

## STRETCHING EXERCISES AND THEIR INFLUENCE ON THE DEVELOPMENT OF CHILDREN'S COORDINATION MOVEMENT CAPABILITIES IN PRIMARY EDUCATION

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**Abstract:** The authors, in their article, approach the issue of stretching and coordination motor skills of children of younger school age in primary education on the basis of diagnosing their motor skills. The aim of the article is to find out its effectiveness in the development of coordination skills of children in primary education through our proposed stretching program. Testing was performed by selected motor tests to determine the level of coordination skills. The sample consisted of 119 third- and fourth-year students from selected primary schools in the village and the city. The data obtained from pretests and posttests were evaluated using the nonparametric Wilcoxon T-test and the nonparametric Mann-Whitney U-test. The obtained results confirmed one of the hypotheses, where there was a statistically significant difference between pretests and posttests in the experimental group, precisely through the applied stretching exercises. The results obtained through the application of stretching exercises point to the fact that these exercises within the teaching of physical education had a positive effect on the development and strengthening of coordination motor skills. In the results of the experimental group of girls and boys, we found that they achieved statistically significant improvements in all motor tests.

**Keywords:** Stretching, motor tests, physical and sports education, motor skills, younger school age, coordination skills.

### 1 Introduction

Stretching and adequate physical activity is an important part of every individual's life, from kindergartens to colleges. Without adequate physical activity, we cannot imagine life in our schools. The child should be guided to physical activities from an early age, because his initial habits are formed in this period. Children perceive their parents as a role model, and when they observe that their parents are not interested in physical activity, we can assume that the child will also imitate their attitude. Oravcová (2009) states that in motor development the child's movements are graceful, well coordinated, physical movement is very important for a child in this period, he is looking for it. Good physical coordination allows him to give good sports performances, he is also skillful in other physical activities. Physical and movement ability is a ticket to success in the children's group in this period. Dexterity, agility, physical performance is appreciated by other children. Physically weaker boys are more often lonely and compensate for their shortcomings by success in school or other hobby activities. According to Jakabčič (2002), during a young schoolchild's physical development, the child's physical performance increases significantly, children are constantly on the move, but they are not yet able to manage their strength well, they can be exhausted quickly. The movement is coordinated and becomes graceful. Physical ability, dexterity, mastery of various skills is also great psychological importance - it provides the child with a certain position in the group of peers.

Stretching is considered as a necessary part of every sports activity, through which we prepare the body for physical activity. Thanks to the implementation of stretching before the performance, we can prevent various injuries. From the theoretical and practical point of view, several authors deal with the issue of stretching, e.g. Alter (1999), Šebej (2001), Buzková (2006), Nelson, Kokkonen (2016), Matthews (2019) and others. Other authors: Kasa (2006), Dovolil et al. (2008), Perič (2008), Kaplánová (2018) deal with motor skills and motor learning. Movement skills, especially coordination and their development in their works are described by the authors: Lednický (2005), Měkota, Novosad (2005), Sedláček, Lednický (2010), Laczo et al. (2014) and others. The authors are dealing with younger school age: Langmeier, Krejčířová (2006), Vágnerová (2012), Řičan (2004), Thorová (2015), Ružbarská (2018), Ružbarská\_Chovanová (2017), Harsa et al (2021) and others. The didactics of physical and sports education are dealt by the

authors: Sýkora (2001), Antala et al. (2014, 2018), Šimonek-Židek (2018), Turek (2014) and others.

Several authors, e.g. Belešová (2018), Kožuchová-Čavojský (2021), Kožík Lehotayová (2017), Severini (2018), Severini et al. (2020) emphasize that teachers significantly influence the development of education and upbringing. The importance of the teaching profession extends to all areas of society. The teacher influences the nature and quality of the relationship with students, conditions the atmosphere in the classroom, stimulates students' interest - including their relationship to sports and active physical activity, their experience at school, the development of their knowledge and their whole personality. This topic, as developed, opens up further opportunities for qualitative research, e.g. Kostrub (2016), Severini, Kostrub (2018). We believe that the effort of teachers of physical and sports education is a constant effort to provide space for each student to be able to exercise physically and to feel the success of their activities, which will accompany him throughout his life.

Several researches by physical education doctors and pedagogical experts confirm that physically fit individuals are able to suppress fatigue from the monotony of life, because good condition allows them to retain much more energy, and therefore interest in their work. We encounter the recommendation of physical activities as part of a healthy lifestyle in the works of several authors, e.g. Rodin (2021), Kaplánová-Gregor (2021), Gorner et al (2021), Rýzková-Labudová (2019), Duda (2017), Šimonek et al. (2014), Horička-Šimonek-Paška (2020) and others. Among other things, these authors emphasize the need for regular exercise from the earliest school age.

It is well known that the exclusion or restriction of physical activity usually has a negative effect on human activities: physical ability is reduced, various diseases arise and aging processes are accelerated. On the contrary - active physical activity helps by activating the cerebral cortex, creating improved conditions for the development of thinking, creation, interactions and experience. This is one of the reasons why well-targeted physical activity, such as stretching, sports and recreational activities, physical work, movement-related hobbies and other activities that children can already learn at school, is very often recommended against the undesirable consequences of strained mental activity. The standardization of motor tests of coordination skills was dealt by the authors: Měkota, Novosad (2005), Skrypkov et al (2021) and others.

### 2 Methodology

**Goal.** The goal of the article is to determine the level of coordination motor skills of children of younger school age in the village and in the city and the subsequent application of stretching exercises to determine their effectiveness. We used five motor tests to determine the level of coordination skills. At the same time, compare our obtained results with the results of other authors. The research sample consisted of 119 third- and fourth-year students in selected primary schools.

**Tasks.** Based on our goal, we set the following tasks: To select the school bases in the village and in the city to solve our issue. Build a complex of stretching exercises corresponding to the age range of children. Select a battery of motor tests to identify and compare coordination skills in primary school students. Perform scheduled testing. Statistically process and evaluate the measured results.

**Hypotheses.** Based on the goal and tasks of the work, we created the following four hypotheses (H 1, H 2, H 3, H 4).

H 1: Due to selected stretching exercises, there will be a statistically significant difference in the experimental group of girls and boys between pretest and posttest focused on coordination motor skills.

H 2: There is a statistically significant difference between the pretest and the posttest focused on coordination motor skills in the control group for both boys and girls.

H 3: By applying selected stretching exercises, the achieved level of coordination motor skills will be statistically more significant in the experimental group of girls compared to girls from the control group, and also the achieved level will be statistically more significant in boys from the experimental group compared to boys from the control group.

H 4: The level of coordination skills will be higher in boys compared to girls, while the progress in boys from the experimental group and in boys from the control group will be more significant in the tests compared to girls from the experimental group and the control group.

**Methods.** Our research involved 119 pupils from primary schools in the town of Púchov in the Trenčín Region (Slovak Republic) and from the village of Hranovnica in the Prešov Region (Slovak Republic), of which 62 were boys and 53 girls. They were third- and fourth-year students from the 1st grade of primary school.

**Data acquisition methods:** We selected 5 motor tests to find out data of the coordination abilities of children. For diagnostics in our research, we performed a selection of motor tests from standardized test batteries from various authors. When selecting standardized tests, we took into account the age range of subjects, which had to meet the age of eight to ten years. We performed a pretest (entrance test) and then, after 14 weeks, we performed a posttest (output test) in a control group (28 boys and 32 girls) and an experimental group (30 boys and 29 girls).

We used the following tests, with each test focused on a different coordination ability.

Test (T 1) aimed at diagnosing the ability to react: Grasping an object - Stopping a falling ruler.

Test (T 2) aimed at diagnosing the kinesthetic-differentiation ability of the lower limbs: Jump to the target from an elevated place.

