THE DEVELOPMENT OF COORDINATION ABILITIES IN SCHOOL PHYSICAL AND SPORTS EDUCATION AND IN SPORTS CLASSES

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Abstract:

The study addresses a topical issue, highlighting the effects of instruction in school physical and sports education in and in sports classes on the development of coordination abilities in 15-year-old students. We have extended knowledge about the level and development of coordination abilities of pubertal-age students. To assess the level of motor coordination, we administered the KTK test battery, which allows a complex assessment of the level of coordination abilities (dynamic balance, coupling ability, kinesthetic-differentiation ability, lower-body frequency ability, and complex body coordination). The tests of coordination abilities were performed by students from both standard classes and special sports classes. The results of the study showed that students from standard classes and special sports classes enhanced their levels of coordination abilities. There were significant differences in coordination abilities between students from standard classes and students from sports classes. Students from special sports classes showed a higher level of motor coordination than students from standard classes.

INTRODUCTION

The current overview and development of knowledge about the most relevant concepts of coordination sphere of human motor skills has been addressed in multiple studies [Belej 2001; Belej, Junger 2006; Chovanová 2009; Chovanová, Majherová 2010; Hirtz 1985; Měkota 2000; Raczek, Mynarski, Ljach 1998; Šimonek 2002; Ružbarská, Turek 2007]. According to Šimonek [2009], the most appropriate and optimal period for the development of coordination abilities is the prepubertal age. Children aged 6 to 9 years experience accelerated development of coordination abilities. Chovanová [1998] found that the age between 7 and 12 years represents an intense phase of motor coordination development. According to Chovanová [1998], coordination abilities may be effectively developed in school physical and sports education classes. This requires regular testing and monitoring of physical and motor development in order to most effectively control and manage the physical education process in terms of improving the physical fitness levels of students. Chovanová, Majherová [2013] developed coordination abilities of 754 students aged 7 to 10 years and 972 students 11 to 15 years, who played non-traditional sports games, under the conditions of school physical and sports education. The results of the study showed improved levels of all

coordination abilities: rhythm ability, reaction ability, balance ability, abilities of movement adjustment and reorganization, frequency ability, spatial-orientation ability, and kinesthetic-differentiation ability. These results confirm the findings on the sensitive periods of school-aged children who, after adapting to new conditions, further improved their levels of coordination abilities. The authors, according to the findings of their study, recommended in particular non-traditional sports games as the means of the development of coordination abilities. As far as the school physical and sports education is concerned, students should develop their levels of balance, spatial orientation, kinesthetic differentiation, rhythm and reaction. According to principles of appropriateness and progression, teachers should choose and incorporate activities for the development of coordination abilities in the classes of physical and sports education. Czaková, Broďáni [2005] found that 10-year-old children who attended elementary schools and eight-year secondary schools in Nitra showed alarmingly low levels of physical fitness. This may be attributed to the lack of interest in sports and lifestyle diseases. Authors emphasize that the benefits of physical and sports education are not to be suppressed. It is vital that parents acquaint their children with the beauty and variety of sports and its effects on organisms of young people. Similarly, Bendíková et al. [2015, 2018] highlight the health benefits for the school population and young generation. Under Article 1 of the regulation of the Ministry of Education of the Slovak Republic on sports classes, sports classes at both elementary and high schools are predominantly intended for athletically gifted students, representing systematic athletic preparation incorporated in the teaching process. In sports classes, students aim to develop their motor preconditions and athletic fitness in a particular sport. The teaching process and its content in sports classes particularly depends on the teaching plan the school, which runs such sports classes. Taking account of these findings, we aimed to determine and improve the level of coordination abilities in the compulsory classes of physical education at elementary school and in sports classes as well. The findings of the study will enable us to extensively assess the level of teaching physical education at elementary schools and sports classes. The issue addressed is topical because the results will contribute to the updating of knowledge about the motor skills of school-age children.

This study was supported by project VEGA 1/0120/19 entitled *"Movement correction of the problematic behavior of students from the standard population and students with special educational needs educated under the conditions of integration"*. One of the aims of the project is to test the possibilities of using physical activities at school and in sports classes for the purpose of developing coordination abilities of students from standard population.

The aim of the study was to extend knowledge about the instruction of school physical and sports education in general and in sports classes on the development of coordination abilities among 15-year-old students.

