

MOTOR PERFORMANCE OF AUSTRIAN AND SLOVAK PUPILS – A COMPARATIVE ANALYSIS

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ABSTRACT. Introduction. Authors compare the school physical education systems in Austria and Slovakia. **Material and method.** A comparative analysis was performed on two samples of pupils (n=85; male 38, female 47) aged 13-14 years in two different countries – Slovakia (n=43) and Austria (n=42). They focus on motor performance of boys and girls and compare the results in 5 selected tests: Sit and Reach, Standing Broad Jump, Sit-Ups in 30 seconds, Bent Arm Hang and 10 x 5m Shuttle Run. Authors expected that difference in the number of P.E. lessons in Austria and Slovakia can influence the level of motor performance of pupils (both male and female). Since the selected Austrian school provided longer P.E. lessons (150 min per week) than the Slovak school (90 min, they expected that Austrian pupils will perform better than their Slovak peers. **Results.** Based on the comparison we can assume that despite the lower number of P.E. lesson, Slovak boys and girls mostly showed better motor performance than the Austrian pupils. Statistically significant differences in favour of Slovak pupils were observed in the variables Standing Broad Jump, Sit-Ups in 30 seconds, Bent Arm Hang and 10 x 5m Shuttle Run (both genders. Austrian girls registered better results only in the Bent Arm Hang test. **Conclusion.** Results of our survey did not validate our expectations that Austrian pupils would have showed better motor performance than their Slovak counterparts, despite the higher number of P.E. lessons in Austria. Better performance can be attributed to sedentary behaviour of Austrian adolescents and higher physical activity of Slovak pupils during their leisure time.

Keywords: *Motor performance; Slovak and Austrian adolescents, P.E. lesson*

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Introduction

Currently, the educational systems in Slovakia as well as Austria are arranged based on the international standard for classification of education - ISCED. In both countries the law declares the right for free of charge compulsory education. In Slovakia pupils are granted a 150-eur worth contribution for covering catering and accommodation costs of ski courses once in the period of lower secondary education. In Austria a gratis skipass can be acquired under certain conditions. Other costs are covered by the pupil himself.

Unfortunately, the new Act on Education in Slovakia has brought reduction of the number of compulsory P.E. lessons to two at all levels of education. Only few schools have good material conditions to add one or more lessons based on school educational program, which offers the teacher a space for initiative and creativity. In Austria, this problem does not exist and number of lessons varies regarding to the type and level of school, however, it does not drop under 2 lessons per week. Curricula of both systems offer a sufficient space for various physical activities open for new trendy sports. They are more attractive for children and youth. Thanks to the natural character of the country in Austria, pupils have opportunity to try non-traditional physical activities, such as skiing, snowboarding, climbing, mountaineering, etc. Other attractive activities include dance, acrobatics, or martial arts, which form a solid component of Austrian curriculum.

Research problem

Diverse development, both political and economic, of the two neighbouring countries within the Central Europe has influenced educational systems in both countries, which obviously results in different attitudes to physical activity of pupils at school and also out of school. Therefore, we raised the following research questions:

1. Is there any difference between motor performance of Austrian and Slovak pupils attending lower secondary education (ISCED 2)?
2. Does the amount of compulsory physical education influence the level of motor performance?

Aim of research. Our comparative research aimed at comparing the two systems of education in P.E. at lower secondary level in Austria and Slovakia, thus contributing to the knowledge of attitudes of pupils to physical activity at school and out of school.

Limits of the survey: We are fully aware that our sample (n=169) represents only a marginal available selection of the population year and we cannot do any far-reaching conclusion out of it. Among other limits is the use of population norms from the year 2002. However, we can presume that certain trends in the motor development of children can be seen from this survey.

The following **research hypotheses** have been set forth:

Hypothesis 1: The level of motor performance of Austrian elementary school male pupils will be higher than the one of Slovak pupils.

Hypothesis 2: The level of motor performance of Austrian elementary school female pupils will be higher than the one of Slovak pupils.

Hypothesis 3: The number of obligatory lessons of P.E. impacts the level of motor performance of pupils.

Methods and sample

Participants. The sample formed 85 pupils (42 Austrian and 43 Slovak pupils) attending lower secondary education (ISCED 2). As to genders, 29+18 female and 14+24 male pupils. 2 schools were randomly selected for the research: NMS (Neue Mittel Schule) 27 Bertha von Suttner in Linz (Austria) and Secondary Grammar School at Golianova 68 in Nitra. Both schools are situated at the outskirts. Testing took place during two P.E. lessons in both countries and twice with a two-week-period break.