Test (T 3) focused on the diagnosis of rhythmic ability: Skipping rope, holding the same pace of movement.

Test (T 4) focused on the diagnosis of spatial orientation ability: Running to numbered targets.

Test (T 5) aimed at diagnosing balance (static balance): Endurance standing on one leg (right, left) eyes closed.

**Methods of processing and evaluation of results:** We statistically processed and evaluated the achieved measured data on the basis of two nonparametric tests, namely: Wilxon's T-test and Mann-Whitney's U-test. According to Tomšík, (2017, p. 248) Wilxon's T-test is used in cases where two groups of measurements are based on the same sample of probands, and they were tested twice. Specifically, they completed pretests and posttests, which are compared with each other. It is based on the differences between the two measurements of each subject. According to Tomšík (2017, p. 256) "The Mann-Whitney U-test is used to compare the medians of two independent samples, and this nonparametric test corresponds to whether the difference between the two means in the two groups is statistically significant." Statistical significance was determined based on  $p < 0.01$ ,  $p < 0.05$  level of significance. The use of several statistical methods can also be found in the authors Gunčaga, Zawadowski, Prodromou (2019). Statistical tests can also be performed in relation to different study results of siblings within one family (see Gorajska, Stando, Gunčaga, 2018). Wilcoxon's exact test with many applications is very often used in pairwise comparisons - both in the technical and educational field, e.g. (Barot et al., 2020; Cieslar et al., 2020).

### 3 Results and discussion

The results obtained from the testing of coordination motor skills of children at younger school age in the village and in the city by applying stretching exercises are presented in graphs and tables with an opinion on the individual four hypotheses. From hypothesis testing using the Wilxon T-test and the Mann-

Whitney U-test, we confirm or do not confirm the existence of statistically significant dependences based on  $p < 0.01$ ,  $p < 0.05$  level of statistical significance (Fuchs-Gunčaga, 2021). We used five motor tests to determine the level of coordination skills.

Using the Wilcoxon T-test, we compared the results obtained in pretests and posttests for each subgroup separately, where we processed their values and analyzed whether there was a statistically significant difference between the tests. We processed each motor test for a given subgroup. To compare the results of special subgroups, the Mann-Whitney U-test was used, which evaluated the differences, i.e. EX (experimental group) girls and KG (control group) girls, EX boys and KG boys, EX boys and EX girls, also KG boys and KG the girls. In each performed test, we analyzed whether there was statistical significance in the differences. All obtained results, which we statistically evaluated, were processed at the level of significance  $p < 0.01$ ,  $p < 0.05$  (Gunčaga et al., 2019), Krpec-Barot (2020).

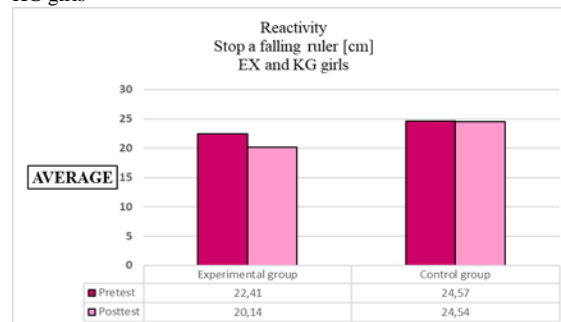
#### 3.1 Evaluation of motor tests

Statistical methods: Wilxon's T-test and Mann-Whitney U-test were evaluated on the basis of the implementation of five motor tests with an opinion on four hypotheses. Next, we will proceed to the presentation of results according to individual tests (T 1, T 2, T 3, T 4, T 5) and take opinion on the four hypotheses set by us.

As can be seen in graph (1) in the experimental group (EX) of girls, we measured an average value of 22.41 cm in the motor test "stopping the falling ruler" and in the posttest we measured an average value of 20.14 cm in the girls' group. Our measurements show that there was an improvement of 2.27 cm, which in percentage terms represents an improvement of 10.15%. From above results means that there was progress in EX girls group. Using a nonparametric Wilcoxon T-test, we evaluated that they achieved a statistically significant difference at the significance level of  $p < 0.05$ . In the control group (KG) of girls, we measured at pretest an average value of 24.57 cm in the motor test and in the posttest we measured an average value of 24.54 cm in the girls' group. These data show that there was no significant improvement between pretest and posttest (Chart 1). We tested the data using a nonparametric Wilcoxon T-test, where we concluded that there was no statistically significant difference in the control group of girls. By comparing the difference between (EX) and (KG) girls using the nonparametric Mann-Whitney U-test, we came to the conclusion that there was no statistical significance in the pretests. However, in the posttests, there was a statistically significant difference at the significance level of  $p < 0.01$  in favor of the experimental group (Graph 1).

#### Test 1 (T 1) Grasping an object - Stopping a falling ruler

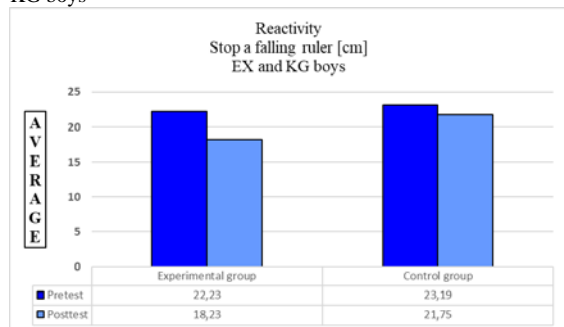
Graph 1: Pretest and posttest: Stopping a falling ruler EX and KG girls



Graph (2) shows that in the experimental group (EX) of boys, we recorded an average value of 22.23 cm in the pretest aimed at stopping the falling ruler. In the posttest, we recorded an average value of 18.23 cm, which shows that there was an improvement in the reactivity by as much as 4 cm, which in percentage terms

represents a progress of 18.89%. Using a nonparametric Wilcoxon T-test, we found that there was a significant statistical difference in boys at the level of significance  $p < 0.01$ .

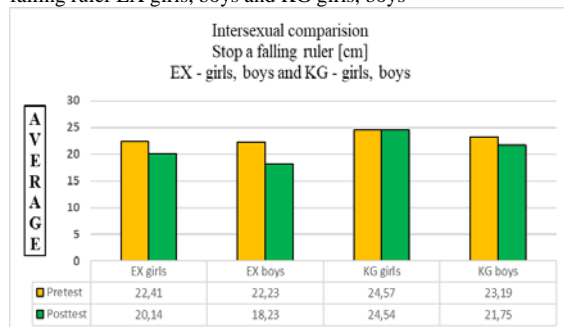
Graph 2: Pretest and posttest: Stopping a falling ruler EX and KG boys



In the control group (KG) of boys, we measured an average value of 23.19 cm in the pretests, while in the posttests we measured an average value of 21.75 cm in the boys. The above values show that the boys' response improved by 1.44 cm, which in percentage represents a progression of 6.20%. Using Wilcoxon's nonparametric T-test, we found that there was no statistical significance between pretest and posttest in boys (KG) in this test. By comparing boys from (EX) and (KG), we evaluated by means of a nonparametric Mann-Whitney U-test that there was no statistical significance in pretests, while in posttests there was statistical significance in favor of (EX) experimental group at significance level  $p < 0.05$  (Chart 2).

From graph (3) it can be read that in the motor pretest aimed at stopping the falling ruler, we measured an average value of 22.41 cm in the experimental group of girls. The boys, also from (EX), were measured an average of 22.23 cm. The measured results show us that the achieved average results were better in boys compared to girls. However, the difference was a minimal, 0.18 cm, which is 0.81%. In (EX) we measured in the posttests as an average value of 20.14 cm for girls, while the boys had an average value of 18.23 cm for the posttest. Based on these data, we state that the achieved values were better in boys compared to girls. In the posttest, the boys were 1.91 cm better, which is 10.45% in favor of the boys.

