

Effect of Technology Based Programme “Brain Breaks” on the Pupils’ Attitudes towards Physical Activity in Secondary Schools

**Lubor Tománek^{1*}, Iveta Cihová¹, Gabriela Luptáková¹, Branislav Antala¹,
Ming-kai Chin² and Peter Šagát³**

¹*Faculty of Physical Education and Sports, Comenius University in Bratislava,
81469 Bratislava, Slovakia*

²*HOPSports Inc., 4262 Blue Diamond Road #102-359, Las Vegas, NV 89139, USA*

³*Physical Education, Health and Recreation Department Prince, Sultan University, 11586 Riyadh,
Kingdom of Saudi Arabia*

ABSTRACT

This study examines effects of the technology-based physical activity intervention program on the attitudes of secondary school pupils towards physical activity. A total of 229 Grade 6 pupils participated in the study. The experimental group completed a 3-month intervention of a 3-5 min physical activity break during a random lesson every school day. A standardized questionnaire (51 items) was used to collect the data on a cognitive, affective and behavioral component of pupils’ attitudes before and after the intervention. The control group only filled in the survey without taking part in the physical activity program. A paired samples t-test was applied to identify the differences between the pre-test and post-test data. The

One-way ANOVA was used to compare two independent samples, differences between the experimental and the control group. As a result, significant differences between the pre-test and post-test were found in overall attitudes of the experimental group in both boys ($p = 0.025$) and girls ($p = 0.039$), and additionally, in the affective component in boys ($p = 0.009$) and girls ($p = 0.002$). Moreover, significant differences between the experimental and the control group were found in pupils’ overall attitudes (boys $p = 0.002$; girls $p = 0.007$), in the affective

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E-mail addresses

lubor.tomanek@uniba.sk (Lubor Tománek)

iveta.cihova@uniba.sk (Iveta Cihová)

gabriela.luptakova@uniba.sk (Gabriela Luptáková)

branislav.antala@uniba.sk (Branislav Antala)

chinmingkai@yahoo.com (Ming-kai Chin)

sagat@seznam.cz (Peter Šagát)

*Corresponding author

component in boys ($p < 0.001$), and in the affective ($p = 0.003$) and behavioral ($p = 0.024$) component in girls. To conclude, such intervention programs may serve as a valuable tool to enhance pupils' attitudes towards physical activity which may lead to their greater active participation in physical activity, and consequently, an improved overall health.

Keywords: Attitudes, physical activity, pupils, secondary schools, technology based programme "Brain Breaks", video-exercise

INTRODUCTION

New technologies affect different areas of life of a current modern civilization. Their influence can often be perceived as positive (Bendikova, 2014; Fox, 1999). However, in case of their impact on an increase or a decrease of physical activity of children and youth the perceptions are rather negative (Lakdawalla & Philipson, 2009; Subrahmanyam et al., 2000). The causes of a decrease in a physical activity volume are associated with the environmental factors, increasing number of school subjects as well as a number of academic lessons per week, increasing number of hours devoted to homeworks, frequent health problems and exemptions from Physical education (PE). The children spend significant amount of time being sedentary, e.g. studying, watching TV, sitting at the computer, tablet or smartphone what reduces possibilities to be physically active (Cooper et al., 2015; European Commission, 2018; Inchley et

al., 2017; Janssen et al., 2004; Seman, 2009). The national education programs often support time allocation for academic subjects to the exclusion of PE. Similarly, to many other European countries, in Slovakia the number of PE classes is limited to two a week. Since the children and youth spend majority of the day in school, the school environment is ideal for introducing programs that will change the trend of physical inactivity among them.

Data suggest the importance of finding new ways of promotion and encouragement of regular physical activity and its integration during the school day. Classroom-based physical activity is a promising way of encouraging in-school physical activity of pupils (Rasberry et al., 2011). It was confirmed positive effect of classroom-based physical activity interventions on academic and physical activity outcomes (Fedewa & Ahn, 2011; Watson et al., 2017). Implemented classroom physical activity breaks improved student physical activity during school and behavior in the classroom (Carlson et al., 2015).

