SPORT - Science & Practice, Vol. 4, №2, 2014, pp. 5-16

Scientific article

DIFFERENCES IN THE MOTOR ABILITIES OF MALE AND FEMALE 6TH GRADE ELEMENTARY SCHOOL STUDENTS

UDK 796.012.1-057.874(497.11)

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Abstract: The motor abilities of elementary school students have often been the subject matter of research in physical culture. Furthermore, authors have dealt with the differences in motor abilities between male and female students of different age groups. The basic aim of this research was to determine the differences in motor abilities between male and female 6th grade elementary school students. The sample of respondents in this research was a group of 124 students from the 6th grade (66 boys of the average age of 12.91 and 58 girls, average age 12.86. Some 12 motor tests were applied for assessing the following motor abilities: precision, balance, speed, flexibility and strength. Based on the results of the canon discriminative analysis, the conclusion was reached that there are statistically significant differences between the tested groups in regards to motor abilities. The boys were more successful in tests for assessing strength, precision, and coordination of the entire body and the speed of alternative leg movements. Girls were more dominant in flexibility and the speed of alternative arm movements. Boys had better results on balance tests and the girls on others, so this can be seen as consistent results in regards to this ability. The obtained results mostly reflect the natural pace of developing motor abilities considering gender and point to a compatibility with the sensitive periods for displaying certain abilities in regards to the gender of the respondents.

Key words: *motor abilities, boys, girls, elementary school*

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INTRODUCTION

The motor abilities of elementary school students have often been a topic of research in physical culture. Authors have researched the motor abilities of students from various aspects. Several authors dealt with the trend of developing the motor abilities of pre-school children (Popović, Cvetković, & Grujičić, 2006; Trajkovski, Tomac, & Marić, 2014), and adolescents (Janz, Dawson, & Mahoney, 2000; Gajević, 2009; Badrić, Sporiš, Trklja, & Petrović, 2012; Milojević, Marković, Gadžić, & Stanković, 2014). Other aspects of research in the area of student motor skills are related to the contemporary problems of the reduction of the level of physical activities which is consequently reflected on the development of motor abilities (Tomkinson, Olds, & Gulbin, 2003; Wedderkopp, Froberg, Hansen, & Andersen, 2004; Šiljeg, Zečić, Morgan, & Kević, 2008; Strel, Bizjak, Starc, & Kovač, 2009). Along with this, authors also researched the differences between the motor abilities of male and female students of different age groups (Gelemanović, Svoboda, & Tomas, 2006; Mladineo, 2006; Mikalački, & Čokorilo, 2007; Georgiev, Aleksandrović, & Petrov, 2009; Badrić, 2011; Kraljević, Gadžić, & Vučković, 2013; Pelemiš, Pelemiš, Mitrović, & Džinović, 2014; Kerić & Ujsaši, 2014).

An interesting and considerable research of the differences in physical development and motor abilities of 4th grade elementary school students in three different generations (1983/84, 1994/95 and 2005/06) was carried out by Jovanović and Jovanović (2008). The total sample consisted of 700 pupils (331 boys and 369 girls), and the authors concluded that boys of the 1983/84 generation were better in all the tests except for the flexibility test and the speed of alternative movements. In the 1994/95 generation, boys were more successful in all tests except for the flexibility test. The same results were repeated for the 2005/06 generation, where girls did better only on the flexibility tests.

It is a fact that motor abilities are an important and complex system which is manifested by movements in everyday activities as well as in more complex situations which are characteristic for various physical activities. The individuality of the changes incites a special interest, especially considering the demands on the organism which are imposed by physical activities (Mišigoj-Duraković, 2008). The level of motor abilities increases with the age of the students - with girls it reaches a plateau at about 14 years of age, and somewhat later with boys. Biologically, more mature boys react better to physical training than girls (Malina, 1994). It is necessary for all those who guide children towards physical activity to know the laws of growth and development, as well as the morphological and functional-physiological changes which occur in childhood. Namely, it is known that physical activity, if well chosen and dosed, can be a stimulating factor in growth and development, although at an excessive a/and age an inappropriate physical activity can have a negative impact (Mišigoj-Duraković, 2008).

Along with the mentioned understanding which every P.E. teacher should have in order to contribute to an adequate teaching process, it should be said that this information is also important during the evaluating of student achievements in physical education. In accordance with the Rulebook on grading students in elementary education (Off. Gazette of the RS, no. 72/09, 52/11 and 55/13), grading the subject of P.E. is carried out based on the abilities of students, the degree of expertise and skills. It is very important for the P.E. teacher in that context to also bear in mind gender differences in the scale of the displayed motor abilities of the students.

