research results indicate its positive impact on psychosomatic status of a person. All of these have spurred interest in this topic, with the aim to improve efficiency of the teaching process in PE classes in primary schools. Pursuant to the abovementioned, the subject of this research was to analyse the effect and contribution of application of the step aerobics programme

for seventh-grade female pupils during PE classes. The aim of this paper was to determine the effectiveness of applying the step aerobics programme for seventh-grade female pupils attending primary schools on their selected motor abilities and cardio-respiratory functions.

Methods

The experimental method with initial and final measurements was used in the research. Empirical and statistical methods were applied in the operationalization and elaboration phases. The experimental programme lasted for eight weeks and it was realised within regular PE classes in primary schools, three times a week, for the duration of one school lesson in the premises specialised for PE classes. Female pupils were divided into two target groups: experimental and control. The experimental group (E) attended programmed step aerobics classes while at the same time the control group (C) attended regular PE classes prescribed by the PE Curriculum developed by the Ministry of Education, Science and Technological Development of the Republic of Serbia (The Rulebook on the Curriculum for 7th Grade of Primary Education, 2009).

Participants

The sample comprised 63 seventh-grade female pupils attending "Jovan Jovanović Zmaj" Primary School from Kanjiža, with average age 13.4, who were divided into the experimental (n=32) and control (n=31) target groups. The experiment participants were female pupils without any chronic diseases, deformities of spinal column and extremities or conditions for which physical activity was not recommended. Female pupils taking part in the experimental programme voluntarily participated in the experiment with the consent of their parents; they were not members of any sports clubs and did not take part in any extracurricular activity.

Variables

Starting from the defined subject and the objective of the research, realistic possibilities and conditions in the environment, the variables of identical methodological nature and those exhibiting features of criteria variables were analysed. Aiming to provide a systematic overview, variables may be divided into two kinds: the variables in the area of motor abilities, and the variables in the area of cardio-respiratory functions.

The variables in the area of motor abilities are divided into variables in the area of strength, variables in the area of general coordination, variables in the area of coordination in rhythm, variables in the area of frequency of movement, and variables in the area of mobility. In the area of strength are: standing broad jump, standing triple jump, low squats in 30 seconds, sit-ups in 30 seconds, and bent-arm hang test; variables in the area of general coordination are: loops with bending down, steps to

a side, and agility on the ground; variables in the area of coordination in rhythm are: non-rhythmic drumming, hand and feet drumming, and rhythmic hops; variables in the area of movement frequency are: foot tapping, plate tapping, and foot skipping; and variables in the area of mobility are: forward bend on the bench and side bend with a stick.

Variables in the area of functional abilities are as follows: pulse frequency at rest, pulse frequency under stress and maximum oxygen consumption.

Instruments

In order to assess motor abilities, the following tests with confirmed metric characteristics were used (Metikoš, Prot, Hofman, Pintar, & Oreb, 1989; Oreb, Vlašić, Cigrovski, Prlenda, & Radman, 2011; Srdić, Bajrić, & Hrnjak, 2017):

Standing broad jump. A female participant is standing facing the mats and jumps forward twice with both feet as far as she can. The longer jump in centimetres is assessed.

Standing triple jump. Facing the mats, a female participant jumps with both feet and bounces back on one foot, then the other and finally with both feet. The longer jump in centimetres is assessed.

Low squats in 30 seconds. A female participant is standing with her legs spread, with a small elevation under her heels. When she gets the "Go" command, she has to do as many squats as she can in 30 seconds, with only proper attempts being counted.

Sit-ups in 30 seconds. A female participant is lying on her back in the initial position. Her legs are bent in the knee joints, at an angle of 90°, while her feet are fixed. Her hands are on the back of her neck, elbows directed towards the knee joints. When she gets the "Go" command, she has to do as many squats as she can, until reaching the sitting position, touching her knees. The upper body has to be lifted up equally and it has to be stretched.

Bent-arm hang test. Using the chair, a female participant grabs the pole in the shoulder width with bent-arm grip. Her chin is above or at the height of the pole. The chair is removed and at that moment, a stop watch is switched on. The task is finished when the female participant is no longer able to be in the pull-up position with her chin above or at the height of the pole.

Loops with bending down. At a distance of 4m, there are two vertical poles with a tight elastic tape spread between them, at the height of upper edge of the female participant's pelvis. The female participant is standing in the high start position next to one of the poles facing the other pole. When she gets the "Go" command, the female participant goes around the poles following the imaginary number eight path, each time bending under the tape. After she has been around the pole in the abovementioned fashion for four times and has run past the starting pole, the test is finished. The time is measured until the female participant touches the imaginary line with her chest.

Steps to a side. Two parallel lines are marked on the ground, 4m away from each other. A female participant is standing with both feet on the ground, within the lines, along the line. When she gets the "Go" command, the female participant moves sideways step

by step as fast as she can, without crossing her legs, until reaching the other line. When she steps on the line or crosses it with her nearer leg, she stops and goes back to the first line in the same manner. The described movement is repeated six times.

Agility on the ground. Two mats are placed facing each other with their narrower sides, while their farther sides are far enough from each other that 4 heavy balls can be placed between them. A female participant sits on the farthest heavy ball in the back, with her legs stretched over the heavy balls at the front. Each leg is positioned on one heavy ball, her arms are stretched while her palms are leaning against her upper legs. The female participant tries to do a backward roll as fast as possible, then lifts up and does a forward roll over the heavy balls, without touching them. After the rolls have been done, she turns at the angle of 180° and touches all four heavy balls with her palms, thus signalling the test has finished.

Non-rhythmic drumming. A female participant is sitting on the chair, with her palms spread at the shoulder width and positioned on the table so that her right palm is on the right side and the left one on the left side of the line. The task is performed in such manner that she has to hit the left side of the table with her left palm twice, and then leave it there in stretched position. After this, she hits the table twice with her right palm over the left hand, touches the forehead and puts the palm on the right side of the table. The test lasts for 20 seconds and she has to do as many correct cycles as it is possible.

Hand and feet drumming. A female participant is facing the corner of the wall, standing with her legs spread. At a signal, the female participant makes the following movements: she kicks once the left wall above the horizontal line with the front part of her left foot, then hits once the right wall with her right palm, hits the left wall twice with her left hand and kicks once the right wall above the horizontal line with the front part of her right foot. The described phases make up one cycle and the test itself lasts for 20 seconds.

Rhythmic hops. A female participant standing with her feet pressed together at the heel and facing the marked squares on the ground hops from one square to another following the rhythm of the metronome (set at 100/') in a ¾ bar, in this order: she hops into the first square on her left foot, into the second square on her left foot, into the third square on her right foot, into the fourth square on her left foot, into the fifth square on her left foot, into the sixth square on her right foot, into the seventh square on her right foot, into the eighth square on her left foot and finally into the ninth square on her left foot. When she hops into the ninth square on her left foot, she enters the area for the turn and within three beats of the metronome, she is supposed to turn at the angle of 180°. After this, she hops in the opposite direction following this order: she hops into the ninth square on her right foot, into the eighth square on her left foot, into the seventh square on her left foot again, into the sixth square on her left foot, into the fifth square on her right foot, into the fourth square on her right foot, into the third square on her left foot, into the second square on her right foot and into the first square on her right foot. The task ends with a landing on both feet behind a starting line.

Foot tapping. A female participant is sitting on the front part of the chair without a backrest, with her hands on the waist. The tapping board is placed in front of the chair so that its narrower side supports the right chair "leg". The opposite, narrower side is fixed by the female participant's foot. She puts her left foot on the ground beside the wooden structure, and the right one on the board, on the left side of the barrier (the left-footed do the opposite). She has to switch the right foot from one to the other side of the barrier, touching the board with her front part of the foot (or with the entire foot). The task lasts for 20 seconds.

Plate tapping. A female participant is sitting on a chair opposite the tapping board. The palm of her non-dominant hand is placed in the middle of the board. She crosses the dominant hand over the non-dominant one and puts the palm on the plate on the board. During the period of 20 seconds, with the fingers of her dominant hand, she touches one plate and then the other, successively, both plates being located on the board at a distance of 60 centimetres.

Skipping. A female participant is standing facing the vertical poles between which there is a rope at the height of the hip joint. During the period of 15 seconds, she should do the maximum quantity of fast skipping (raising her knees high) while standing.

