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Are We Doing the Right Thing? Motor Assessment in Adapted Physical Education

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ABSTRACT

In the Croatian high school system, students can attend the same school, but, based on their cognitive abilities, they may be assigned to a regular or an adapted study program. The basic assumption is that students differ predominantly based on their cognitive rather than motor abilities. Therefore, their motor abilities are evaluated through the same battery of motor tests. The aim of this study is to evaluate the metric characteristics of the tests used to evaluate motor abilities of high school students enrolled in an adapted study program, and to compare their results with the results of students engaged in the standard curriculum. The sample consisted of 28 high school students, 14 students in the adapted teaching program (experimental group P) and 14 students in the regular teaching program (control group R). The motor tests were used to assess their muscular endurance, explosive strength, coordination, and flexibility. Normality of distribution was checked by using the Kolmogorov–Smirnov test (KS), while the data processing also included factor analysis, the intraclass correlation coefficient and the t-test for independent samples. The level of statistical significance was set at $p<0.05$. The obtained data confirmed the homogeneity, sensitivity, and factorial validity of the tests. The results of the t-test for independent samples clearly showed a difference between the arithmetic means of the groups. The students of the R group had better results in all tests than those of the P group. The results suggest the possibility of a significantly different level of motor abilities between high school students attending regular schools according to an adapted or standard study program. All together this points to the need of an individual interpretation of a student's results rather than a comparison with the set standards. Also, the validation of customized motor tests for a specific population should be considered.

Key words: *motor testing, physical education, individualized teaching, developmental disability*

Introduction

A child with developmental disabilities begins his education after undergoing specific diagnostics. Based on his real possibilities, in agreement with the doctor, the parents may decide whether the child will enrol a regular school (throughout an adapted or regular study program with the help of an assistant) or join an institution with a special educational program. If the child's abilities are satisfying, the enrolment of a regular school would be better because his peers and the whole ambience may help him improve his expressions and everyday life participation significantly, especially in subjects such as art, music and Physical Education[1]. Through the inclusion in a regular school, a child with developmental disability is given equal opportunities in learning basic values and developing his cognitive, physical, social, and emotional abilities.

After their compulsory primary education, adolescents with developmental disabilities who are auto sufficient may attend regular secondary schools, according to an adapted educational program. The adapted curriculum of Physical Education classes encompasses "students with visual and/or hearing impairments, with voice and speech disorders, with specific learning difficulties, with physical disabilities, chronic diseases, mental retardation and students with behavioural disorders caused by an organic or progressive psychopathological condition"[2]. In Croatia, 20–25% of children attend one of the forms of adapted curricula[3]. The most common difficulties of high school students attending an adapted study program are related to less developed intellectual, graphomotor, reading and learning abilities as well as mild emotional difficulties, motor slowness and difficul-

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ty coping in new situations. The adapted program is not standardized but individualized according to the student's capabilities. In Physical Education classes, it is necessary to provide all students with the opportunity to participate in physical activities and make as much progress as possible, in accordance with their abilities. The benefits of physical activities for people with disabilities have been repeatedly confirmed[4]. It improves cognitive performance, promotes musculoskeletal and cardiometabolic wellness, and effectively aids in the prevention and treatment of a variety of health conditions, including cardiovascular disease, diabetes and other metabolic disorders, neurological diseases, sarcopenia, osteoporosis, and cancer[4–7]. All of the above is especially true for the population of adolescents who already have certain health problems, and whose health is imperative both for themselves and for society as a whole. In addition, recent findings suggest the possibility of facilitating later cognitive development through early learning of basic motor patterns such as gait, in children with intellectual disabilities[8].

The adaptation of Physical Education classes is done based on objectively measured student`s motor abilities, taking into account their health condition and diagnoses. The assessment of motor abilities is an integral part of Physical Education classes. The motor abilities of secondary school students attending a regular or adapted study program are evaluated through the same battery of motor tests. The main reason lies in the assumption that since they are all physically auto sufficient, they differ predominantly based on their cognitive rather than motor abilities. Relationships between motor (especially fine motor skills, bilateral body coordination and timed performance in movements) and cognitive development have previously been proved in children aged 4–15 years[9]. Although this has rarely been studied on children with intellectual disabilities, and the results are contradictory[8]. still the question arises as to whether all the tests used to estimate motor abilities of secondary school students are valid for the population of students with a global lower level of cognitive development, attending an adapted study program. Metric characteristics of the tests used to assess motor abilities in adolescents attending an adapted study program due to specific degrees of disability have been insufficiently investigated and exploring the possibility of individualized (adapted) motor testing for these students may lead to a higher quality of Physical Education. The aim of this study was to evaluate the metric characteristics of the tests used to assess motor abilities of high school students attending an adapted study program, and to compare their results with the results of students engaged in a standard program.