Set of motor tests used to assess the level of motor performance of pupils. In order to obtain data on the level of motor performance of pupils the method of testing using the system EUROFIT was used. Five tests were selected: **Sit and Reach, Standing Broad Jump, Sit-Ups in 30 seconds, Bent Arm Hang and 10 x 5m Shuttle Run**. For finding out the amount of time devoted to performing out-of-school physical activities, explorative questionnaire method was used. Respondents were submitted short questionnaire with 12 questions focusing on personal data (age, gender, grade) of the pupil, and the amount of time devoted to sport activities outside the lessons.

Research data were processed and analysed using mathematic and statistical methods (mean, median, minimum value, maximum value, standard deviation, 5% and 95% percentile, Mann-Whitney U-test and Cohen's test. The level of $\alpha = 0.05$ was used. Graphic form was used for description of the data distribution – factorized box plot. Cohen's coefficient (Table 1) served for evaluating the effect between two independent values:

$$d = \frac{M_1 - M_2}{SD_{pooled}}, \text{ where } SD_{pooled} = \sqrt{\frac{SD_1^2 + SD_2^2}{2}}, M_1 - M_2$$

Represents difference of two arithmetic means of the compared variables, SD_1^2 a SD_2^2 represent the square number of standard deviation of the variables analysed.

Table 1. Criterion of evaluation of Cohen's coefficient

Effect of the coefficient	Resulting effect
$d \geq 0,80$	Large effect
$d \in \langle 0.50 - 0.80 \rangle$	Medium effect
$d \in \langle 0.20 - 0.50 \rangle$	Small effect

Results and discussion

For the verification of the hypotheses the data were extracted concerning motor performance of individual pupils by means of motor tests. Results of EUROFIT tests represented depending variables, while gender and country of origin were independent variables.

In the following tables are presented descriptive statistical data of depending variables. Table 2 depicts descriptive statistics of variables for Austrian pupils, Table 3 for Slovak pupils, Table 4 describes statistics for boys and Table 5 for girls, regardless of their country of origin.

Table 2. Descriptive statistics of Slovak pupils (both genders)

Variable	Average	Median	Min. value	Max. value
Bent Arm Hang [s]	6.5556	2.2300	0.0000	32.1600
Standing Broad Jump [m]	1.7088	1.7000	1.3000	2.2500
Sit-ups [30 s]	24.5814	25.0000	10.0000	33.0000
Shuttle run (10x5m) [s]	18.9783	18.7500	16.7000	21.5300
Sit And Reach [cm]	19.2326	20.0000	4.0000	38.0000
Variable	Std. Deviation	5% Perc.	95% Perc.	Missing data
Bent Arm Hang [s]	8.5214	0.0000	24.5560	0
Standing Broad Jump [m]	0.2103	1.3500	2.1000	3
Sit-ups [30 s]	5.0532	15.4000	32.0000	0
Shuttle run (10x5m) [s]	1.1903	17.1040	21.3330	2
Sit And Reach [cm]	8.4292	6.5000	36.8000	0

Table 3. Descriptive statistics of Austrian pupils (both genders)

Variable	Average	Median	Min. value	Max. value
Bent Arm Hang [s]	8.5530	6.0550	0.0000	38.8300
Standing Broad Jump [m]	1.5138	1.5350	0.6800	1.9300
Sit-ups [30 s]	19.7750	20.0000	9.0000	26.0000
Shuttle run (10x5m) [s]	20.3124	20.4700	17.2300	23.2800
Sit And Reach [cm]	13.3382	13.9000	1.0000	29.0000
Variable	Std. Deviation	5% Perc.	95% Perc.	Missing data
Bent Arm Hang [s]	9.0510	0.0000	29.8390	2
Standing Broad Jump [m]	0.2762	1.0535	1.8995	2
Sit-ups [30 s]	4.2757	10.1000	25.9500	2
Shuttle run (10x5m) [s]	1.5978	17.5370	22.8070	1
Sit And Reach [cm]	6.4766	2.6250	25.5350	2