Forward bend on the bench. A female participant is standing with her feet together on the 40 cm high bench with a scale, with her legs stretched. With her arms forestretched, she puts her hands one on top of the other so that her middle fingers are completely overlapping. The female participant bends forward, keeping her legs and arms stretched. With the palms of her stretched arms, she "slides" along the meter scale until she reaches the lowest possible point and remains there for a while. This task is repeated twice.

Side bend with a stick. A female participant is standing and holding a stick in her right forestretched arm in such manner that she is clasping the stick with her right hand until the zero point, while her left hand is clasping the stick immediately next to the meter scale. The female participant lifts the stick in the forestretched position from the initial position and at the same time, she pulls her hands apart sliding with her right hand along the stick, while her left hand remains fixed on the supporter. She has to make a side bend above her head while holding the stick in her stretched arms without a swing so that the distance between her arms is as small as possible.

For measuring the pulse frequency at rest and under stress, the pulse meter was used (POLAR V800).

Direct determining of the maximum oxygen consumption (VO_{2max}) was conducted on the treadmill (COSMED T150-Italy) along with the use of gas analyser (COSMED Quark b2-Italy) by means of progressively increasing stress. The testing protocol is such that after warm-up (3 min at the speed of 3 km/h, without inclination), the speed-up to 7 km/h is linearly increasing (each minute by 1 km/h with the inclination of 1.5%). The increase of 0.5 km/h after every 30 seconds follows, with the steady inclination of 1.5%.

For measuring values for variables such as standing broad jump and triple jump, we used centimetre tape (FREEMANS FT 15, Freemans Measures, India) with 0.1cm

accuracy, while in case of variables such as low squat in 30 seconds, sit-ups in 30 seconds, bent-arm hang test, loops with bending down, steps to a side and agility on the ground, non-rhythmic drumming, hand and feet drumming, foot tapping, plate tapping and skipping, the time was measured using the stop watch (Ultrak BTS, Model No: A 650, China) in seconds and hundredths.

Statistical Data Processing

Statistical software IBM SPSS 20.0 was used in the research. All obtained results were processed by means of descriptive and comparative statistical methods. In the area of descriptive statistics, the following was processed: arithmetic mean – Mean, standard deviation – SD, while in the area of comparative statistics, ANOVA 2x2 Between Subjects was used.

Experimental Programme

In order to complete this research, a specially programmed step aerobics classes had been devised and conducted three times a week lasting for 45 minutes, during eight weeks and with a total of 24 classes. Choreography for the bench was prepared for each class in order to develop aerobic endurance, as well as components intended for the development of strength and mobility. The music tempo ranged from 128 to 136 bpm, while each class had a different music programme. Each class was divided into the introductory-preparatory part, the main part and the final part. The introductory-preparatory part, the main purpose of which was to physiologically introduce and prepare the body for more intensive workout in the main part of the class, comprised exercises which were supposed to prepare those muscular groups which would be most engaged in the main part of the class. Basic characteristics of this class segment were exercises with small movement amplitude, exercises of gentle stretching, moderate exercising pace, simple coordination exercises and cranial-caudal ordering of the shaping exercises. This class phase lasted between 8 and 10 minutes, applying the frontal method of work with pupils and music tempo ranging from 128 to 132 bpm. In the main part of the class, aerobic choreography with bench was implemented, which included changing and non-changing steps of step aerobics. This class segment lasted between 15 and 20 minutes and the female pupils were constantly active. The music tempo in this segment ranged between 132 and 136 bpm. In addition to the aerobic choreography, muscle strengthening exercises, strengthening exercises for abdominal muscles, back muscles, arm and shoulder muscles, abductors and adductors as well as gluteal region were also performed in the main segment of the class. Within the final segment of the class, stretching exercises for those muscle groups which had been engaged most in the main part of the class were applied. Stretching exercises were performed according to the following schedule: easy stretching, relaxation and then developmental stretching. Music in this segment had to be soothing and relaxing, with music tempo of 128 bpm.

Results

Table 1 shows descriptive statistical indicators for the experimental and control groups in the initial and final measurements, as well as the ANOVA 2x2 results for motor abilities.

Table 1

Results for motor abilities of the experimental and control groups

			Initial measurement	Final measurement	
Variable	Group	N	Mean±SD	Mean±SD	F
Standing Broad Jump (cm)	E	32	186.47±12.05	191.53±13.35	5.89*
	C	31	180.10±9.41	182.20±10.40	
Standing Triple Jump (cm)	E	32	517.44±31.46	549.53±39.28	36.38**
	C	31	513.06±25.06	515.61±21.93	
Low Squats (number of reps)	E	32	28.34±2.12	30.60±2.41	32.16**
	C	31	26.29±1.71	27.03±2.00	
Sit-ups in 30 sec (number of reps)	E	32	22.40±2.76	25.37±3.04	31.83**
	C	31	21.61±1.94	22.61±1.78	
Bent-Arm Hang Test (s)	E	32	43.19±17.30	46.18±18.28	1.21
	C	31	42.10±12.77	43.31±12.44	
Loops Bend Over (s)	E	32	10.35±0.77	9.21±0.64	67.89**
	C	31	10.48±0.60	10.25±0.66	
Steps Side (s)	E	32	11.02±0.98	10.23±0.56	8.13**
	C	31	11.79±0.73	11.44±0.66	
Agility Ground (s)	E	32	5.27±0.56	4.74±0.46	18.49**
	C	31	5.89±0.42	5.72±0.34	
Non-rhythmic Drumming (number of reps)	E	32	10.84±2.67	17.34±1.91	263.43**
	C	31	7.54±2.30	9.03±2.08	
Drumming with Hands- Feet (number of reps)	E	32	8.69±2.22	14.06±2.17	103.83**
	C	31	6.38±2.65	8.22±2.44	
Rhythmic Hops	E	32	10.59±4.57	20.06±1.61	31.97**
	C	31	9.19±3.18	14.03±2.50	
Foot Tapping (number of reps)	E	32	31.28±2.53	35.28±3.05	60.60**
	C	31	31.84±2.10	33.03±2.00	
Plate Tapping (number of reps)	E	32	46.78±3.44	52.12±3.10	31.96**
	C	31	44.54±5.16	46.10±4.33	
Skipping (s)	E	32	25.75±3.55	34.87±3.83	80.84**
	C	31	23.10±2.09	25.45±2.08	
Forward Bend Bench (cm)	E	32	49.94±5.96	52.94±5.78	44.35**
	C	31	50.16±6.26	49.65±5.45	
Side Bend Stick (cm)	E	32	65.53±14.09	58.06±10.61	17.00**
	C	31	72.35±14.09	69.77±13.20	

*Legend: E-experimental group; C-control group; N-number of participants; SD-standard deviation; F-ANOVA 2x2; *p<0.01; **p<0.001*

Descriptive statistical indicators show the positive influence of step aerobics classes on the development of the observed motor abilities although both groups showed some improvements between the initial and the final measurements.

Based on the results of the experimental and control groups (Table 1) obtained by ANOVA 2x2, we notice statistically significant differences in variables in the area of strength, coordination, movement frequency and pliability. Statistically significant differences in the final measurement after the experimental procedure had been conducted were noticeable between the experimental and the control groups in variables in the area of strength: standing triple jump, low squats in 30 seconds and sit-ups in 30 seconds at the $p<0.001$ significance level, as well as standing broad jump ($p<0.01$). Apart from this, in the final measurement we noticed that the experimental group achieved statistically significantly better results, at $p<0.001$ significance level, in all three variables in the area of general coordination: loops with bending down, steps to a side and agility on the ground as well as the variables in the area of coordination in rhythm: non-rhythmic drumming, hand and feet drumming, rhythmic hops. ANOVA 2x2 results shown in Table 1 indicate that the experimental classes of step aerobics contributed to the statistically significantly better results of the experimental group in the final measurement ($p<0.001$) for the variables in the area of movement frequency: foot tapping, plate tapping, foot skipping; and variables in the area of mobility: forward bend on the bench and side bend with a stick.

Statistically significant difference in the final measurement was not detected only in the case of a single variable in the area of strength – bent-arm hang test.

Table 2 shows descriptive statistical indicators for the experimental and control groups in the initial and final measurements, as well as the ANOVA 2x2 results for cardio-respiratory functions.