Material and methods

Participants

The sample consists of 28 Croatian high school students, 15.79 ± 1.19 years old, divided into two groups. The experimental group consists of 14 students attending an adapted teaching program (8 girls and 6 boys – group A) while the control group consists of students attending a regular curriculum (8 girls and 6 boys – group R). Students of the A group most often have the following difficulties: unevenly developed intellectual abilities, organically conditioned CNS dysfunction, mild emotional difficulties, present dysgraphia, graphomotor skills less developed, difficulties in concentrating and learning, specific reading difficulties (dyslexia), global intellectual functioning below average, hearing impairment, motor slowness, specific learning and computational difficulties, damage to organs and organ systems, mild intellectual difficulty, difficulty coping in new situations and difficulties with the respiratory system (asthma, rhinitis).

Procedures

Participants motor abilities were evaluated by means of standardized motor tests usually used in regular Physical Education classes for high school students. The motor tests were as follows: throwing a medicine ball (1 kg) from a supine position, standing long jump, polygon with a turn, sit-ups, sit and reach flexibility test and squats in 1 minute[10].

Throwing a medicine ball (1 kg) from a supine position (MESBML) – this test was used to estimate the student's throwing performance. The student threw the medicine ball from a supine position, with straight arms as far as possible three times. The result of all three measurements (in cm) was recorded and the arithmetic mean of three repetitions was used for further statistical processing[10].

Standing long jump test (MESSDM) – the test estimated the student's jumping performance. The subject attempts to jump as far as possible, landing on both feet without falling three times. The covered distance was recorded (in cm). The arithmetic mean of three repetitions was used for further statistical processing[10].

Polygon with a turn test (MKOPLO) – the test was used to assess the student`s coordination. Four lines were marked on the floor (start, end and two auxiliary lines). The lines were 3 m apart. A frame of a Swedish box was placed on the second auxiliary line. The student was in a four-legged position, facing the direction of movement with his palms on the starting line. At the examiner's signal he moved as fast as he could to the first auxiliary line. After crossing the auxiliary line, he turned 180 degrees and continued to move backwards. Then he slipped through the frame of the Swedish box. The task was completed when he crossed the finish line with all parts of his body. Time was measured in seconds. The task was performed 3 times, and the arithmetic mean of three repetitions was used for further statistical processing[10].

Sit ups (MRSPTK) – the test evaluated the student`s endurance of the abdominal muscles (repetitive strength). Students lied in a supine position with the knee bended at 90° and palm on their tights. They performed as much sit ups as they could in 1 minute. The test was performed three times and the arithmetic mean was used for further

analysis. This test is usually conducted only once in school[10]. For the purposes of this research, it was conducted three times with a rest in between. This allowed the conduction of the necessary statistical analyses, especially intercorrelation and factor analysis.

Sit and reach flexibility test (MFLPRU) – the test evaluated the student`s lower back and hamstring flexibility. The students bend forward from a sitting position with straight legs three times. The contact distance in cm was recorded. The test was performed three times and the arithmetic mean was used for further analysis[10].

Squats (MRSCUC) – the test was used to evaluate the student`s lower extremity muscles endurance. Students performed as many squats as they could in one minute for three times (with rest in between). The test was performed three times and the arithmetic mean was used for further analysis. This test is also usually conducted only once in school[10], but in this study it was conducted three times in order to make possible the intercorrelation and factor analysis needed to evaluate its homogeneity and factorial validity.

Data analysis

Basic central and dispersive parameters were calculated for all variables. Measures of asymmetry (skewness) and elongation (kurtosis) of the distribution were used to check the sensitivity of the variables. The normality of the distribution was checked using the Kolmogorov – Smirnov (KS) test. The factorial analysis was used to check for factorial validity. The intercorrelation coefficient was used as an indicator of test homogeneity. The T-test for independent samples tested the possibility of a test to distinguish the degree of motor abilities of students attending the regular curriculum and students attending the adapted study program. The level of statistical significance was set at $p < 0.05$.