Graph 3: Pretest and posttest: Intersex comparison - Stopping the falling ruler EX girls, boys and KG girls, boys



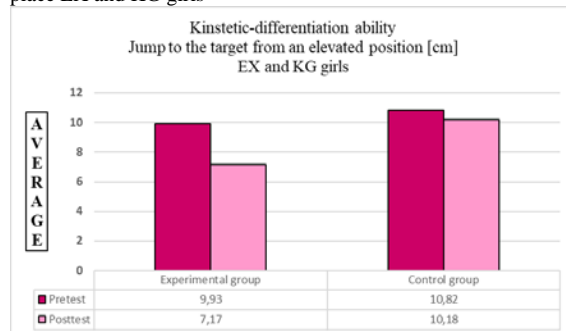
By comparing the results obtained between the (EX) group of girls and (EX) boys using the nonparametric Mann-Whitney U-test, we found that there was no statistically significant difference in either the pretests or the posttests. In the test focused on reactivity, we measured the achieved value in the pretest of the (KG) girls in the pretest with an average of 24.57 cm, while in the boys from (KG) we measured the average value of 23.19 cm. We know from the results that in comparison, the boys achieved a better average value in the pretest by 1.38 cm, which is a difference of 5.63% in percentage terms. In (KG), we measured an average value of 24.54 cm for girls in posttests and an average value of 21.75 cm for boys. From the measured results when comparing girls and boys, we see that there was a

difference of 2.79 cm, which is a percentage of 11.35% in favor of boys. By comparing the difference between the (KG) group of girls and (KG) boys using the Mann-Whitney nonparametric U-test, we found that there was no statistically significant difference in the pretest. In the posttest, however, there was a significant statistical difference in favor of boys at the significance level of  $p < 0.05$  (Graph 3).

Graph (4) shows that in girls (EX) we measured an average value of 9.93 cm in the test in a motor test, which focuses on the kinesthetic-differentiation ability, jump to the target from an elevated place. In the posttest, we recorded a value of 7.17 cm in the experimental group of girls, which shows that there was an improvement in the kinesthetic-differentiation ability. Specifically, the girls improved by 2.76 cm, which in percentage terms represents a progress of 27.78%. Based on the results obtained, we can confirm that there was a significant improvement in girls (EX). Using the Wilcoxon nonparametric T-test, we calculated a statistically significant difference between the pretest and the posttest, which is at the level of significance  $p < 0.01$ . In girls (KG), we recorded a value with of 10.82 cm during the pretest. In the posttest, we measured an average value of 10.18 cm. The measurements show that in the control group of girls there was an improvement of 0.64 cm, which in percentage terms shows a progress of 5.94%. We tested the data using a nonparametric Wilcoxon T-test, where we found that there was no statistically significant difference in the control group of girls. By comparing girls (EX) and girls (KG) using the nonparametric Mann-Whitney U-test, we noticed that there was no statistically significant difference in the pretest. However, in the posttest we observed a difference in the level of significance  $p < 0.01$  in favor of (EX) the group of girls (Graph 4).

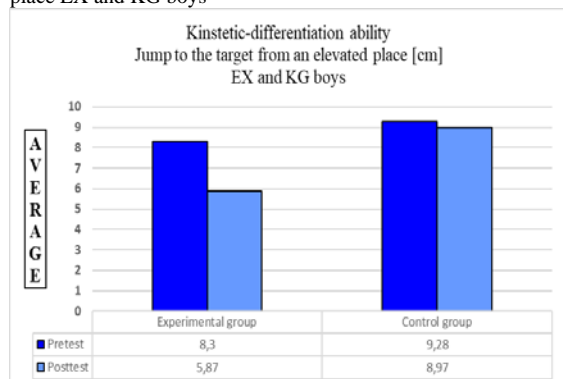
**Test 2 Jump to the target from an elevate place**

Graph 4: Pretest and posttest: Jump to the target from an elevate place EX and KG girls



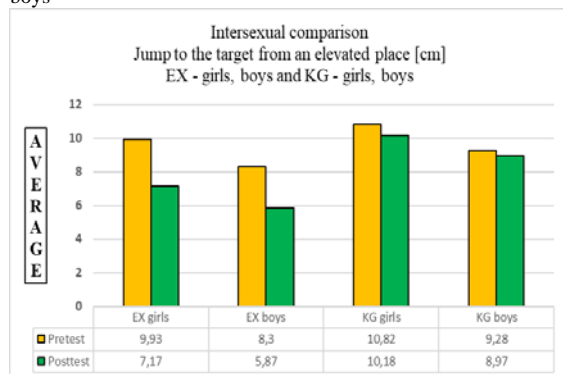
Graph (5) shows that in boys (EX) we measured an average value of 8.3 cm in a motor test, which focuses on jumping to a target from an elevated place, and in a posttest we measured an average value of 5.87 cm in an experimental group of boys. Our measurements show that there was an improvement of 2.43 cm, which in percentage terms is an improvement of 29.32%. From the above data, we conclude that in boys (EX) there was a progression in kinesthetic-differentiation ability. Using a nonparametric Wilcoxon T-test, we evaluated that they achieved a statistically significant difference at the significance level of  $p < 0.01$ . In boys (KG) we measured an average value of 9.28 cm in a motor test and in a posttest we measured an average value of 8.97 cm in boys (KG). The above data show that there was a minimal improvement of 0.31 cm. In percentage terms, there was a small improvement of 3.37%. In boys (KG), there was no statistical significance by the nonparametric Wilcoxon T-test (Chart 5). By comparing the difference between boys (EX) and boys (KG) using the nonparametric Mann-Whitney U-test, we found that there was no statistical significance in the pretests, but there was a statistically significant difference in the posttests. The difference was in favor of boys (EX) at the significance level  $p < 0.01$  (Graph 5).

Graph 5: Pretest and posttest: Jump to the target from an elevated place EX and KG boys



The evaluation of the graph (6) showed that in the motor pretest, which is aimed at jumping to the target from an elevated position, we measured the average value of 9.93 cm in girls (EX) and an average of 8.3 cm in boys (EX). The measured results show us that the achieved average results were better in boys compared to girls. The difference was 1.63 cm, which is 16.42% in percentage terms. For girls (EX) we measured an average value of 7.17 cm for girls in the posttest, while for boys (EX) we measured an average value of 5.87 cm for the posttest. Based on these data, we state that the achieved values were higher in boys compared to girls. Specifically, the boys were 1.3 cm better, which represents a percentage difference of 18.21%. Using the Mann-Whitney nonparametric test, we found by a comparison of girls (EX) and boys (EX) that there was no statistically significant difference in pretests or posttests. In the test focused on reactivity, we measured a value of 10.82 cm in average in the girls (KG) in the pretest. For boys (KG), we measured an average value of 9.28 cm. Based on this, we can state that in comparison, the boys (KG) achieved a better average value with a pretest of 1.54 cm, which in percentage terms is a difference of 14.21%. (Chart 6). For girls (KG) we measured an average value of 10.18 cm in the posttest and for boys (KG) an average value of 8.97 cm was measured. From the measured results we see that in the comparison of girls and boys there was an improvement in boys by 1.21 cm, which represents a percentage difference of 11.89%. By comparing the results obtained in girls (KG) and boys (KG), we did not measure statistical significance in pretest or posttest using the Mann-Whitney U-test (Graph 6).