Table 2

Results for cardio-respiratory functions of the experimental and control groups

			Initial measurement	Final measurement	
Variable	Group	N	Mean±SD	Mean±SD	F
PulsFreqRest (number of beats)	E	32	82.87±4.68	75.19±6.28	32.24**
	C	31	84.00±5.14	81.87±5.70	
PulsFreqStress (number of beats)	E	32	154.88±4.16	150.19±3.88	14.87**
	C	31	152.13±5.49	150.97±4.41	
VO_{2max} ml/kg/min	E	32	54.93±4.87	63.31±2.38	104.29**
	C	31	51.12±2.72	50.19±2.56	

*Legend: E-experimental group; C-control group; N-number of participants; SD-standard deviation; F-ANOVA 2x2; *p<0.01; **p<0.001*

Based on the ANOVA 2x2 results, we notice that after eight weeks of applying experimental step aerobics programme, some statistically significant differences ($p<0.001$) between the experimental group and the control group became evident in the observed cardio-respiratory functions. The obtained results indicate that the experimental group achieved statistically better results in the final measurement compared to the control group.

Discussion

The application of innovative curriculum in physical education classes over the period of eight weeks resulted in significant positive changes in the area of motor abilities and cardio-respiratory functions of female pupils. Since aerobic exercise classes accompanied by music are characterised by movements and mobility of the entire body to a particular music rhythm with moderate and intensive activities, special attention was paid to the intensification and rationalisation of programme components and thus significant improvement of the results can be justified, which is completely in compliance with the research in this area (Mandarić et al., 2011; Nikić & Milenković, 2013; Olvera et al., 2010). The analysis of the obtained results in the area of motor abilities indicates the fact that properly conducted experimental procedure in PE classes statistically significantly influenced the improvement of the level of the observed variables in this area. Based on the results of variables in the area of strength, we can conclude that the experimental programme influenced the improvement of results of dynamic muscular potential of lower extremities and repetitive muscular potential. The obtained results in the area of dynamic muscle potential of lower extremities are in compliance with the results of the research studying the effects of step aerobics application on muscular strength of lower extremities (Hallage et al., 2010), but also with the research results obtained by applying the aerobic dancing to the repetitive and explosive power (Viskić-Štalec et al., 2007). However, when comparing the relation between the experimental process and PE classes and their impact on variables in the area of strength, we can conclude that there are no statistically significant differences in the results for endurance pull-ups, which means that the applied experimental procedure did not statistically significantly differ from the PE classes. Research results in the area of general coordination and coordination in rhythm indicate that experimental step aerobics programme statistically significantly influenced all analysed variables. Since aerobic exercise to music is characterised by movements and mobility of the entire body to the tempo and the rhythm of the music, improvement of the results in the area of coordination makes sense. In fact, improvement of the outcome in the area of coordination in the experimental group is the result of applying steps in a precisely defined rhythm compiled into choreography, with simultaneous successive climbing up and down the platform as well as performance of movement structures, both with arms and feet and at different levels. In addition to this, we should bear in mind that these movement structures were performed with specially chosen musical accompaniment, which defined the tempo and exercise rhythm. In the research analysing the impact of aerobic exercise to music on coordination (Mandarić et al., 2011; Viskić-Štalec et al., 2007), it is stated that aerobic exercise to music develops almost all types of coordination, which is in compliance with the obtained results.

The obtained results in the area of movement frequency indicate that aerobic exercise to music statistically significantly influenced the improvement of movement frequency

of upper and lower extremities, which can be supported by making movements to the music tempo ranging between 132 and 136 beats in the central segment of the class. The results in the area of movement frequency for the experimental group are in compliance with the results related to the coordination in rhythm (Mandarić et al., 2011). After analysing the results in the area of mobility, we can conclude that stretching exercises properly conducted in the final segment of the class statistically significantly influenced the improvement of the results for variables in this area (Nikić & Milenković, 2013; Stojanović-Tošić et al., 2011).

Research results in the area of cardio-respiratory functions indicate that the experimental programme statistically significantly influenced the decrease in the heart frequency at rest and under stress as well as the increase in the maximum oxygen consumption. The obtained research results are within the limits of the results in which it was concluded that step aerobics primarily influenced the cardiovascular fitness and maximum oxygen consumption (Drobnik-Kozakiewicz et al., 2013; Ossanloo et al., 2012). In addition to the abovementioned, since step aerobics belongs to the group of moderate to intensive activities (Olvera et al., 2010), as well as the fact that the platform height affects the increase in the pulse frequency under stress and the intensity of exercise (Bryukhanova et al., 2013), the obtained results can be confirmed. Also, by analysing the relation between step aerobics (Brick, 1996; Pillarella & Roberts, 1996) and running, cycling, swimming, walking and weight-lifting, as well as their influence on the selected morphological characteristics, motor abilities and cardio-respiratory fitness of the population of recreational athletes, authors conclude that step aerobics influences the improvement of cardiovascular endurance to the greatest extent. After comparing classical PE classes with the experimental innovative curriculum, as well as their influence on the maximum oxygen consumption, it can be concluded that the female pupils from the control group achieved poorer results compared to the female pupils from the experimental group; that is, aerobic exercise accompanied with music, performed three times a week in the duration of one school lesson improved the results of maximum oxygen consumption. Recommendations of the American College for Sports Medicine from 2011 support the obtained results by stating that 20-60-minute exercise in aerobic mode three to five times a week improves cardiovascular endurance and has a positive impact on the cardiovascular system. Accordingly, we can conclude that specially programmed aerobic exercise classes, such as step aerobics classes in which the stress intensity is regulated by the speed of movements, exercising rhythm and counting repetition, represent a proper means for intensification of PE classes, reduction of inactive period while raising optimal organism stress in the body of each female pupil.

The stated research results indicate that the applied innovative programme components accompanied by music had a positive impact on the analysed area and that its application may complete other tasks regarding the PE classes. Those results do not diminish the significance and impact of the prescribed programme components

of PE, but they indicate justified reasons for applying new, more modern programme components and organisation work patterns in PE classes. In fact, organisation work patterns typical of this programme component, not characterised by competition but self-conscious individual training, may lead to the improvement of physical self-esteem (Burgess et al., 2006) and encourage pupils to lead active lives and do exercises outside the school system (Corbin, 2002).

Conclusion

Bearing in mind that PE classes in schools represent the most available way to promote physical activities among today's school population, there is a need to adjust teaching components to the contemporary trends of the society. In accordance with this, innovative curriculum should stimulate pupils to engage in a lifelong physical activity, positively influence their health and provide optimal intensification and rationalisation of the teaching process. Based on these findings, the programme for step aerobics classes was developed and applied during PE classes of a group of seventh-grade female pupils.

After eight weeks of applying the innovative programme components in the form of step aerobics classes, we can conclude that functional and motor abilities improved significantly in the seventh-grade female pupils. With regard to this, with necessary reservations preventing any wrong conclusion, we can say that such innovative model of exercise in PE classes, compared to classical classes, gave better results in the transformation and development of psycho-physical abilities of female pupils, their motivation and activity in the class. At the same time, research results indicate that the application of such teaching components provides better optimisation, rationalisation and intensification of the teaching process in terms of operational efficiency in performing tasks within the PE classes. By applying the contemporary organisational forms of classes such as step aerobics, the class may be connected with everyday life and interests of pupils, thus increasing their motivation for applying the acquired knowledge from school during their leisure time, extracurricular activities as well as after finishing their schools in the form of lifelong physical activity that can contribute to their lifelong fitness.

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Učinkovitost primjene inovativnih programskih sadržaja u nastavi tjelesne i zdravstvene kulture

Sažetak

Cilj istraživanja bio je utvrditi učinke programirane nastave step aerobika kod učenica sedmih razreda osnovne škole. Istraživanje je provedeno na uzorku od 63 učenice sedmih razreda osnovne škole, podijeljenih metodom ciljanog uzorka na eksperimentalnu (n=32) i kontrolnu (n=31) skupinu. Učinci step aerobika praćeni su u prostoru motoričkih sposobnosti (16 varijabli) i kardiorespiratornih funkcija (3 varijable). Eksperimentalni čimbenik predstavljala je nastava step aerobika koja je trajala osam tjedana i koja je ostvarena u okviru redovite nastave tjelesne i zdravstvene kulture. Rezultati ANOVA 2x2 ukazuju na to da je nastava step aerobika statistički značajno utjecala na poboljšanje 15 varijabli iz prostora motoričkih sposobnosti i svih varijabli iz prostora kardiorespiratornih funkcija eksperimentalne skupine u odnosu na kontrolnu. Najveći napredak zamijećen je u neritmičkom bubnjanju (F=263,43; p<0,001), bubnjanju rukama i nogama (F=103,83; p<0,001) i maksimalnoj potrošnji kisika (F=104,29; p<0,001). Na temelju dobivenih rezultata može se zaključiti da nastava step aerobika kao inovativan programski sadržaj ima praktičnu primjenljivost u nastavi s ciljem preciznog doziranja vježbanja i ostvarenja cilja i zadataka tjelesne i zdravstvene kulture.