Results

Descriptive statistics for all variables can be found in Table 1 (group A) and 2 (group R). The results of the Kolmogorov-Smirnov test for both groups indicate a normal distribution of results (Max D). The test for asymmetry of the distribution (Skewness and Kurtosis) for both groups indicate a significance of $p < 0.05$, which shows that the results are normally distributed.

The correlation matrix for both groups is shown in Table 3 (group A) and 4 (group R). It is to be expected that each test measures its own dimension (motor ability), which indicates that the correlation should be as small as possible, or that it does not exist at all. Reading the results from the Tables, it can be seen that in certain tests (MESBML and MESSDM) the correlation is at a significant level, which could be assumed given that both tests evaluate the student's power.

TABLE 1

DESCRIPTIVE STATISTICS FOR GROUP A

Variable	Valid N	Mean	Min	Max	St.Dev.	Skewness	Kurtosis	Max D	K–S p
MESBML	14	6.56	3.50	9.07	1.82	–0.13	–1.11	0.11	p>.20
MESSDM	14	119.29	63.33	170.00	35.23	–0.08	–1.34	0.17	p>.20
MKOPLO	14	14.51	8.05	25.26	5.11	0.66	–0.14	0.18	p>.20
MRSPTK	14	37.52	18.33	81.67	16.82	1.38	2.55	0.14	p>.20
MFLPRU	14	43.21	21.67	66.67	12.35	–0.19	–0.09	0.14	p>.20
MRSCUC	14	35.67	20.33	56.00	9.52	0.47	0.15	0.10	p>.20

St. Dev – standard deviation, K–S p – p value of the Kolmogorov – Smirnov test, MESBML – throwing a medicine ball (1 kg) from a supine position test, MESSDM – standing long jump test, MKOPLO – polygon with a turn test, MRSPTK – sit ups, MFLPRU – sit and reach flexibility test, MRSCUC – squats

TABLE 2

DESCRIPTIVE STATISTICS FOR GROUP R

Variable	Valid N	Mean	Min	Max	St.Dev.	Skewness	Kurtosis	Max D	K–S p
MESBML	14	8.85	6.43	13.07	2.08	0.90	–0.39	0.21	p>.20
MESSDM	14	178.43	134.00	234.00	34.39	0.27	–1.36	0.16	p>.20
MKOPLO	14	8.43	6.12	12.29	1.96	0.69	–0.53	0.17	p>.20
MRSPTK	14	70.40	43.67	95.33	12.94	0.12	0.84	0.19	p>.20
MFLPRU	14	62.81	43.67	73.00	8.90	–1.08	0.60	0.19	p>.20
MRSCUC	14	52.93	46.00	65.00	5.49	1.01	0.55	0.14	p>.20

St. Dev – standard deviation, K–S p – p value of the Kolmogorov – Smirnov test, MESBML – throwing a medicine ball (1 kg) from a supine position test, MESSDM – standing long jump test, MKOPLO – polygon with a turn test, MRSPTK – sit ups, MFLPRU – sit and reach flexibility test, MRSCUC – squats

TABLE 3

CORRELATION ANALYSIS FOR GROUP A

Variable	Means	Std. Dev.	MESBML	MESSDM	MKOPLO	MRSPTK	MFLPRU	MRSCUC
MESBML	6.56	1.82	1.00	0.84	–0.79	0.64	0.12	0.60
MESSDM	119.29	35.23	0.84	1.00	–0.88	0.67	0.30	0.57
MKOPLO	14.51	5.11	–0.79	–0.88	1.00	–0.70	–0.43	–0.57
MRSPTK	37.52	16.82	0.64	0.67	–0.70	1.00	0.42	0.47
MFLPRU	43.21	12.35	0.12	0.30	–0.43	0.42	1.00	0.17
MRSCUC	35.67	9.52	0.60	0.57	–0.57	0.47	0.17	1.00

St. Dev – standard deviation, MESBML – throwing a medicine ball (1 kg) from a supine position test, MESSDM – standing long jump test, MKOPLO – polygon with a turn test, MRSPTK – sit ups, MFLPRU – sit and reach flexibility test, MRSCUC – squats

TABLE 4

CORRELATION ANALYSIS FOR GROUP R

Variable	Means	Std. Dev.	MESBML	MESSDM	MKOPLO	MRSPTK	MFLPRU	MRSCUC
MESBML	8.85	2.08	1.00	0.88	–0.49	0.33	–0.48	0.57
MESSDM	178.43	34.39	0.88	1.00	–0.55	0.23	–0.63	0.63
MKOPLO	8.43	1.96	–0.49	–0.55	1.00	–0.39	0.16	–0.24
MRSPTK	70.40	12.94	0.33	0.23	–0.39	1.00	–0.11	0.53
MFLPRU	62.81	8.90	–0.48	–0.63	0.16	–0.11	1.00	–0.33
MRSCUC	52.93	5.49	0.57	0.63	–0.24	0.53	–0.33	1.00