Table 4. Descriptive statistics of both Austrian and Slovak boys

Variable	Average	Median	Min. value	Max. value
Bent Arm Hang [s]	10.5641	7.5500	0.0000	38.8300
Standing Broad Jump [m]	1.7051	1.7100	1.1400	2.2500
Sit-ups [30 s]	22.1622	23.0000	10.0000	32.0000
Shuttle run (10x5m) [s]	19.4274	19.2150	16.7000	22.8400
Sit And Reach [cm]	11.7595	10.0000	1.0000	23.0000
Variable	Std. deviation	5% Perc.	95% Perc.	Missing data
Bent Arm Hang [s]	10.3912	0.0000	32.8270	1
Standing Broad Jump [m]	0.2205	1.3290	2.1150	1
Sit-ups [30 s]	4.0860	12.7000	28.4000	1
Shuttle run (10x5m) [s]	1.5812	17.0800	22.5265	0
Sit And Reach [cm]	5.7070	2.3500	22.1000	1

Table 5. Descriptive statistics of both Austrian and Slovak girls

Variable	Average	Median	Min. value	Max. value
Bent Arm Hang [s]	5.0683	2.8500	0.0000	27.1600
Standing Broad Jump [m]	1.5305	1.5500	0.6800	2.1000
Sit-ups [30 s]	22.3478	22.0000	9.0000	33.0000
Shuttle run (10x5m) [s]	19.8336	19.6700	17.1400	23.2800
Sit And Reach [cm]	20.1180	19.1000	6.0000	38.0000
Variable	Std. deviation	5% Perc.	95% Perc.	Missing data
Bent Arm Hang [s]	6.3611	0.0000	22.6575	1
Standing Broad Jump [m]	0.2718	1.0640	2.0200	4
Sit-ups [30 s]	6.0781	10.7000	32.0000	1
Shuttle run (10x5m) [s]	1.5204	17.2800	22.2850	3
Sit And Reach [cm]	7.7958	7.5900	36.6500	1

The comparison shows that boys perform better in the test Bent Arm Hang (10.56 s) than the girls (5.07 s). In the test Standing Broad Jump boys jumped further (1.7 m) than the girls (1.53 m). Boys and girls showed approximately the same performance in the test Sit-ups (22 repetitions). Boys were faster than girls (by 0.41 s) in the Shuttle Run Test 10x5 m. As expected, girls recorded better result (20.12 cm) than boys (11.75 cm) in the Sit And Reach test.

Differences in motor performance of Austrian and Slovak boys

Hypothesis 1 expressed the assumption that there exist a statistically significant difference in the motor performance of Austrian and Slovak boys, in favour of the former ones. To verify the assumption on the level of 0.05 nonparametric Mann-Whitney U test was used for the results in the selected motor tests. Results are presented in Table 6.

Table 6. Results of Mann-Whitney U test for hypothesis 1

Mann-Whitney U Test (Country)					
Marked tests are significant on the level $p < .05000$					
Variable	Sum. r. gr. 1	Sum. r. gr. 2	U	Z	p-value
Bent Arm Hang [s]	284.5000	418.5000	142.5000	0.56369	0.572963
Standing Broad Jump [m]	324.0000	379.0000	103.0000	1.80069	0.071753
Sit-ups [30 s]	316.5000	386.5000	110.5000	1.56582	0.117393
Shuttle run (10x5m) [s]	212.5000	528.5000	107.5000	-1.81568	0.069420
Sit And Reach [cm]	323.5000	379.5000	103.5000	1.78503	0.074257

The test showed that all p-values are higher than the level $\alpha = .05$. We can state that the hypothesis H_0 is not refused. There are not significant differences between the results of tests between Austrian and Slovak boys (Table 7).

Table 7. Results of Cohen's test for hypothesis 1

Variable	Slovak boys			Austrian boys			Cohen's coefficient	
	Mean	Std. deviation	n	Mean	Std. deviation	n	d	Effect size
Bent Arm Hang [s]	12.2136	11.0589	14	9.5600	10.0815	23	0.2508	Small effect
Standing Broad Jump [m]	1.8036	0.2214	14	1.6452	0.2017	23	0.7477	Medium effect
Sit-ups [30 s]	23.6429	4.3431	14	21.2609	3.7321	23	0.5883	Medium effect
Shuttle run (10x5m) [s]	18.7821	1.2241	14	19.8038	1.6655	24	0.6990	Medium effect
Sit And Reach [cm]	13.7500	5.9509	14	10.5478	5.3210	23	0.5673	Medium effect

Figure 1 depicts box plots of individual parameters separately for boys from Slovakia (left side) and from Austria (right side).