The main aim of this research is to establish the differences in motor abilities between male and female 6th grade elementary school students.

METHOD

Sample

The sample of respondents in this research was a group of 124 students of the 6th grade attending the elementary schools Jovo Kursula and Čibukovački partizani from Kraljevo. Of this number, 66 respondents were male, average age 12.91 years (±0.29), and 58 respondents were female, average age 12.86 (±0.40).

Variables

For the sample of variables which assess motor abilities, applied was a set of 12 variables which assessed the following motor abilities: precision, balance, coordination, flexibility and strength.

The tests for assessing motor abilities are separated from the battery which consists of 110 tests (Gredelj, Metikoš, Hošek and Momirović, 1975):

a) For assessing precision (striking the horizontal target with the hand – GHCR and striking the vertical aim with the foot - GVCN)
b) For assessing balance (standing on one foot alongside the balance bench - SJUK and standing on one foot with closed eyes - SZOJ)
c) For assessing coordination (a figure eight with bending - OSAS and drumming with the hands and the feet - BURN)
d) For assessing speed (tapping with the hand - TAPR and tapping with the foot - TAPN)
e) For assessing flexibility (deep bend on the bench - DPKL and stick exercises - ISKP)
f) For assessing strength (standing long jump - SUDM and chin-ups - VISZ).

Method of data processing

The measuring results are statistically processed and the basic central and dispersion parameters are calculated. The normality of distribution was assessed with Skewness and Kurtosis. Along with descriptive statistics, also applied was a canonical discriminant analysis in order to determine the differences in the motor abilities of the respondents.

RESULTS

Table 1. *Basic physical features of the respondents*

Physical features	Boys	Girls
	AS (SD)	AS (SD)
Body height	158.07 (7.02)	159.03 (7.22)
Body weight	50.92 (10.73)	50.30 (8.84)

The average values of body weight and height of the respondents (Table 1) are within the expected ranges and values for the tested age (Gajević, 2009).

Table 2. *Central and dispersion parameters of the variables for assessing the motor abilities of boys*

Variable	AS (SD)	Min - Max	Range	Skewness	Kurtosis
GHCR	16.55 (5.27)	5 - 36	31	0.75	1.68
GVCN	11.73 (3.71)	3 - 20	17	0.18	-0.45
SJUK	8.98 (5.31)	3.10 – 34.30	31.20	2.39	7.69
SZOJ	18.81 (12.75)	5.10 – 61.20	56.10	1.34	1.15
OSAS	58.36 (4.69)	49.80 – 71.20	21.40	0.51	0.14
BURN	6.38 (2.97)	0 - 15	15	0.68	0.39
TAPR	35.82 (4.54)	25 - 48	23	-0.11	0.14
TAPN	29.32 (3.19)	22 - 35	13	-0.04	-0.70
ISKP	85.20 (15.79)	52 - 125	72	0.23	-0.67
DPKL	34.02 (6.91)	17 – 45	28	-0.46	-0.26
SUDM	164.86 (25.01)	94 - 212	118	-0.70	0.17
VISZ	26.47 (18.44)	1.10 – 85.90	84.80	0.59	0.28

AS – arithmetic mean, SD – standard deviation, Min – minimum result, Max – maximum result, Range – difference between the minimum and maximum results, Skewness – parameter of asymmetry of the distribution results, Kurtosis – parameter of the tailedness of the results compared to normal distribution

Based on the results from Table 2, it can be seen that the distribution of results by the majority of the assessed variables does not significantly deviate from normal distribution. The exception is the variable for assessing balance (SJUK) where distribution is of an exceptionally positive direction which points to the fact that the majority of respondents had weaker results. At the same time, the value of the coefficient of roundness for this variable is somewhat higher and indicates some extreme results which significantly deviate from the average. The values of the standard deviation and the range of results point to the fact that a somewhat greater heterogeneousness is also evident in variables for assessing statistical and explosive strength (VISZ and SUDM), as well as the flexibility of the shoulder area (ISKP) and balance (SZOJ).

These kinds of results are to be expected in the tested age (high school age) as the biological development of students is intense, unequal and heterochronous, which is also reflected on the motor abilities. There are periods when some abilities develop more quickly (sensitive stages of development), in order to be followed by periods of slower development (Radovanović and associates, 2009).