St. Dev – standard deviation, MESBML – throwing a medicine ball (1 kg) from a supine position test, MESSDM – standing long jump test, MKOPLO – polygon with a turn test, MRSPTK – sit ups, MFLPRU – sit and reach flexibility test, MRSCUC – squats

TABLE 5

CORRELATION ANALYSIS BETWEEN REPETITIONS FOR THE MESBML TEST FOR GROUP A

Variable	Means	Std. Dev.	MESBML 1	MESBML 2	MESBML 3
MESBML 1	6.257143	1.511858	1.000000	0.659930	0.708484
MESBML 2	6.685714	2.190489	0.659930	1.000000	0.980784
MESBML 3	6.728571	2.146349	0.708484	0.980784	1.000000

St. Dev – standard deviation, MESBML – throwing a medicine ball (1 kg) from a supine position test

TABLE 6

CORRELATION ANALYSIS BETWEEN REPETITIONS FOR THE MESSDM TEST FOR GROUP A

Variable	Means	Std. Dev	MESSDM 1	MESSDM 2	MESSDM 3
MESSDM 1	116.8571	31.44680	1.000000	0.978819	0.936787
MESSDM 2	122.7857	38.26462	0.978819	1.000000	0.936812
MESSDM 3	118.2143	37.76685	0.936787	0.936812	1.000000

St. Dev – standard deviation, MESSDM – standing long jump test

TABLE 7

CORRELATION ANALYSIS BETWEEN REPETITIONS FOR THE MKOPLO TEST FOR GROUP A

Variable	Means	Std. Dev.	MKOPLO 1	MKOPLO 2	MKOPLO 3
MKOPLO 1	15.28000	6.265679	1.000000	0.942413	0.951608
MKOPLO 2	14.07714	4.363004	0.942413	1.000000	0.987166
MKOPLO 3	14.17429	4.921882	0.951608	0.987166	1.000000

St. Dev – standard deviation, MKOPLO – polygon with a turn test

The homogeneity of the results between the iterations (repetitions) of each test is shown in Tables 5 – 10 for group A and in Tables 11 – 16 for group R. The intercorrelation coefficient was used as an indicator of test homogeneity.

The results of the factor analysis are shown in Table 17 (for group A) and 18 (for group R). It is clear from the results that individual tests reveal a significant part of the total variance for both students' groups.

TABLE 8

CORRELATION ANALYSIS BETWEEN REPETITIONS FOR THE MRSPTK TEST FOR GROUP A

Variable	Means	Std. Dev.	MRSPTK 1	MRSPTK 2	MRSPTK 3
MRSPTK 1	35.35714	17.53505	1.000000	0.880657	0.909530
MRSPTK 2	37.71429	17.10793	0.880657	1.000000	0.979786
MRSPTK 3	39.50000	17.16324	0.909530	0.979786	1.000000

St. Dev – standard deviation, MRSPTK – sit ups

TABLE 9

CORRELATION ANALYSIS BETWEEN REPETITIONS FOR THE MFLPRU TEST FOR GROUP A

Variable	Means	Std. Dev.	MFLPRU 1	MFLPRU 2	MFLPRU 3
MFLPRU 1	40.42857	11.97892	1.000000	0.940470	0.935246
MFLPRU 2	43.35714	12.28262	0.940470	1.000000	0.982727
MFLPRU 3	45.85714	13.38114	0.935246	0.982727	1.000000

St. Dev – standard deviation. MFLPRU – sit and reach flexibility test

TABLE 10

CORRELATION ANALYSIS BETWEEN REPETITIONS FOR THE MRSCUC TEST FOR GROUP A

Variable	Means	Std. Dev.	MRSCUC 1	MRSCUC 2	MRSCUC 3
MRSCUC 1	34.28571	10.34355	1.000000	0.146282	0.811989
MRSCUC 2	36.64286	14.66344	0.146282	1.000000	0.494609
MRSCUC 3	38.07143	10.69482	0.811989	0.494609	1.000000