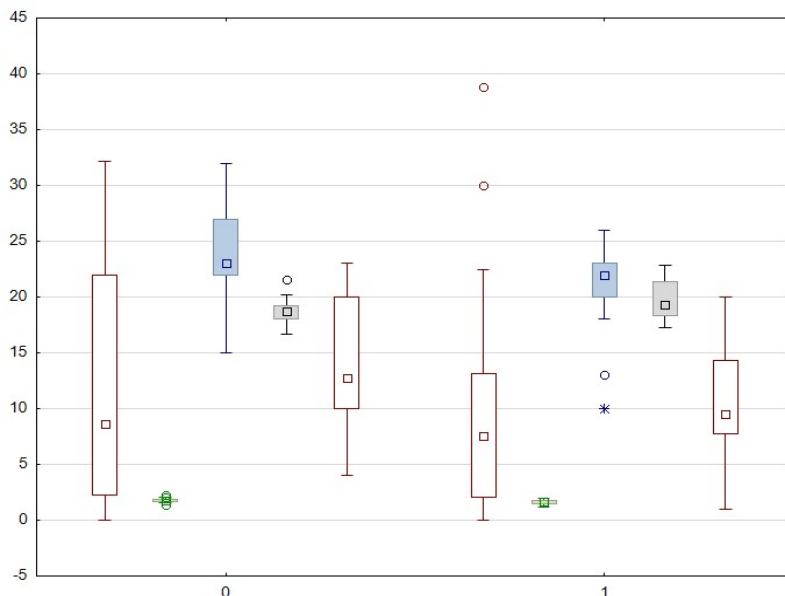


Figure 1. Factorized box plot of analysed variables according to the variable „country“ (boys). Explanations: from left to right: T1, T2, T3, T4, T5 (for Slovakia) and T1, T2, T3, T4, T5 (for Austria)

Differences in motor performance of Austrian and Slovak girls

Hypothesis 2 expressed the assumption that there exist a statistically significant difference in the motor performance of Austrian and Slovak girls, in favour of the former ones. To verify the assumption on the level of 0.05 nonparametric Mann-Whitney U test was used for the results in the selected motor tests. Results are presented in Table 8.

Table 8. Results of Mann-Whitney U test for hypothesis 2

Mann-Whitney U Test (Country)					
Marked tests are significant on the level $p < .05000$					
Variable	Sum. r. gr. 1	Sum r. gr. 2	U	Z	p-value
Bent Arm Hang [s]	597.5000	483.5000	162.5000	-1.90022	0.057405
Standing Broad Jump [m]	726.5000	219.5000	66.5000	3.82537	0.000131
Sit-ups [30 s]	860.5000	220.5000	67.5000	4.06215	0.000049
Shuttle run (10x5m) [s]	440.0000	550.0000	62.0000	-4.02527	0.000057
Sit And Reach [cm]	761.0000	320.0000	167.0000	1.79782	0.072207

The following statements can be deduced from Table 8:

- The first variable – Bent Arm Hang – p-value is 0.057405, which means that H_0 is not refused. Performance of both Austrian and Slovak girls is not significantly different.
- The second variable – Standing Broad Jump – p-value is 0.000131, which is less than $\alpha = 0.05$, thus H_0 is refused. There are significant differences between the results of Austrian and Slovak girls in this test.
- The third variable – Sit-ups – p-value is 0.000049, which means that the hypothesis H_0 is refused. There are significant differences between the results of Austrian and Slovak girls in this test.
- The fourth variable – 10x5m Shuttle Run – p-value is 0.000057, which means that we refuse H_0 . There are significant differences between the results of Austrian and Slovak girls in this test.
- The fifth variable – Sit And Reach – p-value is 0.072207, which means that H_0 is not refused. Performance of both Austrian and Slovak girls is not significantly different. (Table 9).

Table 9. Results of Cohen’s test for hypothesis 2

Variable	Slovak girls			Austrian girls			Cohen’s coefficient	
	Mean	Std. Deviation	n	Mean	Std. deviation	n	d	Effect size
Bent Arm Hang [s]	3.8241	5.3297	29	7.1906	7.5168	17	0.0517	No effect
Standing Broad Jump [m]	1.6577	0.1890	26	1.3359	0.2675	17	0.1697	No effect
Sit-ups [30 s]	25.0345	5.3751	29	17.7647	4.2357	17	0.1502	No effect
Shuttle run (10x5m) [s]	19.0800	1.1828	27	21.0306	0.1632	17	0.1632	No effect
Sit And Reach [cm]	21.8793	8.2371	29	17.1135	6.0808	17	0.0658	No effect

Figure 2 depicts box plots of individual parameters separately for girls from Slovakia (left side) and from Austria (right side).