Due to an excessive interest of current young generation in information and communication technologies, their integration into physical activity seems like a promising way how to motivate pupils to get involved. Short, classroom- and technology-based physical activities may be applied both in a recess and in the academic lessons (Cloes & Mornard, 2014; Podnar & Novak, 2015; Tumynaitė et al., 2014). Applied Brain Break® video exercises as an interventional program can have

positive effects on interest and motivation for physical activity among schoolchildren and the contribution of such activities on learning for health and holistic development (HOPSports® Inc., 2017b; Popeska et al., 2018; Uzunos et al., 2017). We assume that this may be one of the ways to form pupils' interest in and attitudes towards physical activity which may lead to their spontaneous engagement into physical activity in their leisure time.

Boroš (2001) defined attitudes as a relatively permanent characteristics of individuals who expressed their opinion (positive or negative) to a certain area of reality and they reflected not only the basic cognitive orientation, but also the value system of a man and his effort orientation. This means that we take an attitude towards all things, actions, people and ourselves. In this sense, the attitudes are a factor that strongly influences the behavior of an individual.

Large number of authors (e.g. Boroš, 2001; Rosenberg & Hovland, 1960) follow the understanding of the 3-component structure of the attitude – cognitive, affective and behavioral. The cognitive component is connected to the rational evaluation of the subject of the attitude. Most frequently this component is created through the taking-over of the opinions of other people. The affective (emotive / emotional) component reflects the emotional relation to the subject of the attitude, and it is more frequently created by the personal experience with the subject of the attitude. Thirdly, the behavioral component is demonstrated in the tendency to act, react in a certain manner to the subject

of the attitude within the meaning. This component of the attitude results from the two previous ones (Nakonečný, 2009).

The aim of our research was to examine the efficiency of three-month multimedia-based physical activity program on the attitudes of 10- to 12- years old pupils from secondary schools. We assumed that intervention of a three-five minutes physical activity breaks during academic lessons daily would have a positive impact on pupils' attitudes towards physical activity, both in boys and girls.

METHODS

A pedagogical experiment was applied as research method. A total of 229 pupils (115 boys, 114 girls) from 6 schools in Bratislava participated in the study. The participants were Grade 6 secondary school students of the average age 11.18 ± 0.77 years. The experimental group consisted of 58 girls (EG-G) and 65 boys (EG-B), and the control group comprised 56 girls (CG-G) and 50 boys (CG-B). The characteristics of the study sample is shown in Table 1. There were no significant differences in somatic parameters found between the experimental and the control group, both in boys and girls.

Before and after the intervention, the experimental and the control group were asked to fill in the standardized questionnaire oriented to the attitudes of the secondary school pupils towards physical activity (Sivák et al., 2000). This questionnaire was accredited and recommended by Ministry of Education of The Slovak Republic since 2000 and it has

Table 1

Selected characteristics of study sample

	Experimental group		Control group	
	Girls	Boys	Girls	Boys
Number	58	65	56	50
Age (years)	11.26 ± 0.71	11.17 ± 0.76	11.05 ± 0.75	11.24 ± 0.87
Body height [cm]	154.60 ± 9.28	154.48 ± 7.89	155.54 ± 7.87	156.50 ± 7.74
Body weight [kg]	40.24 ± 7.26	43.52 ± 7.92	40.09 ± 7.00	43.66 ± 7.77

Notes: The values are in format $M \pm SD$.

been repeatedly used in different national surveys of the Slovak population (Balgá & Antala, 2015; Bartík, 2005; Görner & Starší, 2001; Mesiarik et al., 2012). The questionnaire consisted of 51 items with a focus on three components of the attitude – cognitive, affective and behavioural (Validity = 0.72, Reliability=0.81). Each component was investigated by 17 questions and consequently awarded by two points (max. 102). The experiment was conducted from March – May in the school year 2016/2017. The distribution of the questionnaire was implemented after an approval of and an agreement with the school directors in cooperation with the class teachers.

During the intervention period, in the experimental groups the class teachers conducted a three-five minutes classroom-based physical activity on a daily basis. It was conducted at any time during a 45-minute academic lesson with the help of video animations. In reality, this intervention plan was accomplished at 70% (48 times, 240 minutes). The pupils stood up next to their work place and imitated video animations projected to the board. The remaining time of the academic lesson in

the experimental classes, and the entire academic lesson in the control classes, was conducted according to the curriculum of the appropriate subject.