Graph 6: Pretest and posttest: Intersexual comparison - Jump to the target from an elevated position EX girls, boys and KG girls, boys

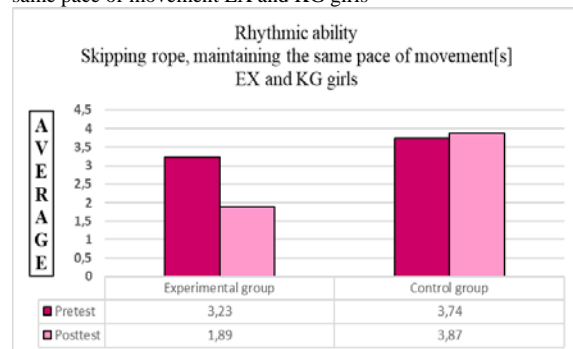


Graph (7) shows that for girls (EX) we measured an average value of 3.23 seconds in a motor pretest, which was aimed at skipping rope and then maintaining the same pace. In posttests, we measured an average value of 1.89 seconds for girls (EX). From the above information, we can see that there was an improvement of 1.34 seconds, what means 41.49% in percentage terms. Based on this, we can say that there was a progression in rhythmic ability. Using a nonparametric Wilcoxon T-test, we calculated that the girls achieved a statistically significant

difference at the significance level of  $p < 0.01$ . For girls (KG), we measured an average value in the pretest of 3.74 seconds, while in posttests we measured the average value of 3.87 seconds. The above values show that there was a deterioration in the average measured value in girls (KG) in rhythmic ability, where we measured a regress of 0.13 seconds. At the same time, we state that the nonparametric Wilcoxon T-test did not show a significant statistical improvement. By comparing the groups of girls (KG) and (EX), we evaluated, using the non-parametric Mann-Whitney U-test, that there was no statistical significance in the pretests. In posttests, on the other hand, there was a statistically significant improvement in favor (EX) at a significance level of  $p < 0.01$  (Graph 7).

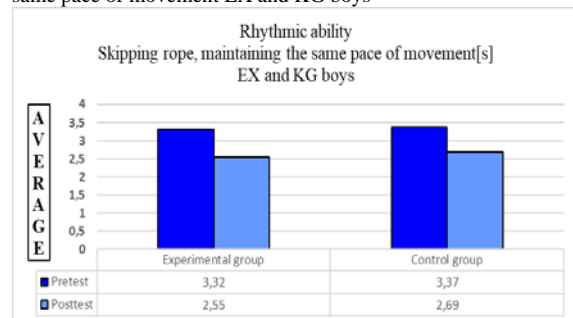
Test 3 Skipping rope, maintaining the same pace of movement

Graph 7: Pretest and posttest: Skipping rope, maintaining the same pace of movement EX and KG girls



In the evaluation (Graph 8) of boys (EX), we recorded an average value of 3.32 seconds in the pretest, which focused on rhythmic ability. In the posttest, we recorded an average value of 2.55 seconds, which shows that the rhythmic ability was improved by 0.77 seconds, which in percentage terms means that there was a progression of 23.17%. (Chart 8). Using a nonparametric Wilcoxon T-test, we found that in the experimental group of boys there was a significant statistical difference at the level of significance  $p < 0.01$ . For boys (KG) we measured an average value of 3.37 seconds in the pretest, while for posttests we measured an average value of 2.69 seconds for boys. These values show that in the control group of boys there was an improvement in skipping rope by 0.68 seconds, which in percentage represents an improvement of 20.02% (Chart 8). Using the Wilcoxon T-test, we found that in boys (KG) there was a statistical improvement at the significance level of  $p < 0.01$ . The improvement could have happened due to physical development or a higher concentration on the performed posttest (Chart 8). Comparing boys (EX) and (KG), we used the Mann-Whitney U-test to conclude that there was no statistical significance in pretests, nor was there any significant statistical significance in posttests (Chart 8).

Graph 8: Pretest and posttest Skipping rope, maintaining the same pace of movement EX and KG boys

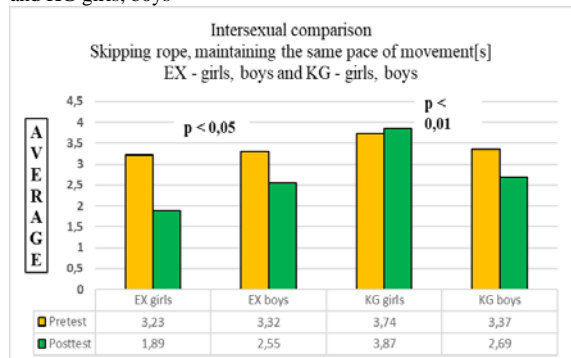


As can be seen (Chart 9) in girls (EX), we measured an average value of 3.23 seconds in the experimental group of girls during a motor pretest aimed at jumping rope and maintaining the same



movement. For boys (EX), we measured an average value of 3.32 seconds during pretest. The measurements show that the achieved average values were better in girls compared to boys. However, the difference achieved in favor of the girls was minimal, by 0.09 seconds. In percentage terms, this is 2.61% (Chart 9). For girls (EX), we measured average value of 1.89 seconds in the posttest, while boys (EX) had a mean post-test of 2.55 seconds. Based on the above data, we state that the achieved values were better in girls compared to boys. There was a more significant difference in favor of girls, who were 0.66 seconds better than boys, which in percentage terms represents a difference of 34.92%. By comparing the difference between girls (EX) and boys (EX) using the Mann-Whitney U-test, we demonstrated statistical significance, while in the posttest there was a significant statistical difference at the significance level of  $p < 0.05$  in favor of girls. In the test focused on rhythmic ability in girls (KG), we measured an average value of 3.74 seconds in the pretest, while in boys (KG) we measured an average value of 3.37 seconds. Based on the results, we can state that in comparison, the boys achieved a better average value in the pretest by 0.37 seconds, which in percentage terms is 10.26%. In posttests, for girls (KG) we measured an average value of 3.87 seconds and for boys (KG) the average value was 2.69 seconds. Based on the results, we state that the comparison showed a more significant improvement of boys, which resulted in a better result in posttests by 1.18 seconds, which represents in percentages 30.43%. By comparing the difference between girls (KG) and boys (KG), we found, using Mann-Whitney's nonparametric U-test, that there was no significant statistical difference in pretests, whereas there were significant statistical differences in posttests between boys (KG) and girls (KG) at the level of significance  $p < 0.01$  in favor of boys (Graph 9).

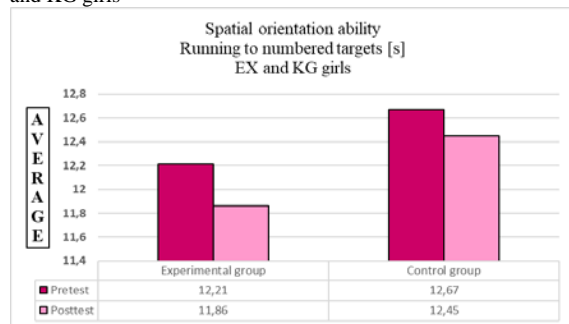
Graph 9: Pretest and posttest: Intersexual comparison - Skipping rope, maintaining the same pace of movement EX girls, boys and KG girls, boys



Graph (10) shows the fact that in the motor pretest (T 4) dealing with spatial-orientation ability, we measured an average value of 12.21 seconds for girls (EX) in the test of running to numbered targets. In the posttest, we measured 11.86 seconds, which shows that there was an improvement in spatial orientation. Specifically, the girls improved by 0.35 seconds, which in percentage terms represents a progression of 2.82% (Chart 10). Based on these findings, we can say that the girls (EX) showed a significant improvement. Using the Wilcoxon nonparametric T-test, we calculated a statistically significant difference between the pretest and the posttest, which is at the significance level  $p < 0.01$ . For girls (KG), we recorded a value with an average of 12.67 seconds during the pretest. In the posttest, we measured an average value of 12.45 seconds. The measurements show that the girls (KG) showed a small improvement of 0.22 seconds, which in percentage terms shows a minimal improvement of 1.75%. We tested the obtained data using a nonparametric Wilcoxon T-test, where we found that (KG) there was a statistically significant difference at the level of significance  $p < 0.05$ . By comparing girls (EX) and girls (KG), we recorded, using the non-parametric Mann-Whitney U-test, that there was no statistically significant difference in the pretest and no significant statistical difference in the posttest (Graph 10).