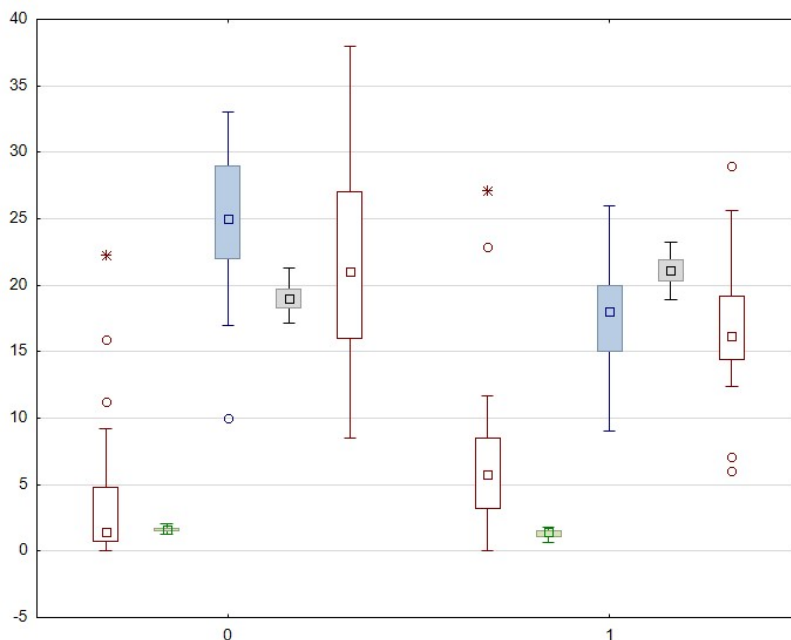


Figure 2. Factorized box plot of analysed variables according to the variable „country“ (girls). Explanations: from left to right: T1, T2, T3, T4, T5 (for Slovakia) and T1, T2, T3, T4, T5 (for Austria)

Conclusions

By means of evaluation of the results we succeeded in getting the following answers to the research hypotheses:

Hypothesis 1: The level of motor performance of Austrian elementary school male pupils will be higher than the one of Slovak pupils.

The results showed that the level of motor performance of Austrian pupils was slightly lower than their counterparts' one in Slovakia. Thus, the ***hypothesis 1 was not confirmed.***

Hypothesis 2: The level of motor performance of Austrian elementary school female pupils will be higher than the one of Slovak pupils.

The results of tests showed that Austrian girls performed better only in the first test. They showed higher level of strength ability of arms. In all the other 4 tests Slovak girls performed better. They showed significantly higher level of strength abilities of the trunk and legs, as well as agility and flexibility. Differences in tests No. 2, 3 and 4 were also statistically significant, in favour of the Slovak girls. ***Hypothesis 2 was not confirmed.***

Hypothesis 3: Number of obligatory lessons of P.E. impacts the level of motor performance of pupils.

If the number of P.E. lessons impacts the motor performance of pupils, the Austrian pupils should have performed better in motor tests than the Slovak pupils. With regard to the number of P.E. lessons (and their length) in Austria (150 min per week) and the number of lessons (2 per week) lasting for 90 min per week, we can state that the *hypothesis 3 was not confirmed*.

Results of our survey did not validate our expectations that Austrian pupils would have showed better motor performance than their Slovak counterparts in both genders. The performance also did not depend on the number of P.E. lessons at school. We can thus express our assumption that Slovak boys and girls participate in more physical activities during their leisure time and the Austrian boys and girls are more sedentary.

Many EU member countries, among them also Slovakia or Austria, attempt to introduce new attractive physical activities and modern methods of teaching into the P.E. lessons. In the centre of curricula and teaching plans stand individual learning needs and prerequisites of pupils focused on the pupil and not on the teacher. Even evaluation is more humanism-oriented in the sense that they focus less on performance and more on positive emotions and enjoyment of pupils at lessons. In Austria, stress is put on the way the pupil shows his/her enjoyment with the future expected positive attitude to physical activities. Despite various research results we could come to the conclusion that the number of P.E. lessons not always influences optimum development of motor performance and skills. The main aspects are clear structure of the lesson, modern methods of teaching and improving the skills of pupils. Very important aspect is also the active time used by the teacher for practical movement of pupils. The time lost by long-lasting changing of dress, talking and idle time does not contribute to effective time use. Results of empiric studies proved that quality of P.E. lessons depends also on the effectiveness of educational time exploitation.

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