Table 3. *Central and dispersion parameters of variables for assessing the motor abilities of girls.*

Variable	AS (SD)	Min - Max	Range	Skewness	Kurtosis
GHCR	14.21 (5.36)	3 - 26	23	0.10	-0.68
GVCN	9.28 (3.96)	2 - 22	20	0.60	0.87
SJUK	8.81 (4.67)	3.30 – 27.20	23.90	1.67	3.44
SZOJ	24.35 (15.64)	3.50 – 76.10	72.60	1.08	1.12
OSAS	61.98 (4.07)	52.10 – 75.20	23.10	0.76	1.40
BURN	6.57 (2.92)	0 - 13	13	-0.15	-0.07
TAPR	36.02 (4.69)	25 - 50	25	-0.09	0.77
TAPN	29.64 (3.80)	21 - 38	17	-0.46	0.04
ISKP	74.79 (14.75)	48 - 110	62	0.36	-0.46
DPKL	38.79 (7.75)	20 – 52	32	-0.60	-0.08
SUDM	148.54 (19.34)	109 – 204.5	95.50	0.64	0.46
VISZ	15.29 (12.00)	1.30 – 63.80	62.50	2,00	5,28

AS – arithmetic mean SD – standard deviation, Min – minimum result, Max – maximum result, Range – difference between minimum and maximum results, Skewness – parameter of asymmetry of the distribution results, Kurtosis – parameter of the tailedness of the results compared to normal distribution

The results from Table 3 show that the majority of the variables have a normal distribution. The variables for assessing static strength (VISZ) and balance (SZOJ) have a somewhat weaker distribution. Based on the values of the standard deviation and the range of the results, the greatest heterogeneousness

was noticed in the variables of the standing long jump (SUDM), standing on one foot with closed eyes (SZOJ) and stick exercises (ISKP). These values show there are greater individual differences in displaying explosive strength, balance and flexibility in girls, which is to be expected for the tested age (Radovanović and associates, 2009).

Tabela 4. . *The significance of an isolated discriminative function*

Function	Eigenvalue	Wilks' Lambda	Chi-Sq	Canonical Corr.	df	p
1	1.23	0.45	93.23	.74	12.00	0.00

Eigenvalue – R-squared or coefficient of determination, Wilks' Lambda - Wilks' lambda distribution test, Chi-Sq – Bartlett's chi-square test, Canonical R – coefficient of canonical correlation, df – degrees of freedom, p – level of relevance

The results of the applied canonical discriminative analysis show that there are significant differences in the tested motor abilities between 6th grade elementary school boys and girls, which are shown by a significant extracted discriminative function (Table 4). The table shows that the separated statistically significant functions at the degree of a statistical assessment Sig.=.000 is of a higher intensity (CR=.74). The discriminative strength of the variables (Wilks' Lambda=.45) is moderate and indicates that these are differences between the group of respondents. The obtained results speak in favor of the fact that motor abilities also significantly contribute to discrimination regarding the gender of the respondents.

Table 5. *Structure of the isolated discriminative function of student motor abilities*

Variable	Function
	1
GHCR	-.22
GVCN	-.44
SJUK	-.01
SZOJ	.42
OSAS	.54
BURN	.00
TAPR	.15
TAPN	-.05
ISKP	-.36
DPKL	.79
SUDM	-.27
VISZ	-.38

Table 5 shows the matrix of the structure of the identified discriminative function from which it is obvious that the coefficients range from -.44 to .79. The greatest contribution to the discriminative function is given by the deep bend on the bench (DPKL=.79) and the figure eight with bending (OSAS=.54), and the least by the drumming of hands and feet (BURN=.00).

The obtained statistical data on the relative size and position of the group centroid in a discriminative area ranges from .03 to 1.18 (Table 6), which points to the fact that the analyzed groups were statistically significantly different regarding the canonical discriminative function.

Tabela 6. *Centroidi grupa*

Pol	**Function**
	1
F	1.18
M	-1.03

Considering the position of the group centroids and the coefficients of the discriminative function of motor abilities of boys and girls, and the forerunner of the group centroids, it is obvious that boys realized better results in a number of motor tests: both tests for assessing precision (GHCR and GVCN), tests for assessing strength (SUDM and VISZ), the speed of alternative movements of legs (TAPN), one test for assessing balance (SJUK) and the coordination of the entire body (OSAS). Here we should also mention that along with the fact that the forerunner in the structure matrix of the isolated function for this test is positive and only ostensibly corresponds with a better result of the girls, the enhanced result represents a smaller value as the test is constructed in such a way that the respondents should carry out a motor task in as short a time as possible. On the other hand, girls were more successful at the following tests: the flexibility of the lower extremities (DPKL) and the flexibility of the shoulder area (ISKP), balance (SZOJ) and the speed of alternative arm movements (TAPR). For the stick exercise test (ISKP) the same is valid as for the coordination test (OSAS) which shows better results for boys, but in this case, by the same analogy, the girls have better test results. There were no differences established between the genders at one coordination test (BURN). The success of discrimination was also presented via the value of the total percentile amounting to 85.5%, which represents a percent of the correctly classified respondents in the group.