Ključne riječi: *kardiorespiratorne funkcije; motoričke sposobnosti; step aerobik; suvremena nastava; učenice*

Uvod

Složeni i raznovrsni zahtjevi društvenog života, tjelesna neaktivnost uz stalni porast pretilosti koja je dostigla pandemijske razmjere, kao i kronične nezarazne bolesti koje ostavljaju trajne posljedice na zdravlje i kvalitetu života (Patton i sur., 2011), između ostalog, nameću potrebu za mijenjanjem i osuvremenjivanjem nastave tjelesne i zdravstvene kulture. Zbog toga je tjelesna i zdravstvena kultura vrlo aktualna tema sa stajališta promjena nastavnog plana i programa, nastavnih sadržaja, tjelesnog razvoja

i tjelesnih sposobnosti današnje školske populacije. Tako je jedan od osnovnih ciljeva navedenih promjena poticaj na redovitu tjelesnu aktivnost, što je ujedno i zahtjev koji si postavlja Europska unija, pokušavajući na taj način ublažiti negativne učinke na zdravlje i poboljšati funkcioniranje društva (Svjetska zdravstvena organizacija – Regionalni ured za Europu, 2007). S druge strane, primarni cilj nastave tjelesne i zdravstvene kulture je da raznovrsnim i sustavnim motoričkim aktivnostima pridonese integralnom razvoju osobnosti učenika, razvoju motoričkih sposobnosti, stjecanju, usavršavanju i primjeni motoričkih umijeća, navika i neophodnih teorijskih znanja u svakodnevnim i specifičnim uvjetima života i rada (Pravilnik o nastavnom programu za 7. razred osnovnog obrazovanja i odgoja, 2009). Imajući u vidu navedene ciljeve, može se reći da sati tjelesne i zdravstvene kulture u školama predstavljaju najdostupniji način poticanja učenika na cjeloživotnu tjelesnu aktivnost i cjeloživotnu formu (Ayers i Saiscsany, 2011; Fairclough, Stratton, i Baldwin, 2002).

Međutim činjenica je kako je sve manje djece tjelesno aktivno, a tijekom sati tjelesne i zdravstvene kulture učenicima je ostavljeno previše neaktivnog vremena. Rezultati istraživanja provedenog na deset lokacija u 684 osnovne škole u Sjedinjenim Američkim Državama ukazuju na to da učenici tijekom sata tjelesne i zdravstvene kulture prosječno pet minuta (15 % sata) imaju intenzivne aktivnosti, a 12 minuta (37 % sata) umjereno do intenzivne aktivnosti, što tjedno iznosi oko 25 minuta tjelesnih aktivnosti (Nader, 2003). S druge strane, porast prevalencije pretilosti u djece i adolescenata u Sjedinjenim Američkim Državama, uz sjedilački način života, ukazuju na potrebu da se u nacionalnim školama sustavno i učinkovito promoviraju ponašanja koja će spriječiti razvoj pretilosti, kao i to da škole trebaju preuzeti vodeću ulogu u osiguravanju svakodnevne i adekvatne količine tjelesne aktivnosti (Pate i sur., 2006). Na neaktivno vrijeme tijekom sata tjelesne i zdravstvene kulture i kvalitetu nastave ukazuju rezultati istraživanja provedenog na učenicima sedmih razreda u Portugalu koji pokazuju da učenici tijekom sata tjelesne i zdravstvene kulture prosječno imaju 14.4 minuta umjereno do intenzivne aktivnosti (frekvencija bila iznad 139 otkucaja) i 6.7 minuta intenzivne aktivnosti (frekvencija bila iznad 159 otkucaja). U zaključku istraživanja navodi se da tijekom sata tjelesne i zdravstvene kulture učenike treba poticati na aktivnije sudjelovanje u nastavnim sadržajima, ali i na redovitu tjelesnu aktivnost izvan škole (Wang, Pereira, i Mota, 2005). Tijekom redovite nastave tjelesne i zdravstvene kulture nastavnici bi kod učenika, osim tjelesnih sposobnosti, trebali razvijati i neke druge vještine poput vještina upravljanja sobom i svojim tijelom, samoocjenjivanja, samonadzora, planiranja vlastitog vremena, postavljanja ciljeva i svladavanja prepreka. Razvojem tih vještina učenici se potiču da nastave s aktivnim životom i vježbanjem i nakon završetka formalnog obrazovanja (Corbin, 2002).

Može se reći da ukupni učinci nastave ne opravdavaju očekivanja, odnosno da tjelesna i zdravstvena kultura nije u dostatnoj mjeri učinkovita u rješavanju osnovnog cilja i zadataka koji se pred nju postavljaju. S tim u vezi jedan je od čestih problema proučavanja tehnologije rada u tjelesnoj i zdravstvenoj kulturi intenzifikacija i racionalizacija

nastavnog procesa u okviru školskog sustava. Rezultati istraživanja ukazuju na to da bi s ciljem optimalne intenzifikacije, racionalizacije i veće učinkovitosti tjelovježbe na satima tjelesne i zdravstvene kulture trebalo primjenjivati suvremenije organizacijske oblike rada, koji će svojim ciljevima i zadatcima omogućiti povećanje intenziteta i aktivnog vremena rada na satu, kao i veću motiviranost učenika (Bavčević, Babin, i Prskalo, 2006; Findak, Prskalo, i Pejčić, 2003). Tako Bavčević, Babin i Prskalo (2006) navode da civilizacijske promjene, zatim promjene u načinu života, kao i suvremeni nastavni standardi, zahtijevaju kako uopće, tako i u tjelesnoj i zdravstvenoj kulturi, otkrivanje optimalnih metoda i modaliteta nastave. U skladu s iznesenim može se zauzeti stav da je potrebna nova strategija koja će pridonijeti ostvarivanju cilja, zadataka i ishoda nastave tjelesne i zdravstvene kulture u školama, kako bi tjelesna i zdravstvena kultura učinkovitije i značajnije pridonijela cjeloživotnoj formi.

Jedna od ključnih strategija za unapređenje kvalitete nastave tjelesne i zdravstvene kulture jest provedba dobro osmišljenog kurikula, koji za cilj ima maksimalno povećanje tjelesne aktivnosti na nastavi i angažiranost djece (Emeljanovas, Mieziene, & Putriute, 2015). S tim u vezi jedna je od mogućnosti za povećanje tjelesne aktivnosti i učinkovitosti nastave tjelesne i zdravstvene kulture primjena grupnih fitness programa. Naime, istraživanja iz prostora grupnih fitness programa ukazuju na njihov pozitivan utjecaj na psihomotorni razvoj učenika, kao i praktičnu primjenjivost u nastavi tjelesne i zdravstvene kulture. Tako rezultati istraživanja utjecaja šestotjedne primjene aerobnog plesa na uzorku učenica od 13 i 14 godina u Velikoj Britaniji ukazuju na statistički značajno smanjenje nezadovoljstva izgledom vlastitog tijela i poboljšanje tjelesnog samopoštovanja (Burgess, Grogan, i Burwitz, 2006). Istraživanje učinaka primjene eksperimentalnog programa *high-low* aerobika u trajanju od osam tjedana na uzorku učenica osmih razreda ukazuju na statistički značajno poboljšanje njihovih morfoloških karakteristika i motoričkih sposobnosti (Mandarić, Sibinović, i Stojiljković, 2011). Rezultati istraživanja na populaciju učenica srednje škole ukazuju na to da primjena aerobnog plesa ima značajan i kompleksan utjecaj na razvoj opće koordinacije i koordinacije u ritmu, kardiorespiratornu izdržljivost, zatim repetitivnu i eksplozivnu snagu i pokretljivost, kao i redukciju prekomjerne težine i masnog tkiva (Viskić-Štalec, Štalec, Katić, Podvorac, i Katović, 2007), a primjena četveromjesečnog programa kick-aerobika ima utjecaja na poboljšanje kardiorespiratorne izdržljivosti, snage mišića ekstenzora leđa, mišića natkoljenice, zatim mišića ruku i ramenog pojasa, kao i povećanje pokretljivosti u zglobu kuka i zglobu ramenog pojasa (Stojanović-Tošić, Kostić, i Đorđević, 2011).