The video-clips were created by volunteers from different countries all over the world and processed by HOPSports® Inc. within an international project “On-Line-Streaming Brain Breaks” (OLSBB). HOPSports® Inc. (2017a, 2017b) developed an innovative physical activity program for schools which provides teachers with a tool for encouraging learning and an active participation of the pupils in the class through integration of physical activity and subject content. It enables teachers to physically engage pupils in a simple and fun way during the school day with a dynamic activity and potentially improve pupils’ health, motivation, memory, on-task behavior and academic achievement.

The research was accredited by Ethic commission of Faculty of Physical Education and Sport, Comenius University in Bratislava on September 9th, 2016 with number 05/2016.

Before the experiment, classroom teachers attended a training session. They were informed about the organization

and conduct of a Brain Break classroom-based physical activity. The teachers were provided with a username and password for accessing the video animations and were given an instruction sheet with simple guidelines.

The IBM SPSS Statistics 23 was used to process the data. Selected quantitative parameters were characterised by an arithmetic mean (M) and a standard deviation (SD). Kolmogorov-Smirnov test was used to determine whether sample data are normally distributed. A paired samples t -test was applied to identify the differences between the pre-test and post-test data. The One-way ANOVA was used to compare two independent samples, differences between the experimental and the control group. We used an alpha level of 0.05 for all statistical tests. Cohen's d and Hedges' g was used to determine the effect size.

RESULTS

Data evaluation enabled us to obtain the results for a comparison of the significance of differences in the score mean values in the individual components of pupils' attitudes to physical activity at the beginning (pre-test) and at the end (post-test) of the intervention period.

Results – Boys

When comparing pre-test score in boys, no significant differences were found between the experimental and the control group. Although the overall score of the experimental group ($M = 73.52$, $SD = 14.89$) was slightly higher than the score of the

control group ($M = 70.36$, $SD = 16.75$), this 4.30% difference was not statistically significant, $F(1, 113) = 1.14$, $p = 0.287$.

Similarly, the pre-test data did not show any significant differences in the attitude's individual components (cognitive, affective and behavioral) between the experimental and the control group in boys (Table 2). The biggest difference – 2.02 points (8.04%) was found in the behavioral component of an attitude. On the contrary, the smallest difference, only 1.82% (0.44 point), was found in the attitude's cognitive component.

It follows that at the beginning of the experiment the boys' attitudes of the experimental and the control group towards physical activity were even.

With respect to boys' attitudes after the intervention, the post-test data showed significant differences in overall score between the experimental ($M = 76.45$, $SD = 13.24$) and the control ($M = 65.96$, $SD = 15.51$) group, $F(1, 113) = 15.26$, $p < 0.001$. The experimental group achieved higher score by 10.49 points (13.72%) compared to the control group ($g = 0.74$, medium effect).

Similarly, the differences between the experimental and the control group of boys were significant in the attitude's affective ($F(1, 113) = 19.42$, $p < 0.001$) and behavioural ($F(1, 113) = 13.23$, $p < 0.001$) component (Table 2). The experimental group achieved higher score than the control group in the affective component by 19.98% (5.26 points) what was considered difference of large effect ($g = 0.83$). In addition, in the behavioral component

Table 2

Significance of differences in score mean values of attitude's individual components to physical activity in boys

