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Original Article

Impact of selected motion programs on swimming capacity and motoric performance of 7 - 8 year children in Slovakia

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Abstract
In the study we present the results of the impact of selected movement programs aimed at increasing the level of swimming ability and motor performance of children aged 7-8 years. 152 children were involved in the research and were divided into 2 groups. The experimental group completed an hour of swimming 1 time per week. The control group underwent various extracurricular physical activities once a week. Both groups had compulsory physical and sports education 2 times a week during the school year to the same extent.
The aim of the research was to broaden the knowledge about the impact of the movement program on the level of swimming ability and motor performance of 7–8 year old children. We conducted testing at the beginning and at the end of the research. Based on the results, we found a significant improvement in swimming capacity ($p < 0.001$). After completing the swimming movement program, each child swam at least 12 meters. In the output measurements of motor abilities, we recorded a statistically significantly higher level of balance abilities ($p < 0.01$). We assume that the improvement of the level of swimming and motor performance was influenced by properly and efficiently designed motion programs in water and dry.
Keywords: **swiming, motoric capacity**

Introduction

Movement in the aquatic environment is one of the favorite and at the same time effective motion activities at any age. The aquatic environment evokes emotions, spontaneous joy in children and a feeling of mental and psychological well-being from active movement in the elderly. Movement is characteristic of this age category. Motorically, the child gains confidence in basic locomotion movements. Uncoordinated movements gradually disappear. The period of younger school age is considered to be so-called. Golden Age of Motoring (Kasa, 2004).

Our pilot studies (Macejková - Benčuriková, 2007; Viczay - Kontra 2008, 2015; Macejková - Viczay, 2010; Viczay, 2011, Viczay et al., 2017) confirm the decreasing level of children's swimming performance in Slovakia. We assume that this phenomenon is closely related to the deteriorating conditions in teaching swimming in primary schools. The director decides on the organization or non-organization of swimming courses on the basis of the school's financial resources. Mostly the swimming course has to be paid for by children by their legal representative from their own funds, which is unfortunately quite problematic in many families. We can state that also for these reasons the swimming “literacy” of children in Slovakia is gradually decreasing.

In the context of the above, we have focused our 3-year research, which specifies the results to what extent the exercise program can affect the swimming ability and motor performance of 7 to 8 year old kids. We hypothesized that an appropriate exercise program with educators with years of experience could be a potential factor in motor development during the early school age. The content of the program took into account the somatic, functional, motor and psychological personalities of children.

Goal

To assess the impact of movement programs on the swimming and motor performance of 7 - 8 year old children in Slovakia.

Hypotheses

H1 We assume that the movement program will significantly increase the performance level of the experimental group.

H2 We assume that the effect of the motion program will significantly increase the level of motor performance in both groups.

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Tasks

U1 Determine level and differences of swimming performance in EG.
U2 Determine the level and differences of motor performance in both groups.
U3 Determine the impact of movement programs on swimming and motor performance.

Methods

Determination of the research situation

Research situation A shows cross-sectional input and output measurements over 3 school years. VA (S, P) t0 to t1→ VB (S, P) t0 to t1→ VC (S, P) t0 to t1. This model allowed us to find out the level of swimming (S1 - S4) and motor performance (P1 - P3) of subject (V152) in 7 - 8 years of age at t0 and t1.
Research situation B describes the division of the group into 2 groups. In our case, this is a parallel experiment that applies to the descriptive, differentiation, and exploring context of phenomena. The experiment was performed in two groups, one group being control (n 59) and the other experimental (n 93). (VKS) t0 → PΔ t1→ (VKS) t1 → (VES) t0 → PΔ t1→ (VES) t1. Comparison of changes in the condition of the person at the end of a parallel experiment determines the effectiveness of the experiment (Kampmiller et al., 2010). Furthermore, we pointed out the impact of the movement program on swimming and motor performance.