MATERIAL AND METHODS

The sample included 40 fifteen-year-old students, 21 students from sports classes and 19 students from standard classes, who attended a high school in Vranov nad Topľou. The educational experiment was carried out during the 2018-2019 school year. In the experimental group, which consisted of students from sports classes, the instruction of school physical and sports education carried out pursuant to the school's teaching plan was assessed. In the control group, we determined the efficiency of school physical and sports education in standard classes carried out according to the state education program. In line with the framework teaching plan for elementary schools, students from the control group participated in two classes of physical education per week. The students volunteered to participate in the educational experiment, and the participation in the experiment was anonymous. Only students whose parents provided their informed consents were included in the sample. We

conducted a two-group educational experiment. The baseline and follow-up levels of coordination abilities were determined in October 2018 and April 2019, respectively. To assess children's motor coordination, we administered the KTK test battery: walking backwards (WB; dynamic balance), hopping for height (HH; coupling ability and kinesthetic-differentiation ability), jumping sideways (JS; lower-body frequency ability), moving sideways (MS; complex body coordination). To determine the efficiency of school physical and sports education carried out according to the state education program and school's teaching plan in sports classes and standard classes, respectively, we used the t-test for dependent samples.

RESULTS

The sample which participated in the educational experiment included 15 students. We administered the KTK test battery (Körperkoordinationstest für Kinder), which was used to determine the levels and the rate of development of coordination abilities: walking backwards (WB; dynamic balance), hopping for height (HH; coupling ability, kinesthetic-differentiation ability), jumping sideways (JS; lower-body frequency ability), moving sideways (MS; complex body coordination). Tables 1 to 4 show baseline and follow-up data for particular coordination abilities including differences between them.

Table 1. Differences between baseline and follow-up levels of coordination abilities in 15-year-old students from sports classes

Tests	*M*	*SD*	*n*	Difference	*t*	Degrees of freedom	*p*
WB: baseline	48.7619	10.14842					
WB: follow-up	53.5238	10.86563	21	-4.762	-2.5066	20	0.020937
HH: baseline	68.8095	2.67617					
HH: follow-up	69.5714	2.67528	21	-0.762	-2.7685	20	0.011853
JS: baseline	81.9524	13.04023					
JS: follow-up	86.5714	9.59985	21	-4.619	-3.0474	20	0.006359
MS: baseline	58.0000	10.50714					
MS: follow-up	62.0476	8.45858	21	-4.048	-2.9532	20	0.007860
MQ sum: baseline	257.5238	29.09402					
MQ sum: follow-up	271.7143	24.30873	21	-14.190	-4.5941	20	0.000176

Note. WB - walking backwards; HH - hopping for height; JS - jumping sideways; MS - moving sideways; MQ - motor quotient

Belej [2001], Hirtz [1985], and Šimonek [2002] consider coordination abilities superior in terms of their contribution to the levels and development of other abilities. Therefore, the assessment of coordination abilities is still a current issue. In school setting, the KTK test battery appears appropriate from the standpoint of staff, material, and time. We used this test battery to determine teaching efficiency in sports classes according to the teaching plan of the school that runs these classes. The assessment included the overall sum of test scores computed by converting and summing up partial test scores to MQ points. The students from sports classes showed significantly different scores in all subtests: walking backwards (WB; dynamic balance), hopping for height (HH; coupling ability, kinesthetic-differentiation

ability), jumping sideways (JS; lower-body frequency ability), moving sideways (MS; complex body coordination). This shows that the follow-up level of coordination abilities was significantly different from their baseline level.

The values of standard deviations were higher for the WB – walking backwards. In the ability of complex body coordination, the results showed considerable deviations from the arithmetic mean and the variance of the sample was higher than for the HH – hopping for height (coupling ability) (Table 1).

Table 2. Differences between baseline and follow-up levels of coordination abilities in 15-year-old students from standard classes

Tests	*M*	*SD*	*n*	Difference	*t*	Degrees of freedom	*p*
WB: baseline	49.8421	10.97099					
WB: follow-up	56.3684	11.26554	19	-6.526	-3.4487	18	0.002865
HH: baseline	69.0000	2.92499					
HH: follow-up	69.8421	2.33959	19	-0.842	-2.9158	18	0.009225
JS: baseline	78.0526	6.67061					
JS: follow-up	83.3158	8.34701	19	-5.263	-4.0014	18	0.000837
MS: baseline	49.0526	7.62652					
MS: follow-up	51.5789	7.41107	19	-2.526	-2.3515	18	0.030287
MQ sum: baseline	245.9474	15.74616					
MQ sum: follow-up	261.1053	19.23219	19	-15.158	-6.0058	18	0.000011

Note. WB - walking backwards; HH - hopping for height; JS - jumping sideways; MS - moving sideways; MQ - motor quotient