Score of attitude's components in boys									
	Cognitive			Affective			Behavioral		
	Pre-test	Post-test	Difference	Pre-test	Post-test	Difference	Pre-test	Post-test	Difference
Experimental group - boys (n = 65)									
M	23.72	24.31	0.59	24.68	26.32	1.64	25.12	25.82	0.70
SD	4.72	4.34	4.23	6.91	5.99	4.90	5.91	5.33	5.10
	$t(64) = 1.12$ $p = 0.269$ $d = 0.13$			$t(64) = 2.71$ $p = \mathbf{0.009}$ $d = 0.25$			$t(64) = 1.10$ $p = 0.277$ $d = 0.12$		
Control group - boys (n = 50)									
M	24.16	22.88	- 1.28	23.10	21.06	- 2.04	23.10	22.00	- 1.10
SD	4.71	5.22	5.80	7.68	6.79	5.09	6.70	5.89	5.68
	$t(49) = 1.56$ $p = 0.125$ $d = 0.26$			$t(49) = 2.83$ $p = \mathbf{0.007}$ $d = 0.28$			$t(49) = 1.37$ $p = 0.177$ $d = 0.17$		
Experimental group to control group comparison									
$F(1, 113)$	0.24	2.56	3.67	1.34	19.42	15.46	2.94	13.23	3.16
p	0.623	0.112	0.059	0.250	$< \mathbf{0.001}$	$< \mathbf{0.001}$	0.089	$< \mathbf{0.001}$	0.078
g	0.09	0.30	0.38	0.22	0.83	0.74	0.32	0.68	0.34

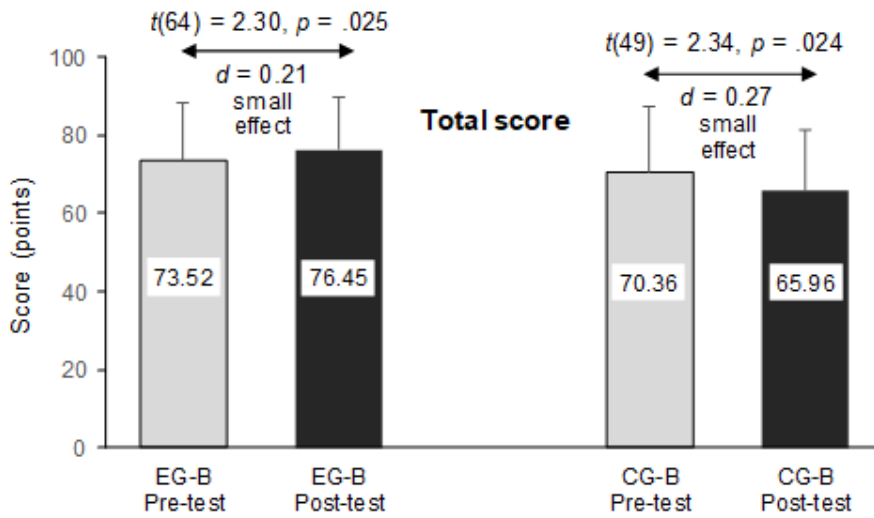
Notes: M – arithmetic mean; SD – standard deviation; p – level of statistical significance; t – paired samples t -test; F – One way ANOVA; d – Cohen's d ; g – Hedges' g

the experimental group achieved higher score by 14.80% (3.82 points) what was a difference of medium effect ($g = 0.68$). On the contrary, although the experimental group achieved higher score also in the cognitive component, the 5.88% difference between the groups was not significant, $F(1, 113) = 2.56$, $p = 0.112$.

A comparison of the pre-test and post-test data in the experimental group of boys shows a significant increase in the overall score, $t(64) = 2.30$, $p = 0.025$ as well as in the affective component of the

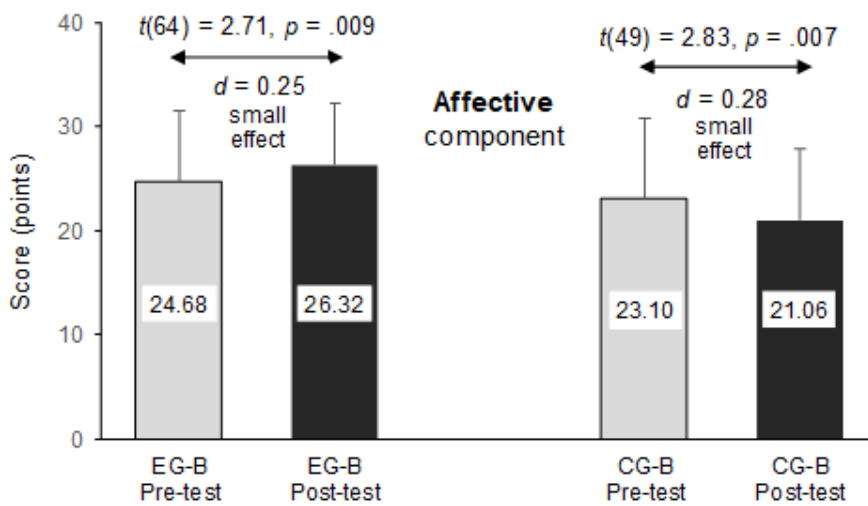
attitude, $t(64) = 2.71$, $p = 0.009$. Due to the intervention program the experimental group's overall score increased by 3.99% ($d = 0.21$, small effect), (Figure 1). During the intervention period the score of all 3 attitude's components increased, however the difference was significant only in the affective one. During the intervention period the score increased by 6.65% ($d = 0.25$, small effect), (Figure 2).