Research group Characteristics

The research presented in this study was conducted among pupils of the 2nd year of primary school in Bratislava in three consecutive school years 2013/14 (n 46), 2014/15 (n 52), 2015/16 (n 54). A total of 152 pupils from two parallel classes (2A, 2B) were involved in the research.
The study group was divided into two groups: the experimental group (n 93) and the control group (n 59). The experimental group (EG) consisted of pupils who completed an 18-hour swimming course with a frequency of one hour per week from October to March in each school year. The content of the lessons was focused on training of the basic swimming skills, breathing, diving, underwater orientation, floating on water, gliding, jumping in to the pool and backstroke swimming practice. The control group (CG) consisted of pupils of different physical activity on dry land exercise to the same extent as EG. In addition to these extracurricular activities, both groups also completed compulsory physical and sports education twice a week during the school year.

The content of the swimming movement program at EG was a simple, easy-to-understand and logically interconnected movement game in which pupils quickly adapted to the aquatic environment.
We have included movement games on the basis of literature according to the age-specific characteristics of children in accordance with the principle of progression (Arold, 1979; Kiricsi, 2002; Tóth, 2002; Benčuriková, 2011).

The content of the movement program in CG was focused on selected sports games (football, table tennis, basketball, floorball, dance) and movement skills training, which were focused on the development of motor skills (balance and strength). Table 1 shows the distribution of pupils by school year.
Table 1 Distribution of pupils by school years (n 152)

School year	**Experimental group (EG)**	**Control group (CG)**
2013/14	32	14
2014/15	30	22
2015/16	31	23
Sum	93	59

Methods of obtaining data

For diagnosis we used standardized tests accepted by experts (Kiricsi, 2002; Tóth, 2002; Moravec - Kampmiller - Sedláček, 2002; Macejková, 2007; Benčuriková, 2011) Swimming capability and motor performance in a relatively short period of time.

We tested the swimming performance at the beginning and at the end of the swimming course with 4 tests: [S1] immersion, [S2] floatingon the water, [S3] gliding and [S4] swimming 12 m distance with backstrokekicking. The degree of submerging indicates the previous experience of children with the aquatic environment.

Floating on the water indicates whether the child can assume a static horizontal position on the surface with the breath held for short amount of time. The gliding points to mastering the basic swimming position. We evaluated the distance in meters after the push from the wall of the pool. Swimming a certain distance shows the effectiveness of the content of the swimming course. We used the [S4] test only after completing the course because the probands did not manage it at the beginning. We had a 12 m x 25 m pool with a depth of 90 cm and a water temperature of 29 ° C.

Testing of selected coordination abilities was carried out by means of 3 modified motor tests (Moravec et al, 2002): By testing [P1] Sit-up we found dynamic abdominal muscles strength, [P2] Flamingo with open eyes we detected static and [P3] Walking test on a bench with 3 turns, we measured the children's dynamic balance skills. The importance of dynamic abdominal muscle strength and balance skills is seen in their use in swimming lessons.

Methods of data processing and evaluation

We used basic statistical characteristics to process and evaluate the results. To assess the differences between input and output measurements, we used the t-test of two relative values for the dependent selections. Pearson's correlation coefficient was used to investigate the relationships between variables. In interpreting the results we rely on graphical methods, logical analysis and synthesis methods using inductive and deductive methods.

Results and discussion

The results of the children's swimming skills are presented in Table 2 and Figure 1. In the S1 immersion test, we found that after completing the swimming program, the children adapted to the aquatic environment, which was reflected in the length of immersion. While on average children stayed below 7.9 s at the beginning, they improved by 4.7 s at the end. With the S2 floating test, we found out that the children stayed in a static position on the breasts with the breath held by an average of 4.5 seconds longer. Similarly, there was an improvement in test S3. Children were able to overcome a distance of 1.1 m longer than at the beginning of the program (Table 2).