Za potrebe ovoga istraživanja primijenjen je jedan od najpopularnijih grupnih fitness programa – step aerobik. Step aerobik je oblik aerobnog vježbanja uz primjenu klupice (stepera) na koju se, prateći tempo glazbe, naizmjenično penje i silazi radeći koreografski kombinirane korake. Osnovni cilj tog programa vježbanja uz glazbu jest razvoj aerobnog fitnessa, tjelesnog zdravlja, kardiovaskularnog fitnessa i tjelesnog sustava (Ossanloo, Zafari, i Najar, 2012). Strukturu programa čine pokreti penjanja i silaženja s klupice, koji

se mogu podijeliti na mijenjajuće, nemijenjajuće i neutralne korake. Zahvaljujući takvoj strukturi koraka moguće je, uz primjenu specifične metodike, osmisliti koreografije u aerobnom režimu rada koje su pristupačne svakom pojedincu tijekom realizacije sata. Osim navedenog, specifičnost step aerobika je mogućnost prilagođavanja visine klupice razini tjelesnih sposobnosti pojedinca, pa na jednom satu step aerobika istodobno mogu vježbati i početnici i napredni vježbači.

Istraživanja iz područja primjene programa step aerobika provedena su najvećim dijelom na populaciji odraslih, ukazujući na njegove pozitivne promjene na motoričke sposobnosti, kardiorespiratorni fitness, cirkularne dimenzionalnosti i tjelesnu kompoziciju. Jedno od istraživanja koje je provedeno na uzorku pretilih djevojčica prosječne starosti 10,3±1,2 godine s ciljem promicanja umjereno do intenzivne tjelesne aktivnosti, ukazuje na to da se tijekom sata step aerobika u odnosu na sportske vještine, ples, programe za razvoj pokretljivosti i dječje igre najviše 37 % od ukupnog sata provede u zoni umjereno do intezivne tjelesne aktivnosti (Olvera, Graham, McLeod, Kellam, i Butte, 2010). U skladu s navedenim rezultati istraživanja provedeni na uzorku studentica Sveučilišta u Gdanjsku (Poljska) ukazuju na to da eksperimentalni program step aerobika, koji traje deset tjedana, utječe na poboljšanje maksimalne potrošnje kisika i razvoja izometrijske snage mišića fleksora zgloba lakta i ekstenzora zgloba koljena (Drobnik-Kozakiewicz, Sawczyn, Zarčbska, Kwitniewska, i Szumilewicz, 2013). Statistički značajno povećanje frekvencije bila u opterećenju i intenzitet vježbanja, podizanjem visine stepera, uočeno je u istraživanju koje je provedeno na uzorku studenata Sibirskog federalnog sveučilišta (Bryukhanova, Bulgakova, Mokrova, i Bogashchenko, 2013). Rezultati istraživanja provedenog s ciljem utvrđivanja učinaka primjene step aerobik programa na motoričke sposobnosti, cirkularnu dimenzionalnost i tjelesnu kompoziciju kod mlađih žena ukazuju na postojanje statistički značajnih učinaka na sva tri promatrana prostora (Nikić i Milenković, 2013). S druge strane, rezultati istraživanja primjene programa step aerobika u trajanju od dvanaest tjedana kod fizički aktivnih osoba ženskog spola ukazuju na statistički značajne promjene na kardiorespiratorni fitness, mišićnu snagu donjih ekstremiteta, dinamičku ravnotežu i agilnost (Hallage i sur., 2010). Eksperimentalni program step aerobika u trajanju od osam tjedana utjecao je kod fizički neaktivnih osoba ženskog spola na redukciju tjelesne mase i promjenu u tjelesnom sastavu (Arslan, 2011).

Popularnost step aerobika, lakoća u koncipiranju sata u radu s osobama različite razine tjelesnih sposobnosti, kao i rezultati istraživanja koji ukazuju na njegov pozitivan utjecaj na psihosomatski status pojedinca, potaknuo je zainteresiranost za ovu temu, s ciljem poboljšanja učinkovitosti procesa nastave tjelesne i zdravstvene kulture u osnovnoj školi. U skladu s navedenim predmet je ovog istraživanja proučavanje učinka i doprinos primjene programa step aerobika kod učenica sedmih razreda osnovne škole u nastavi tjelesne i zdravstvene kulture. Cilj je ovoga rada utvrditi učinkovitost primjene programa step aerobika kod učenica sedmih razreda osnovne škole, na njihove odabrane motoričke sposobnosti i kardiorespiratorne funkcije.

Metode

U istraživanju je primijenjena metoda eksperimenta, s inicijalnim i finalnim mjerenjem. U fazi operacionalizacije i elaboriranja primijenjene su empirijska i statistička metoda. Eksperimentalni program trajao je osam tjedana i ostvaren je u okviru redovite nastave tjelesne i zdravstvene kulture u osnovnoj školi. Program je realiziran tri puta tjedno u trajanju od jednog školskog sata, u dvorani za tjelesnu i zdravstvenu kulturu. Učenice su bile podijeljene metodom ciljanog uzorka u dvije skupine: eksperimentalnu i kontrolnu. Eksperimentalna je skupina polazila programiranu nastavu step aerobika, a kontrolna je skupina za to vrijeme polazila redovite sate tjelesne i zdravstvene kulture propisane Nastavnim planom i programom tjelesne i zdravstvene kulture, Ministarstva prosvjete, znanosti i tehnološkog razvoja Republike Srbije (Pravilnik o nastavnom programu za 7. razred osnovnog obrazovanja i odgoja, 2009).

Uzorak ispitanika

Uzorak ispitanika činile su 63 učenice sedmih razreda osnovne škole „Jovan Jovanović Zmaj" iz Kanjiže, prosječne dobi 13,4 godina podijeljene metodom ciljanog uzorka u jednu eksperimentalnu (n=32) i kontrolnu (n=31) skupinu. Eksperimentom su bile obuhvaćene učenice koje nisu imale neke kronične bolesti, deformitete kralježnice i ekstremiteta, ili bolesti za koje nije indicirana tjelesna aktivnost. Učenice obuhvaćene eksperimentalnim programom dobrovoljno su sudjelovale u eksperimentu uz suglasnost roditelja i nisu bile angažirane u nekoj sportskoj sekciji kao izvannastavnoj aktivnosti.

Uzorak varijabli

Polazeći od postavljenog predmeta i cilja istraživanja, objektivnih mogućnosti i uvjeta sredine, ispitane su varijable koje su iste metodološke prirode i imaju atribute kriterijskih varijabli. S ciljem sustavnog prikaza varijable je moguće podijeliti na: varijable iz prostora motoričkih sposobnosti i varijable iz prostora kardiorespiratornih funkcija.

Varijable iz prostora motoričkih sposobnosti podijeljene su u varijable iz prostora snage, varijable iz prostora opće koordinacije, varijable iz prostora koordinacije u ritmu, varijable iz prostora frekvencije pokreta i varijable iz prostora pokretljivosti. U skladu s tim varijable iz prostora snage su: skok udalj iz mjesta, troskok iz mjesta, duboki čučanj za 30 sekundi, podizanje trupa za 30 sekundi i izdržaj u zgibu; varijable iz prostora opće koordinacije: osmica sa saginjanjem, koraci u stranu i okretnost na tlu; zatim varijable iz prostora koordinacije u ritmu: neritmičko bubnjanje, bubnjanje nogama i rukama, poskoci u ritmu; varijable iz prostora frekvencije pokreta: taping nogom, taping rukama, skiping; i varijable iz prostora pokretljivosti: pretklon na klupici i iskret palicom.

Varijable iz prostora kardiorespiratornih funkcija su: frekvencija bila u mirovanju, frekvencija bila u opterećenju i maksimalna potrošnja kisika.

Instrumenti

Za procjenu motoričkih sposobnosti primijenjeni su testovi koji imaju potvrđene metrijske karakteristike (Metikoš, Prot, Hofman, Pintar, i Oreb, 1989; Oreb, Vlašić, Cigrovski, Prlenda, i Radman, 2011; Srdić, Bajrić, i Hrnjak, 2017) i to:

Skok udalj iz mjesta. Ispitanica stane licem okrenuta prema strunjačama i sunožnim odrazom skoči dva puta naprijed što dalje. Ocjenjuje se duži skok u centimetrima.