In the control group of boys the comparison between pre-test and post-test data shows that all four measured parameters



Notes: EG-B – experimental group of boys; CG-B – control group of boys

Figure 1. Differences in the overall score of attitudes to physical activity between pre-test and post-test data in experimental and control group of boys



Notes: EG-B – experimental group of boys; CG-B – control group of boys

Figure 2. Differences in the affective component of attitude to physical activity between pre-test and post-test data in experimental and control group of boys

decreased throughout the intervention period (Table 2). The boys achieved a significant decrease in the attitude's affective component by 8.83% ($p = 0.007$, $d = 0.28$, small effect), (Table 2, Figure 2), as well as in the overall score (pre-test $M = 70.36$, $SD = 16.75$; post-test $M = 65.96$, $SD = 15.51$) of the attitudes towards physical activity ($p = 0.024$, $d = 0.27$, small effect), (Figure 1).

Most importantly, the comparison of changes in the experimental and the control group shows significant differences in overall score (experimental group $M = 2.92$, $SD = 10.27$; control group $M = -4.40$, $SD = 13.31$), $F(1, 113) = 10.38$, $p = 0.002$, $g = 0.63$ (medium effect) and the attitude's affective component to physical activity ($p < 0.001$, $g = 0.74$, medium effect), (Table 2).

In conclusion, the 3-month Brain Break intervention program had a positive impact

on the boys' overall attitudes towards physical activity, affective component of the attitude in particular.

Results – Girls

A comparison of pre-test data prior to intervention did not show any significant differences in the attitudes towards physical activity between the experimental and the control group of girls. Although not significant, the control group ($M = 74.75$, $SD = 16.72$) achieved higher overall score of the attitudes by 5.85% (4.37 points) compared to the experimental group ($M = 70.38$, $SD = 15.63$), $F(1, 112) = 2.08$, $p = 0.152$, including all 3 attitude's components, the affective one in particular (9.96% difference). Similarly, a comparison of the post-test data did not show any differences of statistical significance in the attitudes between the experimental and the control group of girls (Table 3).

Table 3

Significance of differences in score mean values of attitude's individual components to physical activity in girls

Score of attitude's components in girls									
Cognitive			Affective			Behavioral			
	Pre-test	Post-test	Difference	Pre-test	Post-test	Difference	Pre-test	Post-test	Difference
Experimental group - girls (n = 58)									
M	23.64	23.83	0.19	22.43	24.48	2.05	24.31	24.95	0.64
SD	5.10	5.31	4.52	6.89	7.12	4.73	6.31	6.82	5.08
	$t(57) = 0.32$			$t(57) = 3.31$			$t(57) = 0.96$		
	$p = 0.750$			$p = 0.002$			$p = 0.343$		
	$d = 0.04$			$d = 0.29$			$d = 0.10$		
Control group - girls (n = 56)									
M	24.52	23.95	- 0.57	24.91	23.88	- 1.03	25.32	23.89	- 1.43

Table 3 (Continued)

Score of attitude's components in girls									
	Cognitive			Affective			Behavioral		
	Pre-test	Post-test	Difference	Pre-test	Post-test	Difference	Pre-test	Post-test	Difference
Control group - girls (n = 56)									
<i>SD</i>	5.04	5.66	5.34	6.81	7.13	5.97	6.29	5.61	4.57
	$t(55) = 0.80$			$t(55) = 1.30$			$t(55) = 2.34$		
	$p = 0.426$			$p = 0.199$			$p = 0.023$		
	$d = 0.11$			$d = 0.15$			$d = 0.24$		
Experimental group to control group comparison									
<i>F</i> (1,112)	0.86	0.01	0.68	3.74	0.21	9.42	0.73	0.81	5.20
<i>p</i>	0.357	0.908	0.412	0.056	0.650	0.003	0.393	0.370	0.024
<i>g</i>	0.17	0.02	0.15	0.36	0.08	0.57	0.16	0.17	0.43