St. Dev – standard deviation, MRSCUC – squats

TABLE 11

CORRELATION ANALYSIS BETWEEN REPETITIONS FOR THE MESBML TEST FOR GROUP R

Variable	Means	Std. Dev.	MESBML 1	MESBML 2	MESBML 3
MESBML 1	8.500000	2.234692	1.000000	0.939591	0.965444
MESBML 2	9.007143	2.042421	0.939591	1.000000	0.982917
MESBML 3	9.057143	2.044774	0.965444	0.982917	1.000000

St. Dev – standard deviation. MESBML – throwing a medicine ball (1 kg) from a supine position test

TABLE 12

CORRELATION ANALYSIS BETWEEN REPETITIONS FOR THE MESSDM TEST FOR GROUP R

Variable	Means	Std. Dev.	MESSDM 1	MESSDM 2	MESSDM 3
MESSDM 1	174.7143	36.10333	1.000000	0.982602	0.963102
MESSDM 2	179.9286	32.56819	0.982602	1.000000	0.950921
MESSDM 3	180.6429	35.71384	0.963102	0.950921	1.000000

St. Dev – standard deviation. MESSDM – standing long jump test

TABLE 13

CORRELATION ANALYSIS BETWEEN REPETITIONS FOR THE MKOPLO TEST FOR GROUP R

Variable	Means	Std. Dev.	MKOPLO 1	MKOPLO 2	MKOPLO 3
MKOPLO 1	9.099286	1.953474	1.000000	0.619923	0.590097
MKOPLO 2	8.118571	2.429327	0.619923	1.000000	0.954365
MKOPLO 3	8.066429	2.095852	0.590097	0.954365	1.000000

St. Dev – standard deviation, MKOPLO – polygon with a turn test

TABLE 14

CORRELATION ANALYSIS BETWEEN REPETITIONS FOR THE MRSPTK TEST FOR GROUP R

Variable	Means	Std. Dev.	MRSPTK 1	MRSPTK 2	MRSPTK 3
MRSPTK 1	68,57143	16,81901	1,00000	0,417970	0,709002
MRSPTK 2	70,78571	15,84142	0,417970	1,00000	0,851637
MRSPTK 3	71,85714	11,95412	0,709002	0,851637	1,000000

St. Dev – standard deviation, MRSPTK – sit ups

TABLE 15

CORRELATION ANALYSIS BETWEEN REPETITIONS FOR THE MFLPRU TEST FOR GROUP R

Variable	Means	Std. Dev.	MFLPRU 1	MFLPRU 2	MFLPRU 3
MFLPRU 1	58,85714	9,921671	1,000000	0,908499	0,797898
MFLPRU 2	63,85714	8,813077	0,908499	1,000000	0,954200
MFLPRU 3	65,71429	9,050530	0,797898	0,954200	1,000000

St. Dev – standard deviation, MFLPRU – sit and reach flexibility test

TABLE 16

CORRELATION ANALYSIS BETWEEN REPETITIONS FOR THE MRSCUC TEST FOR GROUP R

Variable	Means	Std. Dev.	MRSCUC 1	MRSCUC 2	MRSCUC 3
MRSCUC 1	48.07143	7.226706	1.000000	0.242498	0.428358
MRSCUC 2	55.64286	6.380344	0.242498	1.000000	0.875329
MRSCUC 3	55.07143	6.533515	0.428358	0.875329	1.000000

St. Dev – standard deviation, MRSCUC – squats

TABLE 17

FACTORIAL ANALYSIS BETWEEN REPETITIONS FOR GROUP A

Variable	Eigenvalue	% total variance	Cumulative eigenvalue	Cumulative %
MESBML	2.901751	96.72502	2.901751	96.72502
MESSDM	2.920921	97.36404	2.920921	97.36404
MKOPLO	2.847283	94.90944	2.847283	94.90944
MRSPTK	2.905788	96.85960	2.905788	96.85960
MFLPRU	2.020073	67.33576	2.020073	67.33576
MRSCUC	2.541146	84.70487	2.541146	84.70487

MESBML – throwing a medicine ball (1 kg) from a supine position test, MESSDM – standing long jump test, MKOPLO – polygon with a turn test, MRSPTK – sit ups, MFLPRU – sit and reach flexibility test, MRSCUC – squats

TABLE 18

FACTORIAL ANALYSIS BETWEEN REPETITIONS FOR GROUP R

Variable	Eigenvalue	% total variance	Cumulative eigenvalue	Cumulative %
MESBML	2.931142	97.70474	2.931142	97.70474
MESSDM	2.456912	81.89706	2.456912	81.89706
MKOPLO	2.334503	77.81677	2.334503	77.81677
MRSPTK	2.775314	92.51047	2.775314	92.51047
MFLPRU	2.084517	69.48389	2.084517	69.48389
MRSCUC	2.504895	83.49649	2.504895	83.49649

MESBML – throwing a medicine ball (1 kg) from a supine position test, MESSDM – standing long jump test, MKOPLO – polygon with a turn test, MRSPTK – sit ups, MFLPRU – sit and reach flexibility test, MRSCUC – squats.