Tab. 2 basic statistics (EG, n 93)

Test	Test	Average	Stdev	Min.	Max.
S1 [s] Diving	input	7,9	4,55	2,7	18,6
	output	12,6	4,17	3,7	21,7
S2 [s] Floating	input	7,0	3,18	1,7	15,7
	output	11,5	4,03	3,5	25,2
S3 (m) Gliding	input	3,3	0,93	1,8	6,3
	output	4,4	1,05	2,5	7,7

Fig. 1 shows the differences between the input and output measurements of swimming capacity. In all 3 tests we have seen positive changes after completing the swimming program. The level of basic swimming skills in the experimental group was significantly better after completing the swimming program ($p < 0.001$). Test S1 (t = -4.915 ***), Test S2 (t = -11.689 ***) and Test S3 (t = -12.255 ***). Every child passed Test S4. It crossed at least 12 meters of backstroke kicking. We can state that hypothesis 1 was confirmed. As a result of the movement program, the level of swimming capability of the experimental group increased significantly. We attribute the improvement to the content of the motion program. The results confirmed the fact that if adequate content and teaching methods were chosen, non-swimmers could manage swimming skills even in the relatively short time (18 hours) available (Figure 1).

Several authors (Arold, 1979; Benchurik, 2011; Viczay et al., 2017; Kiricsi, 2002; Macejk and Viczay, 2010; Toth, 2002 and others) consider that basic swimming skills should be given sufficient attention from the start of the training because they form the basis of future swimming technique. The acquisition of swimming skills affects the quality of swimming competence.

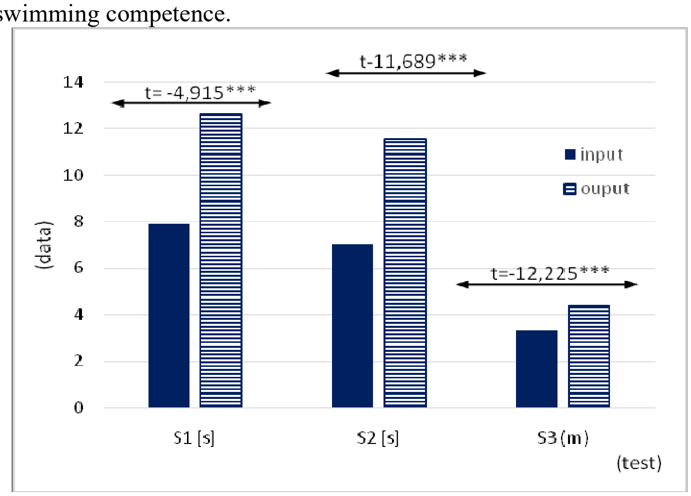

Figure 1 Changes in swimming skills level in selected swimming tests (EG, n 93)

In the second task we investigated the current state and changes of selected motor skills due to various out-of-school physical activities. The results of motor abilities are presented in Table 3. In the P1 Sit up test, we measured the level of dynamic abdominal strength.At the beginning of the study, we recorded an average performance of 14.2 cycles of valid repetitions in the experimental set (EG).After the movement program, the number of repetitions increased (19.3) by 5.1 attempts. The difference between input and output was significant at $p < 0.001$; $t = -13.512$ ***. Improvement also occurred in the control group (CG), but was 2.1 repeats lower than EG ($p < 0.001$; $t = -4.984$). Table 3 shows that the average performance of the control group pupils was higher at the start of the study (15.8) but lower than the EG (18.2) after completing the exercise program.It can be stated that although EG pupils who were less efficient at entry and gave better performance in the sit up test at the end of the study, the swimming movement program did not affect their level of dynamic abdominal strength.In an overall comparison with the reference study Moravec et al. (2002) the pupils of both groups ranked in the average band.Swimming locomotion is realized in a specific environment. The non-swimmer must adapt to the physical patterns of the aquatic environment and learn swimming movements. The swimming position is horizontal. The aquatic environment is mobile and constantly changing. A non-swimmer must learn to regulate his balance in a horizontal position.According to Zemkova (2003), the balance ability is the starting position for most physical activities for example: swimming, sledging, gymnastics. Regular, systematic training can significantly increase its level. Based on the above, we have deliberately included testing of balance abilities in the research. In the Flamingo P2 test, similar to the P1 test, we found statistically significant relationships between the input and output measurements in both groups in favor of the experimental group (EG $t = -6.160$ ***). The difference in average performance between groups in the outcome measurements in this test was statistically insignificant.We tested dynamic balance skills using the P3 Bench Walk test with 3 360 ° turns. The differences between input and output for both groups were minimal. CG was 0.6 seconds faster in P3 on average. Significant differences in mean performance after completion of the motion program favored the experimental set ($p < 0.05$; $t = -1.972$ *). In hypothesis 2 we assumed that after applying the motion program, the motor performance level in both groups would increase significantly. This hypothesis was confirmed for dynamic balance abilities at a significance level of $p < 0.05$ (Table 3).We realize that in addition to applied programs, the differences in the tests could also be due to the quality of higher nerve activity, which is closely related to the energy processes of the individual or the genetic limitation of the development of motor abilities. The variability of the data in individual tests is also confirmed by the conclusions of the research by Laczo et al. (2014). According to them, inheritance acts as a general factor on the level of motor abilities. Their development can be influenced not only by the targeted educational program but also by the environment and living conditions.