Troskok iz mjesta. Licem okrenutim prema strunjačama ispitanica sunožnim odrazom doskoči na jednu nogu, zatim na drugu nogu i na kraju sunožno doskoči. Ocjenjuje se duži skok u centimetrima.

Duboki čučanj za 30 sekundi. Ispitanica stane u raskoračni stav, a ispod peta se postavlja povišenje. Na znak „sad", u vremenu od 30 sekundi, treba izvesti što više čučnjeva; broje se pravilno izvedeni pokušaji.

Podizanje trupa za 30 sekundi. Ispitanica legne u početni položaj na leđima. Noge su savijene u zglobu koljena, pod kutom od 90°, a stopala su fiksirana. Šake su na zatiljku, laktovi usmjereni pema zglobu koljena. Na znak „sad" u 30 sekundi treba učiniti što više podizanja trupa do sjeda dodirujući koljena. Trup se mora ravnomjerno podizati i biti ispružen.

Izdržaj u zgibu. Uz pomoć stolice ispitanica se u širini ramena hvata za vratilo pothvatom. Brada se nalazi iznad ili u visini vratila. Stolica se uklanja i u tom trenutku se uključuje štoperica. Zadatak je završen u trenutku kada se ispitanica više ne može naći u položaju zgiba s bradom iznad ili u visini vratila.

Osmica sa saginjanjem. Na udaljenosti od 4 m nalaze se dva stalka između kojih je razapeta i zategnuta elastična traka, a koja se nalazi u visini gornjeg ruba zdjelice ispitanice. Ispitanica stoji u poziciji visokog starta pokraj jednog stalka okrenuta licem u smjeru drugog. Na znak „sad" ispitanica obilazi stalke slijedeći zamišljenu liniju broja osam, saginjući se svaki put ispod trake. Nakon što obiđe oko stalaka na opisan način četiri puta i protrči pokraj stalka koji je služio za start, test je završen. Mjeri se vrijeme do trenutka kada dotakne grudima zamišljenu liniju.

Koraci u stranu. Na tlu su označene dvije paralelne linije na međusobnom razmaku od 4 m. Ispitanica stoji sunožno unutar linija, bočno uz liniju. Na znak „sad" ispitanica se što brže kreće bočno korak-dokorak, bez križanja nogu, do druge linije. Kada stane vanjskom nogom na liniju ili prijeđe preko nje, zaustavlja se i na isti se način vraća do prve linije, koju mora dotaknuti stopalom ili preko nje prijeći. Opisano kretanje ponavlja se šest puta.

Okretnost na tlu. Dvije strunjače postavljene su tako da užim stranicama budu jedna nasuprot druge, a razdvojene toliko da se između njih mogu postaviti 4 medicinke. Ispitanica sjeda na „posljednje" medicinke, a noge ispruža preko „prednjih" medicinki. Svaka noga nalazi se na jednoj medicinki, ruke su opružene i dlanovima oslonjene na natkoljenice. Ispitanica što brže napravi kolut natrag, podigne se i napravi kolut naprijed

preko medicinki tako da ne dotakne medicinke. Nakon koluta okrene se za 180° i dlanovima dotakne sve 4 medicinke, tada test završava.

Neritmičko bubnjanje. Ispitanica sjedi na stolici, s dlanovima razmaknutim u širini ramena i postavljenim na stol tako da je desni dlan desno, a lijevi dlan lijevo od linije. Zadatak se izvodi tako da se lijevim dlanom udari dva puta po lijevom dijelu stola, te ga se ostavi položenog na tom mjestu, desnim dlanom prekriženim preko lijeve ruke udari se dva puta po stolu, zatim se dotakne čelo i spusti dlan na desni dio stola. Trajanje testa je 20 sekundi za vrijeme kojih treba učiniti što više pravilnih ciklusa.

Bubnjanje nogama i rukama. Ispitanica je licem okrenuta prema kutu zida u raskoračnom stavu. Na znak ispitanica izvodi sljedeće pokrete: prednjim dijelom lijevog stopala jednom udari lijevi zid iznad vodoravne linije, zatim jednom udari desnim dlanom desni zid, lijevom rukom dva puta udari lijevi zid, a zatim prednjim dijelom desnog stopala jednom udari desni zid iznad vodoravne linije. Navedene faze čine jedan ciklus, a test traje 20 sekundi.

Poskoci u ritmu. Ispitanica u spetnom stavu, licem okrenuta prema označenim kvadratima na podu, a u ritmu metronomom (namještenog na 100/') u ¾ taktu, skače na jednoj nozi iz kvadrata u kvadrat ovim redoslijedom: u prvi kvadrat doskače lijevom nogom, u drugi kvadrat lijevom nogom, u treći kvadrat desnom nogom, u četvrti kvadrat lijevom nogom, u peti kvadrat lijevom nogom, u šesti kvadrat desnom nogom, u sedmi kvadrat desnom nogom, u osmi kvadrat lijevom nogom, u deveti kvadrat lijevom nogom. Kada lijevom nogom doskoči u deveti kvadrat, ulazi u prostor za okret i u roku od tri otkucaja metronomom treba se okrenuti za 180°. Nakon toga na jednoj nozi skače u suprotnom smjeru ovim redoslijedom: u deveti kvadrat desnom nogom, u osmi kvadrat lijevom nogom, u sedmi kvadrat ponovno lijevom, u šesti kvadrat lijevom nogom, u peti kvadrat desnom nogom, u četvrti kvadrat desnom nogom, u treći kvadrat lijevom nogom, u drugi kvadrat desnom, u prvi kvadrat desnom nogom. Zadatak je završen sunožnim doskokom iza startne linije.

Taping nogom. Ispitanica sjedi na prednjem dijelu stolice bez oslonca na naslon, s rukama o struku. Daska za taping postavljena je ispred stolice tako da se svojom užom stranom upire o desnu „nogu" stolice. Suprotnu, užu stranu, ispitanica fiksira svojim stopalom. Ona postavlja lijevo stopalo na tlo pokraj drvene konstrukcije, a desno na dasku, s lijeve strane pregrade (ljevonozi obrnuto). Zadatak je da što brže prebacuje desnu nogu s jedne na drugu stranu pregrade, dodirujući prednjim dijelom stopala (ili cijelim stopalom) dasku. Zadatak traje 20 sekundi.

Taping rukom. Ispitanica sjedi na stolici nasuprot daske za taping. Dlan nedominantne ruke postavi na sredinu daske. Dominantnu ruku prekriži preko nedominantne ruke i dlan postavi na ploču na dasci. U vremenu od 20 sekundi dodiruje prstima dominantnom rukom naizmjenično jednu pa drugu ploču na dasci udaljenu 60 centimetara.

Skiping nogama. Ispitanica stoji licem okrenuta prema stalcima između kojih je razvučeno uže koje se nalazi u visini zgloba kuka. U vremenu od 15 sekundi treba napraviti maksimalno brzo skip (visoko podizanje koljena) u mjestu.

Pretklon na klupici. Ispitanica stoji sunožno na klupici visine 40 cm s opruženim nogama na kojoj se nalazi skala. Iz predručenja šake postavlja jednu preko druge, tako da se srednji prsti potpuno poklope. Ispitanica izvodi duboki pretklon zadržavajući opružene noge i ruke. Dlanovima opruženih ruku „klizi" niz skalu metra do najniže moguće točke u kojoj se za trenutak zadrži. Zadatak se ponavlja dva puta.

Iskret palicom. Ispitanica u stojećem stavu i priručenju drži palicu tako da desnom šakom obuhvati palicu neposredno do nulte točke, a lijevom obuhvati palicu neposredno pokraj mjerne skale. Iz početnog položaja ispitanica podiže palicu u predručenje i istodobno razdvaja ruke klizeći desnom šakom po palici, dok lijeva ostaje fiksirana na držaču. Zadatak je da napravi iskret iznad glave držeći palicu pruženim rukama, tako da razmak između ruku bude što je moguće manji, bez zamaha.

Za mjerenje frekvencije bila u mirovanju i opterećenju koristio se pulsmetar (POLAR V800).