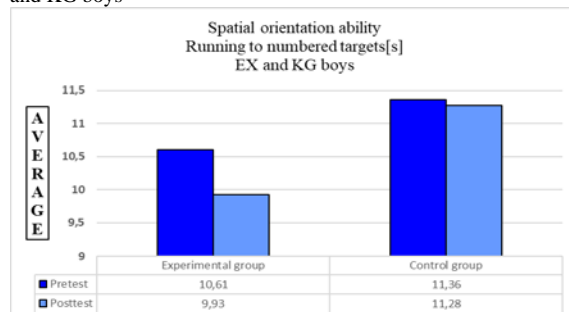
**Test 4 Test Running to numbered targets**

Graf 10: Pretest and posttest: Running to numbered targets EX and KG girls



From graph (11) it can be read that in the motor pretest of boys (EX) we measured an average value of 10.61 seconds. The average posttest value in this group of boys was 9.93 seconds. These values show that there was an improvement of 0.68 seconds, which in percentage represents a progress of 6.42%. According to the non-parametric Wilcoxon T-test, a statistically significant improvement was found at the significance level of  $p < 0.01$ . For boys (KG) we measured an average value of 11.36 seconds during the pretest and in the posttest we measured an average value of 11.28 seconds. Therefore, we state that there was a negligible improvement of 0.08 seconds, which in percentage terms is a minimum progress of 0.71%. From the results we can confirm that there was no statistically significant improvement using the Wilcoxon nonparametric T-test. Comparing boys (EX) and (KG), we found, thanks to the Mann-Whitney U-test, that there was a statistically significant difference at the level of significance  $p < 0.05$  during the pretest and also a significant statistical difference at the level of posttest, namely at the level significance  $p < 0.01$  (Graph 11).

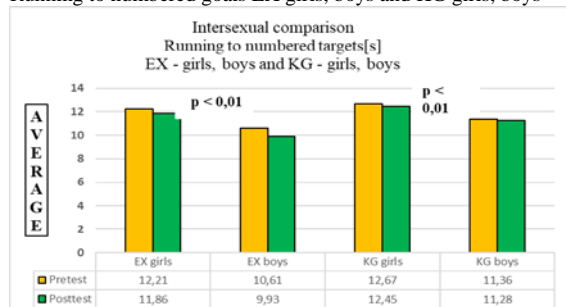
Graph 11: Pretest and posttest: Running to numbered targets EX and KG boys



In the graph (12), we measured an average value of 12.21 seconds for girls (EX) and an average value of 10.61 seconds for boys (EX) in motor pretest aimed to running to numbered targets. When we measured values in pretest, the difference is 1.6 seconds, while the boys were better. The difference in percentage represents a better performance of 13.06% in favor of boys (EX). For girls (EX) we measured an average value of 11.86 seconds in the posttest, while for boys (EX) we measured the average value in the posttest 9.93 seconds. The measurements show that the average values were better for boys compared to girls by 1.93 seconds, which in percentage terms is a difference of 16.27% in favor of boys. Using the Mann-Whitney nonparametric test, we found that by comparing the experimental group of girls and the experimental group of boys, there was a significant statistical difference in pretest and posttest at the significance level  $p < 0.01$ . In the test focused on spatial-orientation ability, we measured an average value of 12.67 seconds for girls (KG) in the pre-test, while we measured an average value of 11.36 seconds for boys (KG). The measurements show that the average values were better for boys compared to girls by 1.31 seconds, which in percentage terms is a 10.33% better performance in favor of boys (Chart 12). For

girls (KG) we measured an average value of 12.45 seconds in the posttest, while for boys (KG) we measured an average value of 11.28 seconds. The measurements show that the average values were better for boys (KG) compared to girls (KG) by 1.17 seconds, which in percentage terms is better performance by 9.37% in favor (KG) of boys. By comparing the achieved results of girls (KG) and boys (KG), we came to the fact, through the Mann-Whitney U-test, that boys (KG) achieved a statistically significant difference at the level of significance  $p < 0.01$  in both pretest and posttest (Graph 12).

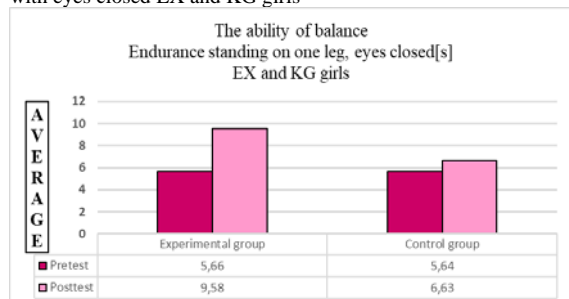
Graph 12: Pretest and posttest: Intersexual comparison - Running to numbered goals EX girls, boys and KG girls, boys



When evaluating graph (13) of girls (EX), we recorded an average value of 5.66 seconds in the pretest dealing with balance ability, specifically focused on static balance. In the post-test, we recorded an average value of 9.58 seconds, which shows that the static balance improved by 3.92 seconds, which in percentage terms means that there was a high progress of 41.02%. Using a nonparametric Wilcoxon T-test, we found that there was a significant statistical difference in the significance level of  $p < 0.01$  of girls (EX). For girls (KG) we measured an average value of 5.64 seconds in the pretest, while in the posttest we measured an average value of 6.63 seconds for the girls. From the above values, it is based on the fact that for girls (KG) there was an improvement in static balance by 0.99 seconds, which in percentage represents a progress of 14.85%. Using the Wilcoxon T-test, we found that in the control group of girls (KG) there was improvement and a statistically significant difference at the significance level  $p < 0.01$ . The improvement could have happened due to the physical development of the girls or by concentrating a higher concentration when performing the posttest. Comparing girls from the experimental (EX) and control groups (KG), we concluded by Mann-Whitney T-test that there was no statistical significance in pretests, while in posttests there was a statistically significant difference at the significance level  $p < 0.01$  (Graph 13).

**Test 5 Endurance standing on one leg with eyes closed**

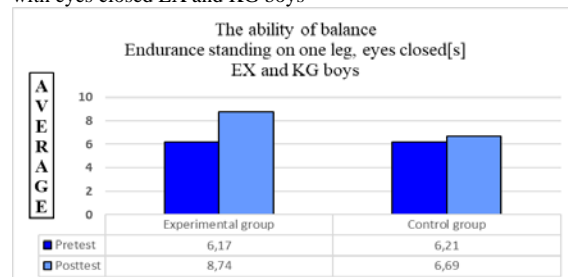
Graph 13: Pretest and posttest: Endurance standing on one leg with eyes closed EX and KG girls



In graph (14) we see that for boys (EX) we recorded an average value of 6.17 seconds when standing on one leg with our eyes closed in pretest. In the post-test, we recorded an average value of 8.74 seconds, which indicates that the static balance improved by 2.57 seconds, which is an overall percentage progress of 41.65%. Using the nonparametric Wilcoxon T-test, we calculated that in boys (EX), there was a statistically significant difference

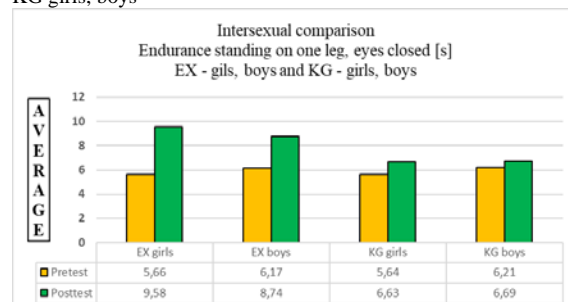
at the significance level of  $p < 0.01$ . For boys (KG), we measured an average value of 6.21 seconds in pretests, while in posttests we measured an average value of 6.69 seconds. From the above values it follows that in boys (KG) there was a minimal improvement in standing on one leg with eyes closed by 0.48 seconds, which in percentage terms is a progress of 7.13%. Using Wilcoxon's T-test, we found that there was no statistical significance between pretest and posttest in the control group of boys in this test. By comparing boys (EX) and boys (KG), we concluded, using the Mann-Whitney U-test, that there was no statistical significance in the pretests, while there was statistical significance in the posttests. There was an improvement in favor (EX) of boys at the level of significance  $p < 0.01$  (Graph 14).