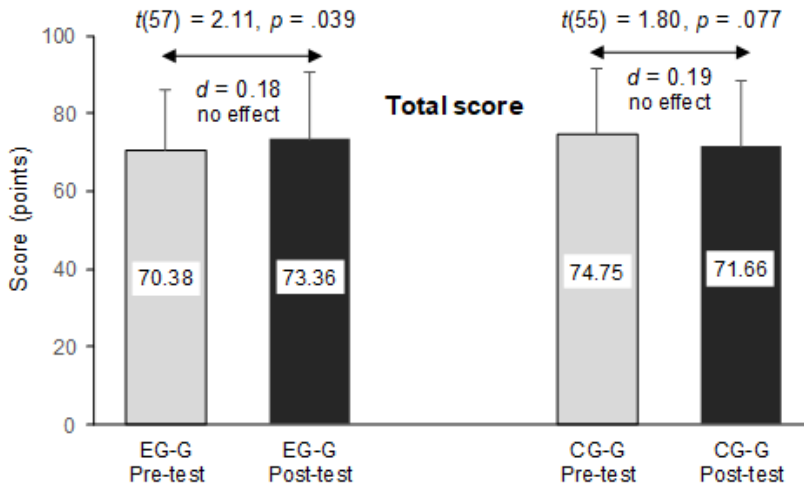
Notes: *M* – arithmetic mean; *SD* – standard deviation; *p* – level of statistical significance; *t* – paired samples t-test; *F* – One way ANOVA; *d* – Cohen's *d*; *g* – Hedges' *g*

Similarly, to boys, in the experimental group of girls the classroom-based physical activity program contributed to a significant increase in overall score of the attitude and its affective component towards physical activity. The overall score (pre-test $M = 70.38$, $SD = 15.63$; post-test $M = 73.36$, $SD = 17.08$) increased by 4.23%, $t(57) = 2.11$, $p = 0.039$ (Figure 3). The attitude's affective component increased by 9.14% ($p = 0.002$, $d = 0.29$, small effect), (Figure 4). The control group of girls achieved a significant decrease in the attitude's behavioral component ($p = 0.023$, $d = 0.24$, small effect), (Table 3). The other two components as well as the overall score decreased as well but the difference was not significant (Table 3, Figure 3).

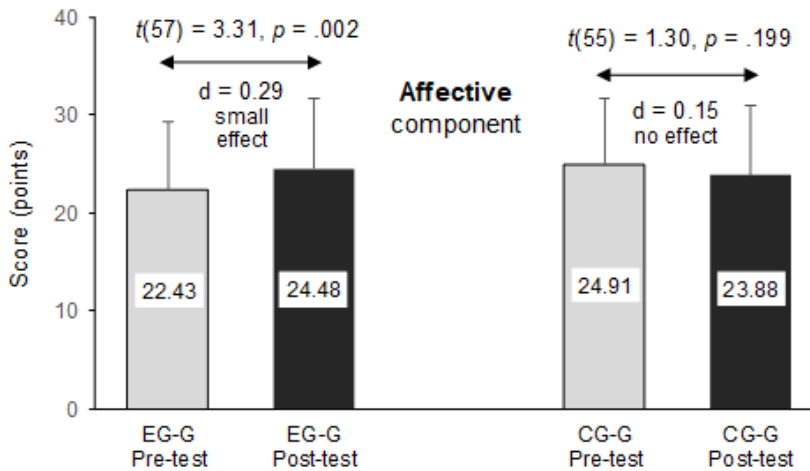
A comparison of the experimental and the control group's changes in attitudes towards

physical activity confirmed the efficiency of the classroom-based physical activity program in girls (Table 3). The experimental group's increase ($M = 2.98$, $SD = 10.75$) was significantly greater compared to the control group ($M = -3.09$, $SD = 12.82$) in the overall score, $F(1, 112) = 7.52$, $p = 0.007$, $g = 0.51$ (medium effect). Furthermore, the experimental group's increase was greater in the behavioral component ($p = 0.024$, $g = 0.43$, small effect) and in the affective component of the attitude in particular ($p = 0.003$, $g = 0.57$, medium effect), (Table 3).