Izravno određivanje maksimalne potrošnja kisika (VO_{2max}) izvršeno je na tredmilu (COSMED T150, Italija) uz korištenje plinskog analizatora (COSMED Quark b2, Italija) putem progresivno rastućeg opterećenja. Protokol testiranja je takav da se nakon zagrijavanja (3 min na brzini od 3 km/h, bez inklinacije), brzina do 7 km/h linearno povećava (svaku minutu po 1 km/h pri inklinaciji od 1,5 %). Zatim slijedi povećanje od 0,5 km/h svakih 30 sekundi, uz očuvanje konstantne inklinacije od 1,5 %.

Za mjerenje vrijednosti u varijablama skok udalj iz mjesta i troskok koristila se centimetarska vrpca (FREEMANS FT 15, Freemans Measures, India) s točnošću od 0.1 cm. U varijablama duboki čučanj za 30 sekundi, podizanje trupa za 30 sekundi, izdržaj u zgibu, osmica sa saginjanjem, koraci u stranu i okretnost na tlu, neritmičko bubnjanje, bubnjanje nogama i rukama, taping nogom, taping rukama i skiping vrijeme mjerilo se primjenom štoperice (Ultrak BTS, Model No: A 650, China) u sekundama i stotinkama.

Statistička obrada podataka

U istraživanju se koristio statistički softver IBM SPSS 20.0. Svi dobiveni rezultati obrađeni su postupcima deskriptivne i komparativne statističke metode. Iz prostora deskriptivne statistike određeni su: aritmetička sredina – Mean; standardna devijacija – SD, a iz prostora komparativne statistike primijenjen je ANOVA 2x2 Between Subjects.

Eksperimentalni program

S ciljem provedbe ovoga istraživanja osmišljena je posebno programirana nastava step aerobika, koja je realizirana tri puta tjedno u trajanju od jednog školskog sata, tijekom osam tjedana, s ukupnim fondom od 24 sata. Za svaki sat bila je osmišljena jedna koreografija na klupici s ciljem razvoja aerobne izdržljivosti, kao i sadržaji namijenjeni za razvoj snage i pokretljivosti. Tempo glazbe kretao se od 128 do 136 bpm, a glazbeni je sadržaj bio različit na svakom satu. Svaki sat bio je podijeljen na uvodno-pripremni, glavni i završni dio. Uvodno-pripremni dio sata, čija je osnovna svrha

fiziološko uvođenje i priprema organizma za intenzivnije vježbanje u glavnom dijelu sata, sastojao se od vježbi čiji je cilj bio priprema onih mišićnih skupina koje će najviše biti angažirane u glavnom dijelu. Osnovne karakteristike ovoga dijela sata bile su vježbe s malom amplitudom pokreta, vježbe laganog rastezanja, umjeren tempo rada, koordinacijski jednostavne vježbe i kranijalno-kaudalni redoslijed vježbi oblikovanja. Ta faza sata trajala je između 8 i 10 minuta, uz primjenu frontalnog oblika rada s učenicama i tempom glazbe od 128 do 132 bpm. U glavnom dijelu sata realizirale su se aerobne koreografije na klupici, koje su se sastojale od mijenjajućih i nemijenjajućih koraka step aerobika. Taj dio sata trajao je između 15 i 20 minuta. U njemu su učenice neprekidno bile aktivne. Tempo glazbe u ovome dijelu bio je od 132 do 136 bpm. Uz aerobnu koreografiju u glavnom dijelu sata realizirane su i vježbe jačanja mišića trbušnog zida, mišića leđa, mišića ruku i ramenog pojasa, mišića abduktora i aduktora, kao i mišića glutealne regije. U okviru završnog dijela sata primijenjene su vježbe rastezanja onih mišićnih skupina koje su najviše bile angažirane u glavnom dijelu sata. Vježbe rastezanja izvodile su se prema sljedećoj shemi: lagano rastezanje (*easy stretch*), zatim opuštanje, a nakon toga ponovno rastezanje (*developmental stretch*). Glazba tijekom toga dijela bila je obavezno umirujuća i opuštajuća, s tempom glazbe od 128 bpm.

Rezultati

U tablici 1 prikazani su deskriptivni statistički pokazatelji eksperimentalne i kontrolne skupine na inicijalnom i finalnom mjerenju, kao i rezultati ANOVA 2x2 motoričkih sposobnosti.

Tablica 1

Deskriptivni statistički pokazatelji ukazuju na pozitivan utjecaj nastave step aerobika na razvoj promatranih motoričkih sposobnosti, premda su obje skupine od inicijalnog do finalnog mjerenja postigle određeni napredak.

Na temelju dobivenih rezultata ANOVA 2x2 između eksperimentalne i kontrolne skupine (Tablica 1) mogu se zamijetiti statistički značajne razlike u varijablama iz prostora snage, koordinacije, frekvencije pokreta i gipkosti. Statistički značajne razlike na finalnom mjerenju nakon provedenog eksperimentalnog postupk zamjećuju se između eksperimentalne i kontrolne skupine u varijablama iz prostora snage, i to: u troskoku iz mjesta, dubokom čučnju za 30 sekundi i podizanju trupa za 30 sekundi na razini značajnosti $p<0,001$, kao i skoku udalj iz mjesta ($p<0,01$). Osim toga, zamjećuje se da je eksperimentalna skupina na finalnom mjerenju na razini značajnosti $p<0,001$ postigla statistički značajno bolje rezultate u sve tri varijable iz prostora opće koordinacije: osmici sa saginjanjem, koracima u stranu i okretnosti na tlu, kao i varijablama iz prostora koordinacije u ritmu: neritmičkom bubnjanju, bubnjanju nogama i rukama, i poskocima u ritmu. Rezultati ANOVA 2x2 prikazani u tablici 1, ukazuju na to da je eksperimentalna nastava step aerobika utjecala tako da eksperimentalna skupina, u odnosu na kontrolnu, na finalnom mjerenju ima statistički značajno bolje rezultate

($p<0,001$) u varijablama iz prostora frekvencije pokreta: tapingu nogom, tapingu rukom i skipingu, kao i varijablama iz prostora pokretljivosti: pretklonu na klupici i iskretu palicom. Statistički značajna razlika na finalnom mjerenju jedino nije zamijećena u jednoj varijabli iz prostora snage, i to izdržaju u zgibu.

U tablici 2 prikazani su deskriptivni statistički pokazatelji eksperimentalne i kontrolne skupine na inicijalnom i finalnom mjerenju, kao i rezultatiti ANOVA 2x2 kardiorespiratornih funkcija.

Tablica 2

Na temelju rezultata ANOVA 2x2 zamjećuje se da je nakon osam tjedana primjene eksperimentalnog programa step aerobika došlo do statistički značajnih razlika ($p<0,001$) između eksperimentalne i kontrolne skupine u promatranim varijablama kardiorespiratornih funkcija. Dobiveni rezultati ukazuju na to da je eksperimentalna skupina na finalnom mjerenju postigla statistički bolje rezultate u odnosu na kontrolnu.

Rasprava

Primjena inovativnog programskog sadržaja u nastavi tjelesne i zdravstvene kulture u trajanju od osam tjedana utjecala je na značajne i pozitivne promjene u prostoru motoričkih sposobnosti i kardiorespiratornih funkcija učenica osnovne škole. S obzirom na to da sate aerobnog vježbanja uz glazbu karakterizira izvođenje pokreta i kretanje cijeloga tijela uz određeni tempo glazbe uz umjeren i intenzivan rad, na kojima se posebna pozornost posvećuje intenzifikaciji i racionalizaciji programskih sadržaja, takvo značajno poboljšanje rezultata ima opravdanje, što je u skladu s istraživanjima iz toga područja (Mandarić i sur., 2011; Nikić i Milenković, 2013; Olvera i sur., 2010). Analiza dobivenih rezultata iz prostora motoričkih sposobnosti ukazuje na činjenicu da je dosljedno realiziran eksperimentalni postupak u nastavi tjelesne i zdravstvene kulture statistički značajno utjecao na poboljšanje razine praćenih varijabli iz tog prostora. Na temelju rezultata varijabli iz prostora snage može se reći da je eksperimentalni program utjecao na poboljšanje rezultata dinamičkog mišićnog potencijala donjih ekstremiteta i repetitivnog mišićnog potencijala. Dobiveni rezultati iz prostora dinamičkog mišićnog potencijala donjih ekstremiteta usklađeni su s rezultatima istraživanja čiji je predmet bila učinkovitost primjene step aerobika na mišićnu snagu donjih ekstremiteta (Hallage i sur., 2010), ali i rezultata istraživanja dobivenih primjenom aerobnog plesa na repetitivnu i eksplozivnu snagu (Viskić-Štalec i sur., 2007). Međutim, usporedbom odnosa eksperimentalnog postupka i nastave tjelesne i zdravstvene kulture i njihova utjecaja na varijable iz prostora snage, zamjetno je da ne postoji statistički značajna razlika u rezultatima izdržaja u zgibu, odnosno da se primijenjen eksperimentalni postupak nije statistički značajno razlikovao u odnosu na klasičnu nastavu. Rezultati istraživanja iz prostora opće koordinacije i koordinacije u ritmu ukazuju da je eksperimentalni program step aerobika statistički značajno utjecao na sve ispitane varijable. S obzirom na to da aerobno vježbanje uz glazbu karakterizira izvođenje pokreta i kretanje cijelog tijela u tempu i ritmu glazbe, poboljšanje rezultata iz prostora koordinacije ima opravdanje.