Graph 14: Pretest and Posttest: Endurance standing on one leg with eyes closed EX and KG boys



The graph (15) shows that in the motor pretest, which is focused on endurance standing on one leg with closed eyes, we measured the average value for girls (EX) of 5.66 seconds. For boys (EX), an average value of 6.17 seconds was measured. The measured results show us that the achieved average results were better in boys compared to girls. The difference was small, 0.51 seconds, which in percentage terms is a better result by 8.40% in favor of the boys. In the posttest, we measured an average hour of 9.58 seconds for the girls (EX), while the average value for the posttest was 8.74 seconds for the boys (EX). The measurements show that the average values were better for girls compared to boys by 0.84 seconds, which in percentage terms is 8.84% in favor of (EX) girls. Using the Mann-Whitney nonparametric U-test, comparing the experimental group of girls (EX) and boys (EX) we found that there was no statistically significant difference in pretest or posttest. In the test focused on balance ability - static balance, we measured an average value of 5.64 seconds for girls (KG) in the pretest, while we measured an average value of 6.21 seconds for boys (KG). We know from the results that in comparison they achieved (KG) a better average value in the pretest by 0.57 seconds, which in percentage terms is a difference of 9.16% in favor of boys (KG). In the posttest, we measured an average value of 6.63 seconds for girls (KG), while an average value of 6.69 seconds was measured for boys (KG). From the measured values in the comparison we see that there was a difference of 0.07 seconds between girls and boys, which is minimal and in percentage terms it is 0.92% in favor of boys. By comparing the results obtained in the control group of girls (KG) and in boys (KG), we did not measure statistical significance in the pretest or posttest using the Mann-Whitney U-test (Graph 15).

Graph 15: Pretest and posttest: Intersexual comparison - Endurance standing on one leg, eyes closed EX girls, boys and KG girls, boys



### 3.2 Evaluation of hypotheses

In our article, we set a goal to determine the impact of the use of stretching exercises on the development of coordination motor skills of children at younger school age. By realizing the research, we wanted to find out the level of coordination skills of primary school children, where we used two independent groups for comparison, namely the experimental and control groups, which we then divided into other subgroups according to gender. Four subgroups were formed, we worked in the empirical part with them, while a stretching plan was applied to the girls and boys from the experimental group, while the control group was taught physical education under normal conditions. In the

previous section, we presented a comparison of the results we achieved. Based on the results obtained, we found that stretching exercises had an effect on coordination skills, which means that they were effective. In some motor tests, there was an improvement not only in the experimental (EX) but also in the control (KG) group. However, in terms of statistical significance, the experimental group had more significant statistical differences compared to the control group, where there was also a more visible progress in the coordination capabilities. For better clarity in the interpretation of the achieved results, we present a table (Tab. 1) with the evaluations of motor tests, where we also present statistical significance.

Table 1: Motor tests, hypotheses and their statistical significance

MOTOR TESTS	Hypothesis 1		Hypothesis 2		Hypothesis 3		Hypothesis 4			
	Experimental group		Control group		GIRLS	BOYS	Experimental group		Control group	
	Comparison Pretest and Posttest		Comparison Pretest and Posttest		Comparison EX x KG	Comparison EX x KG	COMPARISON GIRLS x BOYS		COMPARISON GIRLS x BOYS	
	GIRLS	BOYS	GIRLS	BOYS	POSTEST	POSTEST	PRETEST	POSTEST	PRETEST	POSTEST
Grasping an object – Stopping a falling ruler	*	**	-	-	**	*	-	-	-	*
Jumping to the target from an elevated place	**	**	-	-	**	**	-	-	-	-
Skipping rope, holding the same pace of movement	**	**	-	**	**	-	-	*	-	**
Running to numbered targets	**	**	*	-	-	**	**	**	**	**
Endurance standing on one leg (right, left) with eyes closed	**	**	**	-	**	**	-	-	-	-

- statistical significance not achieved, \* statistical significance at p level <0.05, \*\* statistical significance at p level <0.01

Hypothesis (H 1) dealt with the influence of selected stretching exercises, which should have resulted in a statistically significant difference in the experimental group of girls and boys between pretest and posttest focused on coordination motor skills. In the table, we present, we can see that there was a significant statistical difference between pretests and posttests of both girls and boys. Given the results that were achieved, we conclude that the stretching exercises we proposed were effective and in both groups there was progress in the motor tests. We confirm the hypothesis (H 1) on the basis of the obtained data.

Hypothesis (H 2) was devoted to the control group, where a statistically significant difference between pretests and posttests focused on coordination of motor skills of boys and girls should have happened, are shown in Table (1), where we see statistical significance for girls in two motor tests as well as for boys, but only in one test. In the vast majority of tests there was no statistically significant difference, therefore we conclude that Hypothesis (H 2) was not confirmed.

Hypothesis (H 3) focused on the application of selected stretching exercises, where the achieved level of coordination motor skills should be statistically more significant in the experimental group of girls compared to girls from the control group, and also the achieved level should be statistically more significant for boys from the experimental group compared with boys from the control group. In the table for girls (EX) and girls (KG) we can see that out of five tests performed, there was a statistically significant difference in the posttests in four at the level of significance  $p < 0.01$  in favor of the experimental group of girls. There was no statistical significance in the motor test - running to numbered targets. A similar situation occurred with boys (EX) and boys (KG). In comparison with the control group of boys, the experimental group of boys did not achieve a statistically significant difference in one motor test - skipping rope, maintaining the same pace of movement. In contrast, in three tests, boys from the experimental group achieved a statistically significant difference in posttests, at a significance level of  $p < 0.01$  in one test at a significance level of  $p < 0.05$ . It follows from the above that, despite the results achieved in favor of the experimental group of girls and boys, we reject the

Hypothesis (H 3). The reason is that there was no statistical significance for girls in one test and same no significance for boys in one test.

Hypothesis (H 4) focused on the level of coordination motor skills, which should be higher for boys compared to girls, while the progress of boys in the experimental group and of boys in the control group should have been more significant in the tests compared to girls in the experimental group and control group. In table (1) we can see that in the experimental group in pretests, where there was a comparison of girls and boys, only one of the tests - running to numbered targets, was statistically significant in favor of boys. Also in the posttests, the boys had a statistically significant difference in their favor in the test - running to numbered targets. However, in the posttests, specifically in the test - skipping rope, maintaining the same pace of movement, the girls achieved a better result compared to the boys, which achieved statistical significance. Similarly, in the control group in the pretests, also in the test - running to the numbered targets, the boys achieved a better result than the girls, which was statistically significant. As we can see in the table in the posttests, the boys had a statistically significant difference in the results in up to three motor tests when compared with the girls, while in two there was no statistically significant difference. Based on these facts, when the boys from the experimental and control groups did not achieve statistically significant differences in all tests compared to the girls, we must reject the Hypothesis (H 4).