The students from standard classes who were included in the control group were taught according to the state education program. The differences in baseline and follow-up levels of coordination abilities among 15-year-old students were significantly different (Table 2) for dynamic balance, coupling ability, kinesthetic-differentiation ability, lower-body frequency ability, and complex body coordination, and sum of MQ points. The instruction of school physical and sports education according to the state education program had positive effect on the levels of coordination abilities. The external factors such as personality of the physical and sports education teacher, conditions for the teaching of physical and sports education, or natural physiological maturation of human organism also contributed to the development of coordination abilities. We may conclude that the values of standard deviations for the control group and the experimental group were almost identical in WB – walking backwards (complex body coordination). We noted more considerable deviations from the arithmetic mean, and the variance for walking backwards was higher than for the hopping-for-height test, which assesses the ability to couple movements.

Table 3. Differences in baseline data between students from standard and sports classes

Tests	*M*	*M*	*t*	Degrees of freedom	*p*	F-test	*p*
WB	49.8421	48.7619	0.32350	38	0.748092	1.168677	0.731436
HH	69.0000	68.8095	0.21510	38	0.830841	1.194592	0.696254
JS	78.0526	81.9524	-1.17128	38	0.248777	3.821546	0.006038
MS	49.0526	58.0000	-3.05331	38	0.004119	1.898090	0.177127
MQ sum	245.9474	257.5238	-1.54098	38	0.131610	3.413958	0.011439

Note. WB - walking backwards; HH - hopping for height; JS - jumping sideways; MS - moving sideways; MQ - motor quotient

The baseline levels of coordination abilities (Table 3) were significantly different between students from standard classes and their counterparts from sports classes. The students from sports classes showed significantly higher levels of motor coordination in the following tests: moving sideways – complex body coordination ($p < .05$), walking backwards – dynamic balance ($p < .05$), hopping for height – coupling ability, and jumping sideways – lower-body frequency ability. There were no significant differences in the overall number of MQ points between the sample of students.

Table 4. Differences in follow-up data between students from standard and sports classes

Tests	*M*	*M*	*t*	Degrees of freedom	*p*	F-test	*p*
WB	56.3684	53.5238	0.81255	38	0.421540	1.074964	0.870147
HH	69.8421	69.5714	0.33899	38	0.736483	1.307555	0.571603
JS	83.3158	86.5714	-1.13893	38	0.261862	1.322719	0.555037
MS	51.5789	62.0476	-4.14352	38	0.000184	1.302666	0.577037
MQ sum	261.1053	271.7143	-1.51956	38	0.136898	1.597596	0.322321

The differences in follow-up test scores showed results similar to the baseline test scores. The students from sports classes showed significantly higher levels of motor coordination in the following tests: moving sideways – complex body coordination ($p < .05$), walking backwards – dynamic balance ($p < .05$), hopping for height – coupling ability, and jumping sideways – lower-body frequency ability. There were no significant differences in the overall number of MQ points between the sample of students (Table 4).

As reported by Šimonek et al. [2008], the development of coordination abilities is unsteady. According to Roth, Winter [2002], there is a specific phase for the development of coordination abilities, phase of instability, and the phase of new adjustment, which boys experience between 12/13 and 14/15 years of age. Due to new body proportions, this period is characterized by the regression and retardation in the development of motor coordination. In their study, Chovanová, Majherová [2013] had 972 students aged 11 to 15 years play non-traditional sports games in order to develop their coordination abilities in school physical and sports education. The results of the study showed improved levels of all coordination abilities: rhythm ability, reaction ability, balance ability, abilities of movement adjustment and reorganization, frequency ability, spatial-orientation ability, and kinesthetic-differentiation ability. The differences between the baseline and follow-up test scores showed significant

development of dynamic balance, ability to couple movements, kinesthetic-differentiation ability, lower-body frequency ability, and complex body coordination.

CONCLUSION

We determined the levels of coordination abilities and aimed to develop coordination abilities within compulsory physical and sports education and sports classes. The results of the study will enable us to considerably assess the level of teaching physical education at elementary schools and sports classes. We may conclude that the study addresses a current issue because the subject of the study concerns the educational process of prepubertal age. We have found significant differences in the levels and development of coordination abilities between 15-year-old students from standard classes and sports classes. Students from sports classes showed higher levels of motor coordination than their counterparts from standard classes. According to the results of the study, we recommend the teachers to monitor the levels and development of coordination abilities using the KTK test battery. We also recommend selecting and incorporating physical activities aimed to develop coordination abilities into the classes of physical and sports education, increasing the number of physical and sports education classes, and establishing sports classes.

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