3 Changes in motor ability levels in the experimental and control groups

Test	Testing	Experimental group			Control group			t: entry, s ↔ ns
		Mean	Stdev	t-value	Mean	Stdev	t-value	t: exit, s ↔ ns
P1 Sit up test (n)	entry	14,2	3,75	-13,512***	15,8	4,22	-4,984 ***	-2,493*
	exit	19,3	4,12		18,2	4,63		1,449
P2 Flamingo test [s]	entry	50,1	32,59	-6,160***	48,4	36,29	-2,079*	-0,294
	exit	74,0	43,53		63,4	51,69		1,357
P3 Dynamics balance [s]	entry	14,9	2,90	3,925 ***	15,1	4,64	-0,661	-0,344
	exit	13,9	2,62		15,7	8,20		-1,972*

Conclusion

Based on the analysis of the results, we conclude that in addition to biological maturation and genetic predisposition, the content of movement programs had a positive effect on the level of swimming skills and development of motor skills of probands. The physical development of children in this age is progressing intensively, the period of younger school age is characterized as the "golden age of motoring" (Kasa, 2004). In this age period the highest gains in the development of fitness and coordination abilities are achieved.

In hypothesis 1, we assumed that the proposed content of the swimming movement program would significantly increase the level of swimming performance of the experimental group. The hypothesis was confirmed ($p < 0.001$). Improvement of the level of monitored skills is attributed to the content of the swimming movement program, which was compiled on the basis of many years of experience in teaching swimming courses. The results confirmed the fact that if adequate content and teaching methods were chosen, non-swimmers could manage swimming skills even in the relatively short time we had.

In hypothesis 2, we assumed that the effect of the motion program would significantly increase the level of motor performance in both groups. This hypothesis was confirmed in the case of dynamic balance abilities ($p < 0.05$). However, we noted significant changes ($p < 0.001$) in all motor tests (abdominal muscle strength, dynamic abilities) between input and output measurements in both groups.

Based on our many years of experience, we recommend to practice swimming training at primary school at least twice a week for a total of 20 lessons. The consolidation of swimming habits is a basic prerequisite for the protection of life when moving in the aquatic environment. Increased number of hours should ensure a higher swimming level of children in Slovakia. The problem is that the swimming course must be paid for by the pupil's legal representative from their own funds, which is unfortunately not possible in many families at present.

We also recommend increasing the number of hours of extracurricular physical activity. At present, adolescents are not very interested in sports and physical activities. Due to the environment in which they grows up, they favors more sedentary activities such as watching TV, playing games on computers, tablets and mobile phones. However, this is not only a problem for Slovak youth, but a global trend. It is generally known that physical activity is an effective means of primary and secondary prevention of civilization diseases. Lack of physical exercise not only affects the physical performance and health of children, but also affects the mental condition and educational abilities.

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