To conclude, similar to boys, the Brain Break intervention program in a duration of three months positively influenced girls' attitudes towards physical activity in general, particularly the affective component of the attitudes.



Notes: EG-G – experimental group of girls, CG-G – control group of girls
 Figure 3. Differences in the overall score of attitudes to physical activity between pre-test and post-test data in experimental and control group of girls



Notes: EG-G – experimental group of girls, CG-G – control group of girls
 Figure 4. Differences in the affective component of attitude to physical activity between pre-test and post-test data in experimental and control group of girls

DISCUSSIONS

Over recent decades, a steadily growing body of literature has indicated the need to examine the positive effects of incorporating classroom-based physical activity among

pupils and educators (Podnar, 2015). Several studies carried out in different parts of Slovakia refer to pupils' attitudes towards physical activity in general. A majority of such papers are focused on

the attitudes towards physical education as a school subject, however without a prior intervention. Based on the results, students' attitudes towards physical education are rather positive (Balga & Antala, 2015; Bartík, 2005; Görner & Starší, 2001). In this context we can compare our findings with the abovementioned studies only to a certain extent. The standardized questionnaire (Sivák et al., 2000) that was used to collect the data is a common tool to examine pupils' attitudes in Slovak and Czech environment, and our pre-test data show similar attitudes of pupils to other studies of this kind. The affective component of the attitude is the one that was positively affected by our intervention program the most. One of the hypothetical reasons might reside in the Brain Break program's relaxing effects.

A number of intervention studies with application of HOPSports Brain Break program focus on pupils' attitudes to different parameters of physical activity in the foreign countries (Glapa et al., 2018; Podnar, 2015; Podnar & Novak, 2015; Tumynaitė et al., 2014), where the results demonstrate positive impact of the program on the attitudes and other selected parameters. The QPA questionnaire (Mok et al., 2015; Uzunož et al., 2017) was used to collect the information on attitudes and other standards from the pupils and pedagogues. An appropriate translation procedure and its verification is a necessary condition for the application of such tool of investigation (Hulka et al., 2014).

CONCLUSIONS

The results of our study advert to the efficiency of a classroom- and technology-based physical activity program on secondary school boys' and girls' attitudes towards physical activity. The experimental group took part in the intervention program daily for three months while the control group did not. Both groups filled in a standardized questionnaire on attitudes and its three components (cognitive, affective, behavioral) to physical activity.

In case of the boys' overall attitudes after the intervention (post-test), the results showed significantly more positive attitudes of the experimental group ($M = 76.45$, $SD = 13.24$) in comparison to the control group ($M = 65.96$, $SD = 15.51$) by 13.72%, $F(1, 113) = 15.26$, $p < 0.001$, $g = 0.74$ (medium effect). Additionally, the difference was significant in favour of experimental group in the behavioral component of the attitude ($p < 0.001$, $g = 0.68$, medium effect) and particularly in the affective component with a large 19.98% difference ($p < 0.001$, $g = 0.83$, large effect).

The girls' attitudes towards physical activity after the intervention were similar to the boys' ones. Furthermore, the differences between the data collected before (pre-test) and after (post-test) the intervention were compared among the groups of girls. The experimental group's increase in the score was significantly greater compared to the control group in three cases: firstly, the overall score of the attitudes ($p = 0.007$, $g = 0.51$, medium effect), secondly, the behavioral component of the attitudes

($p = 0.024$, $g = 0.43$, small effect) and thirdly the affective component ($p = 0.003$, $g = 0.57$, medium effect).

Our results confirmed the hypothesis that short, technology- and classroom-based physical activities during academic lessons may positively affect pupils' attitudes towards physical activity in general. These findings support other studies in this area and contribute to the enrichment of sport science with a special focus on physical activity programs in school settings, physical activity and new technologies, new technologies in teaching profession and teacher training.

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