Naime, poboljšanje rezultata u prostoru koordinacije kod eksperimentalne skupine rezultat je primjene koraka u točno definiranom ritmu, sastavljenih u koreografije, uz istodobno naizmjenično penjanje i silaženje na steper i sa stepera, kao i izvođenja kretnih struktura, kako nogama tako i rukama u različitim ravninama. Osim toga te su se kretne strukture u svakom trenutku izvodile uz posebno odabranu glazbenu pratnju, koja je definirala tempo i ritam vježbanja. U istraživanjima koja su proučavala utjecaj aerobnog vježbanja uz glazbu na koordinaciju (Mandarić i sur., 2011; Viskić-Štalec i sur., 2007) navodi se da se aerobnim vježbanjem uz glazbu razvijaju gotovo sve vrste koordinacije, što je u skladu s dobivenim rezultatima.

Dobiveni rezultati iz prostora frekvencije pokreta ukazuju na to da je aerobno vježbanje uz glazbu statistički značajno utjecalo na poboljšanje frekvencije pokreta donjih i gornjih ekstremiteta, što se može opravdati izvođenjem pokreta u tempu glazbe od 132 do 136 bita u glavnom dijelu sata. Rezultati iz prostora frekvencije pokreta eksperimentalne skupine u skladu su s rezultatima koordinacije u ritmu (Mandarić i sur., 2011). Analizom rezultata iz prostora pokretljivosti može se zaključiti da su dosljedno realizirane vježbe rastezanja, koje su se provodile u završnom dijelu sata, statistički značajno utjecale na poboljšanje rezultata varijabli iz tog prostora (Nikić i Milenković, 2013; Stojanović-Tošić i sur., 2011).

Rezultati istraživanja iz prostora kardiorespiratornih funkcija ukazuju na to da je eksperimentalni program statistički značajno utjecao na smanjenje frekvencije srca u mirovanju i pri opterećenju, kao i na povećanje maksimalne potrošnje kisika. Dobiveni rezultati istraživanja nalaze se u okvirima rezultata u kojima se došlo do zaključka da step aerobik najviše utječe na kardiovaskularni fitness i maksimalnu potrošnju kisika (Drobnik-Kozakiewicz i sur., 2013; Ossanloo i sur., 2012). Osim navedenog, s obzirom na to da se step aerobik ubraja u umjerene do intenzivne aktivnosti (Olvera i sur., 2010), kao i da visina klupice utječe na povećanje frekvencije bila u opterećenju i intenzitet vježbanja (Bryukhanova i sur., 2013), dobiveni rezultati imaju opravdanje. Također, proučavajući odnos između step aerobika (Brick, 1996; Pillarella i Roberts, 1996) i trčanja, vožnje bicikla, plivanja, pješačenja i dizanja utega, kao i njihov utjecaj na odabrane morfološke karakteristike, motoričke sposobnosti i kardiovaskularni fitness populacije rekreativaca, autori dolaze do zaključka da step aerobik ima najveći utjecaj na poboljšanje kardiovaskularne izdržljivosti. Usporedbom klasične nastave tjelesne i zdravstvene kulture i eksperimentalnog inovativnog programskog sadržaja, kao i njihova utjecaja na maksimalnu potrošnju kisika, uočava se da su učenice kontrolne skupine postizale slabije rezultate u odnosu na učenice eksperimentalne skupine, odnosno da je aerobno vježbanje uz glazbu tri puta tjedno u trajanju od jednog školskog sata poboljšalo rezultate maksimalne potrošnje kisika. U prilog dobivenim rezultatima su i preporuke Američkog koledža za sportsku medicinu (The American College of Sports Medicine) iz 2011. da vježbanje koje se provodi od 20 do 60 minuta u aerobnom režimu, tri do pet puta tjedno, utječe na poboljšanje kardiorespiratorne izdržljivosti, odnosno ima pozitivan utjecaj na kardiovaskularni sustav. U skladu s navedenim može se reći

da posebno programirana nastava aerobnog vježbanja, kao što je nastava step aerobika, u okviru koje se intenzitet opterećenja regulira brzinom izvođenja pokreta, ritmom vježbanja i brojem ponavljanja, predstavlja pogodno sredstvo za intenzifikaciju nastave tjelesne i zdravstvene kulture, smanjenje neaktivnog vremena uz istodobno postizanje optimalnog opterećenja organizma svake učenice.

Navedeni rezultati istraživanja ukazuju na to da je primijenjeni inovativni programski sadržaj uz glazbu imao pozitivan utjecaja na istraživani prostor i da se njegovom primjenom mogu zadovoljiti i ostvariti zadaci nastave tjelesne i zdravstvene kulture. Spomenuti rezultati ne umanjuju značaj i utjecaj propisanih programskih sadržaja tjelesne i zdravstvene kulture, već ukazuju na opravdanost primjene novih, suvremenijih programskih sadržaja i organizacijskih oblika rada u okviru nastave tjelesne i zdravstvene kulture. Naime, organizacijski oblici rada koji su karakteristični za ovaj programski sadržaj, a za koji nije karakteristično nadmetanje, već samosvjesno i samostalno vježbanje, mogu osigurati poboljšanje fizičkog samopoštovanja (Burgess i sur., 2006) i potaknuti učenike na aktivan život i vježbanje i izvan školskog sustava (Corbin, 2002).

Zaključak

Imajući u vidu činjenicu da sati tjelesne i zdravstvene kulture u školama predstavljaju najdostupniji način promicanja tjelesne aktivnosti među današnjom školskom populacijom, nameće se potreba prilagodbe nastavnih sadržaja suvremenim tendencijama društva. U skladu s tim inovativni programski sadržaji trebaju potaknuti učenike na cjeloživotnu tjelesnu aktivnost, zatim pozitivno utjecati na njihovo zdravstveno stanje, kao i osigurati optimalnu intenzifikaciju i racionalizaciju nastavnog procesa. Na temelju tih spoznaja sastavljen je program nastave step aerobika, koji je primijenjen na satima tjelesne i zdravstvene kulture učenica sedmih razreda.

Nakon osam tjedana eksperimentalne programirane nastave step aerobika, zaključak je da je primjenom navedenog programa u nastavi tjelesne i zdravstvene kulture kod učenica došlo do poboljšanja motoričkih sposobnosti i kardiorespiratornih funkcija. S tim u vezi, uz obavezne ograde da se ne pogriješi u zaključivanju, može se reći da je takav inovativni model vježbanja u nastavi tjelesne i zdravstvene kulture, u odnosu na klasičnu nastavu, dao bolje rezultate u transformaciji i razvoju psihofizičkih sposobnosti učenica, potaknuo njihovu motiviranost i angažiranost na satu. Ujedno, rezultati istraživanja upućuju na činjenicu da je primjenom takvih nastavnih sadržaja moguća veća optimalizacija, racionalizacija i intenzifikacija nastavnog procesa u smislu operativne efikasnosti rješavanja zadataka nastave tjelesne i zdravstvene kulture. Primjenom suvremenih organizacijskih oblika sata kao što je step aerobik, sat može biti veza sa svakodnevnim životom i interesima učenika, povećavajući njihovu motivaciju za primjenu naučenog u školi tijekom slobodnog vremena, izvanškolskih aktivnosti, kao i nakon školovanja kao dio cjeloživotne tjelesne aktivnosti čime može pridonijeti njihovoj cjeloživotnoj formi.