From the above results we can state that Hypothesis (H 1), based on the application of stretching exercises in physical education classes, the experimental group of girls and boys achieved statistically significant differences between pretests and posttests, where the tests were focused on coordination motor skills. There was no significant improvement in the control group of girls and boys, which rejected the Hypothesis (H 2). When comparing the experimental group of girls with the control group of girls, as well as in the experimental group of boys and the control group of boys, there were no significant improvements in favor of the experimental group of girls and boys, and we also reject Hypothesis (H 3). In the intersexual comparison, where the boys from both groups were supposed to be better than the girls from both groups, this fact was not confirmed to us, so we also rejected the Hypothesis (H 4).

#### 4 Conclusion

In our article, we tried to approach the use and impact of stretching on the development of coordination motor skills of children at younger school age in physical education and sports classes. Based on the application of selected exercises for students in primary education, we wanted to find out their effectiveness, efficiency and level of coordination skills selected by us.

The choice of motor tests was conditioned by the material and technical equipment of the schools and the age of our probands. After completing the pretests in both groups, a set of stretching exercises was applied to the experimental group, which lasted for 14 weeks. Following the end of the selected period, post-tests were performed again. We used two nonparametric tests to process and evaluate the measured results. Wilcoxon nonparametric T-test, which was used to compare the results obtained between pretests and posttests within one group, where we tested the difference at the level of significance  $p < 0.01$  and  $p < 0.05$ . The second test we used was the nonparametric Mann-Whitney U-test, on the basis of which we compared the values of two independent groups. We processed the obtained results into graphs, we interpreted the results and we were able to verify our hypotheses by them. In our research, only one of the hypotheses was confirmed, which was aimed at achieving statistical significance in the experimental group of girls and boys between pretests and posttests, and stretching exercises were applied in these groups. Based on the obtained results, we state that in all motor tests, the probands in the experimental group improved their performance. The experiment we performed was able to

positively influence the development of coordination motor skills of children at younger school age. We had to reject the remaining three hypotheses on the basis of unfulfilled statistical significance. Most importantly, we consider that the goal of the work, which was to determine the level of coordination skills and applied exercises to come to their effectiveness, we managed to meet, while the level of coordination skills reached a statistically significant difference, which can confirm that stretching exercises were effective and efficient in our studied younger school-age children in the village and in the city.

As a positive, we would like to note that the results achieved through the application of stretching exercises point to the fact that these exercises in physical education classes have been positively proven and have had a positive impact on the development and strengthening of coordination motor skills. In the results of the experimental group of girls and boys, we found that they achieved statistically significant improvements in all motor tests.

In conclusion, we consider it necessary to emphasize that one of the important tasks of every teacher is to arouse students' interest in movement and exercise. However, the teacher should be able to properly motivate students, he should be thoroughly prepared for the teaching process and he should also have a positive attitude towards his students. Last but not least, it is essential that the teacher adheres to all important didactic principles. Only such a teacher can fulfill the goals of physical and sports education in our schools and at the same time have influence on children to develop their motor abilities and skills.

#### Literature:

- Alter, M. J.: *Strečink: 311 protahovacích cviků pro 41 sportu*. Praha: Grada Publishing, 1999. 228 p. ISBN 978-80-7169-763-3.
- Antala B. et al.: *Pohybová aktivita žiaka v škole a jej ovplyvňovanie prostredníctvom nových technológií*. Bratislava: Slovenská vedecká spoločnosť pre telesnú výchovu a šport, 2018.
- Belešová, M.: *Primárne vzdelávanie v teórii a v praxi*. Bratislava: Vydavateľstvo Univerzity Komenského, 2018. 192 p. ISBN 978-80-223-4577-4.
- Buzková, K.: *Strečink: 240 cvičení pro dokonalé protažení celého tela*. 1 vyd. Praha: Grada Publishing, 2006. 220 p. ISBN 80-247-1342-X.
- Doválil, J. et al.: *Lexikon sportovního tréninku*. 2. upravené vyd. Praha: Univerzita Karlova v Praze, Karolinium, 2008. 313 p. ISBN 978-80-246-1404-5.
- Duda H.: *Racjonalne kierowanie uzdolnionym graczem (na przykładzie edukacji w Szkole Mistrzostwa Sportowego Piłki nożnej im. Józefa Kałuży i Henryka Reymana w Krakowie)*, Studia i monografie, 32, AWF Kraków, 2017.
- Fuchs, J., Gunčaga, J.: *Theoretische und empirische Analysen zum geometrischen Denken*. Münster : WTM-Verlag, 2021. pp. 93-104. ISBN 978-3-95987-199-0.
- Gorajska, M., Stando, J., Gunčaga, J.: *The Influence of Birth Order on the Results of the State E-Test in Mathematics*. In: (Smyrnova Trybulska, E., Ed.) *E-Learning and Smart Learning Environment for the Preparation of New Generation Specialists*, Book Series: E-learning, 2018, 10. pp. 199-219.
- Gömer K., Karol Gomer, Makarowski, R., Roskova M.: *Aggression among Slovak males training in martial arts versus other sports disciplines*. In *Ido movement for culture : journal of martial arts anthropology*. – Strzyżów: Idōkan Poland association, 2021. - ISSN 2084-3763. - Vol. 21, no. 2 (2021), pp. 47–56.
- Gregor, T.: *Psychológia športu*. Bratislava: Mauro Slovakia, 2013. 400 p. ISBN 978-80-968092-7-9.
- Gunčaga, J., Zawadowski, W., Prodromou, T.: *Visualisation of Selected Mathematics Concepts with Computers - the Case of Torricelli's Method and Statistics*. In: *European Journal of Contemporary Education*. 2019. 8 (1), pp. 69-91 DOI: 10.13187/ejced.2019.1.69.
- Harsa, P., Michalec, J., Vaškovicová, M., Kaplánová, A., Gregor, T.: *Význam spoľehlivosti v činnosti pedagógů a trenérů v oblasti športu*, s. 131-136. Bratislava 2021: In *Vedecký zborník Univerzity Komenského v Bratislave 2021*, s. 473-487. ISBN 978-80-223-5013-6.