DISCUSSION

Motor abilities are a very important factor in the proper growth and development of children. In several researches dealing with the motor abilities

of elementary school children, the authors came to the conclusion that there are differences between boys and girls in various age periods (Gelemanović, Svoboda, & Tomas, 2006; Mladineo, 2006; Georgiev, Aleksandrović, & Petrov, 2009; Badrić, 2011; Kraljević, Gadžić, & Vučković, 2013; Pelemiš, Pelemiš, Mitrović, & Džinović, 2014; Kerić & Ujsaši, 2014).

Adolescence is a specific period which to a significant extent coincides with the so called sensitive period for the developing of a large number of motor abilities (Balyi & Way, 2005). A current research was carried out with the aim to establish the differences in motor abilities between boys and girls in the adolescent age (the 6th grade of elementary school). The conclusions reached are important in the context of evaluating the achievement of pupils in physical education, as P.E. teachers should also have in mind gender differences in displaying the motor abilities of students.

The results obtained point to the fact that boys were more successful in tests for assessing strength (standing long jump and chin-ups), precision (aiming for the horizontal target with the hands and aiming for the vertical target with the feet), the coordination of the entire body (the figure eight with bending), the speed of alternative foot movements (foot tapping). Girls were more dominant in displaying flexibility (a deep bend on the bench and stick exercises), a test of balance (standing on one foot with eyes closed) and the speed of alternative hand movements (hand tapping).

The research results largely correspond with the results of Kraljević, Gadžić and Vučković (2013) whereupon the authors established that boys have significantly better results in strength (standing long jump and chin-ups), precision (aiming for the horizontal target with the hands and aiming for the vertical target with the feet), coordination of the entire body (the figure eight with bending), while the girls were more convincing at the tests for assessing flexibility (deep bend on the bench and stick exercises).

A significant congruence is also evident in the results by Mikalački and Čokorilo (2007), where the authors concluded that boys were more dominant in displaying strength (standing long jump, chin-ups and raising the trunk), coordination of the entire body (slalom with three medicine balls and the backwards polygon), and the girls in flexibility (bending while seated).

Similar results were noted by Krsmanović and Radosav (2008), who established a statistically significant difference in the 20m run, backwards polygon, spread leg bending, standing long jump, pull-ups and slalom with three medicine balls. In all the tests except for the leg bending, the boys showed better results than the girls.

The results obtained in this research are largely concurrent with the research by Badrić (2011) who determined differences on the level of motor abilities in respondents of the same age. The mentioned differences showed that boys were more successful with tests for assessing explosive strength

(standing long jump, throwing medicine balls while lying on the back and a 20m sprint with a running start), the coordination of the entire body (the backwards polygon, sidestepping and slalom running), while girls were more convincing at tests for assessing flexibility (spread leg bending, bending on the bench and hand thrust behind the back upwards). In the given research, there were no significant differences in the tests of the speed of alternative movements (hand tapping, foot tapping and feet tapping against the wall), while somewhat surprising are the results of the tests of repetitive strength where girls had better results in two of a total of three applied tests (squats and raising the trunk from the back).

Taking into consideration the results of current, as well as the earlier mentioned researches, the differences in the displayed motor abilities of the respondents considering the gender are evident. Boys have more stressed abilities of strength, precision and coordination, while girls dominate in flexibility. It is interesting that girls were better at the test of the speed of alternating arms movements (hand tapping), while as expected, boys had better results on the tests for assessing the speed of alternative foot movements (foot tapping). On one test of balance, boys had the better results, and girls on the other, so that it can be viewed as a congruent result in this ability. The obtained results mostly reflect the natural pace of the development of motor abilities considering the gender and indicate compatibility with the sensitive periods for displaying certain abilities compared to the gender of the respondents.

CONCLUSION

In researching the differences between the motor abilities of the 6th grade male and female students, it was concluded that there were some statistically significant differences in the tested sample. Thus, based on the obtained results it can be concluded that motor abilities differ significantly in the sample. Along with these facts, it should be stressed that the research has certain limitations. Primarily, this pertains to the size of the sample and the number of applicable tests for assessing motor abilities.

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