13. Horička, P., Šimonek, J., & Paška, L.: Relationship between reactive agility, cognitive abilities, and intelligence in adolescents. *Journal of Physical Education & Sport*, 20(3): 2263-2268. ISSN 2247 - 806X. DOI:10.7752/jpes. 2020.s 3304.
14. Hříčka, J., Kovářová, M., Beňačka, J.: *Pohybová aktivita edukantů fyzioterapie vo voľnom čase a jej reflexia na vybraných zdravotných a zdravotných charakteristikách*. Trnava: UCM, 2011. 151 p. ISBN 978-80-8105-323-8.
15. Jakabčič, I.: *Základy vývinovej psychológie*. Bratislava: IRIS, 2002. 83 s. ISBN 80-89018-34-13.
16. Kampmiller, T., Vanderka, M. et al.: *Teória športu a didaktika športového tréningu*. 1 vyd. Bratislava: ICM Agency Bratislava, 2012. 356 p. ISBN 978-80-89257-48-5.
17. Kasa, J.: *Športová antropomotorika*. 3. vyd. Bratislava: Slovenská vedecká spoločnosť pre telesnú výchovu a šport, FTVŠ UK, 2006 a. 209 p. ISBN 80-968252-3-2.
18. Kaplánová, A.: Individual differences of sensitivity of tennis players to injustice situations from the perspective of the five-factor model of personality big five theory. *Acta Gymnica*. 48(1), p.21-26 doi: 10.5507/ag.2018.002.
19. Kaplánová, A., Gregor, T.: Self-acceptance, Shame Withdrawal Tendencies and Resilience as Predictors of Locus of Control of Behavior *Psychologica*. 2021. .Studies DOI 10.1007/s12646-020-00589-1.
20. Kasa, J.: *Pohybové predpoklady a ich diagnostika*. 1. vyd. Bratislava: FTVŠ UK, 2006 b. 153 p. ISBN 80-8075-134-X.
21. Kostrub, D.: *Základy kvalitatívnej metodológie – keď interpretované významy znamenajú viac ako vysoké čísla*. Bratislava: PdF UK, 2016. 161 p. ISBN 978-80-223-4166-0.
22. Kožík Lehotayová, B.: *Učiteľ materskej školy a grafomotorika*: CREA-AE, (elektronický zdroj). Banská Bystrica: UMB, 2017. pp 171-178. ISBN 978-80-557-1374-8.
22. Kozuchová, M., Čavojský, I.: *Pedagogika voľného času detí*. Bratislava: Univerzita Komenského, 2021. 217 s. ISBN 978-80-223-5140-9.
23. Krpec, R. a Barot, T. Particular quantitative analysis of accesses to mathematical study sources. *International Journal of Didactical Studies*. 2020, 1(1), s. 30-42. ISSN 2718-0409.
24. Laczo, E. et al.: *Rozvoj a diagnostika pohybových schopností detí a mládeže*. Bratislava: NŠC s FTVŠ UK. 2014. 160 p. ISBN 978-80-971466-0-3.
25. Langmeier, J., Krejčířová, D.: *Vývojová psychologie*. 3. vyd. Praha: Grada Publishing, 2006. 344 p. ISBN 80-247-1284-9.
523. Lednický, A.: *Koordináčné schopnosti: charakteristika, rozvoj, diagnostika*. 1 vyd. Bratislava: Slovenská vedecká spoločnosť pre telesnú výchovu a šport, 2005. 86 p. ISBN 80-89075-26-6.
26. Matthews, J.: *Strečink pro aktivní život*. Praha: Grada Publishing, 2019. 208 p. ISBN 978-80-271-2549-7.
27. Měkota, K., Novosad, J.: *Motorické schopnosti*. 1. vyd. Olomouc: Univerzita Palackého v Olomouci, 2005. 175 p. ISBN 80-244-0981-X.
28. Merica, M.: Effect of Stretching on Sports performance in Softball. In: *Sportivnye igry v fizičeskom vospitanii, rekreacii i sporte: zbornik z medzinárodnej vedeckej konferencie*. Smolensk (Rusko): SGAFKST, 2018. pp. 119-121. ISBN 978-5-94578-151-1.
29. Moravec, R., Kampmiller, T., Sedláček, J. et al.: *Eurofit. Telesný rozvoj a pohybová výkonnosť školskej populácie na Slovensku*. Bratislava: SVSpreTVaŠ, 2002. 180 p. ISBN 80-89075-11-8.
30. Moškova, S.: *Využitie strečingu na rozvoj koordináčnych schopností u detí mladšieho školského veku*. Bratislava, PdF UK, 2020. 86 p.
31. Nelson, G. A., Kokkonen, J.: *Strečink na anatomických základoch*. 2. prepracované vyd. Praha: Grada Publishing, 2015. 224 p. ISBN 978-80-247-5485-7.
32. Oravcová, J.: *Vývinová psychológia*. Banská Bystrica: Univerzita Mateja Bela, 2010, 232 p. ISBN 978-80-80839-37-6.
33. Perič, T.: *Sportovní příprava dětí*. 2. vyd. Praha: Grada Publishing, 2008. 192 p. ISBN 978-80-247-2643-4.
34. Rodin, A.: The Concept of Formation of Effective Physical Actions of Athletes in Game Sports. In *Žiak, pohyb, edukácia: vedecký zborník 2021*. Bratislava: Univerzita Komenského, 2021. ISBN 978-80-223-5248-2. s. 134 – 141.
35. Rýžková, E., Labudová, J.: *Vplyv pohybových programov vo vodnom prostredí na biologické a motorické ukazovatele žien v strednom veku* [elektronický dokument]. - 1. vyd. - Bratislava: Slovenská vedecká spoločnosť pre telesnú výchovu a šport, 2019. - 94 s. [online] ISBN 978-80-89075-80-5.
36. Ružbarská, I. & Chovanová, E.: Motor abilities of prepubertal children – theoretical perspectives on physical and sports education at primary school. Lüdenscheid, Germany. 2017: RAM – Verlag. 190 p. ISBN 978-3-942303-49-1.
37. Ružbarská, I.: *Motorické predpoklady detí v kontexte predprimárneho a primárneho vzdelávania*. Prešov: Vydavateľstvo Prešovskej univerzity, 2018. Prešovská univerzita, Pedagogická fakulta, 211 p. ISBN 978-80-555-2185-5.
38. Ríčan, P.: *Cesta životem – Vývojová psychologie*. 2. prepracované vyd. Praha: Portál, 2004. 390 p. ISBN 80-7367-124-7.
39. Sedláček J., Lednický, A.: *Kondičná atletická príprava*. Bratislava: Slovenská vedecká spoločnosť pre telesnú výchovu a šport, 2010. 168 p. ISBN 978-80-89075-34-8.
40. Severini, E. et al.: Self-regulation of learning in the natural science of future teachers. In: *AD ALTA*. Roč. 10, č. 2 (2020), s. 289-293.
41. Severini, E.: Samostatnosť dieťaťa vo výskumných interpretáciách rodičov = Child's autonomy in parent's research interpretations. In: *Terazniejszosc i przyszlosc edukacji dzieci, mlodzięzy i doroslych wybrane problemy*. Siedlce: Akka, 2018. pp. 67-87. ISBN 978-83-948104-7-4.
42. Severini, E., Kostrub, D.: *Kvalitatívne skúmanie v predprimárnom vzdelávaní*. Prešov: Rokus, 2018. 182 p. ISBN 978-80-895-1071-9.
43. Sýkora, F.: Didaktika telesnej výchovy. In: *ANTALA, B. et al. 2001. Didaktika školskej telesnej výchovy*. 1. vyd. Bratislava: FTVŠ UK, 2001. pp. 8-15. ISBN 80-968252-5-9.
44. Šebej, F.: *Strečing*. Bratislava: TIMY, 2001. 128 p. ISBN 80-8065-019-5.
45. Štulrajter, V., Matis, J., Šíma, O.: *Strečink: Cvičenia kĺbovej pohyblivosti*. Bratislava: SLOVŠPORT, 1984. 175 p.
46. Švec, Š. et al.: *Metodológia vied o výchove*. 1. vyd. Bratislava: Vydavateľstvo IRIS, 1998. 303 p. ISBN 80-88778-73-5.
47. Šimonek, J., & Židek, R.: Sports talent identification based on motor tests and genetic analysis. 2018. *Trends in Sport Sciences* 25(4): 201-207 ISSN 2299-9590.
48. Šimonek, J. et al.: *Metodická príručka telesnej výchovy pre materské školy a prvý stupeň základných škôl*. Bratislava: AT Publishing, 2014. 140 p. ISBN 978-80-88954-62-0.
49. Thorová, K.: *Vývojová psychologie*. Praha: Portál, 2015. 576 p. ISBN 978-80-262-0714-6.
50. Turek, I.: *Didaktika*. Bratislava: Wolters Kluwer, 2014. 620 p. ISBN 978-80-8168-004-5.
51. Vágnerová, M.: *Vývojová psychologie*. 1. vyd. Praha: Univerzita Karlova v Prahe, 2012. 536 p. ISBN 978-80-246-2153-1.

#### Primary Paper Section: A

#### Secondary Paper Section: AK