TABLE 19

T-TEST FOR INDEPENDENT SAMPLES

Variable	Mean A	Mean R	t-value	df	P value	Valid N A	Valid N R	St. Dev A	St. Dev R	f-ration variances	P variances
MESBML	6.56	8.85	–3.11	26	0.004516	14	14	1.82	2.08	1.30	0.639578
MESSDM	119.29	178.43	–4.49	26	0.000128	14	14	35.23	34.39	1.05	0.932571
MKOPLO	14.51	8.43	4.16	26	0.000310	14	14	5.11	1.96	6.81	0.001477
MRSPTK	37.52	70.40	–5.80	26	0.000004	14	14	16.82	12.94	1.69	0.356470
MFLPRU	43.21	62.81	–4.82	26	0.000055	14	14	12.35	8.90	1.93	0.250005
MRSCUC	35.67	52.93	–5.88	26	0.000003	14	14	9.52	5.49	3.00	0.057352

A – group A. R – group R. St. Dev. – standard deviation. MESBML – throwing a medicine ball (1 kg) from a supine position test. MESSDM – standing long jump test. MKOPLO – polygon with a turn test. MRSPTK – sit ups. MFLPRU – sit and reach flexibility test. MRSCUC – squats.

Table 19 shows the results of the t-test for independent samples, which shows that there is a statistically significant difference between the arithmetic means of both groups for all investigated variables.

Discussion and Conclusion

The assessment of motor abilities is an integral part of Physical Education classes. However, when standard tests are used to evaluate motor abilities of different students` subgroups two things are of special concern: a) the validity of the used tests on a specific population; b) possible differences of the achieved results between groups. The aim of this study was to evaluate the metric characteristics of a battery of motor tests on a sample of high school students attending an adapted study program, and to compare their results with those of students attending a regular study program.

First, the normality of the distribution of the results achieved in all the performed motor tests, for the students enrolled in a regular and adapted study program was checked. The Kolmogorov-Smirnov test for both groups showed that the results are normally distributed, which was further confirmed by the Skewness and Kurtosis values ($p < 0.05$). The obtained data support the fact that the tests may well discriminate both student populations based on the achieved results.

After confirming that the results in the measured motor abilities were normally distributed in both the studied populations, possible relationship between each of the studied variables, separately for students attending the adapted and those attending the regular teaching program was checked by correlation analysis. Assuming that each test measures a specific dimension, there should be no significant correlation between the monitored variables. However, a positive correlation between the variables MESBML and MESSDM in both groups was registered ($r = 0.84$ for group A; $r = 0.88$ for group R – Tables 3 and 4). This was to be expected given the fact that both variables are used to estimate power, through a throwing or jumping task, therefore there is a certain predictive value of one test to another[11]. The lack of correlation between the remaining variables indicates that each test measures a separate ability (the one it was constructed for).

Homogeneity of the tests was checked using a correlation analysis that showed a significant correlation between the iterations (repetitions) of each test for both groups of subjects. In both students' groups, the used test measured the same dimension in each iteration, which is confirmed by means of a significantly high intercorrelation coefficient between iterations (0.66 – 0.99 for group A; 0.59 – 0.98 for group R) (Tables 5 – 16). The obtained data describe how the results achieved in each test depend on the same object of measurement or an identical combi-

nation of different objects of measurement that is constant through all the repetitions[11]. Therefore, each of the used motor tests measure the same dimension in all three repetitions, in both students' groups. This indicates that the tests normally used in practice have a satisfactory diagnostic value of the motor ability they measure in high school students, regardless of their different cognitive ability, on which basis they have been assigned to different study programs[12]. The students of the A group had motor slowness, and this may give a possible explanation on why they performed worse than students of the R group in the measured motor tests. Still, the results they achieved in different repetitions of the same test were highly correlated, indicating a good homogeneity of the test construct even when used on students with specific intellectual impairment and motor slowness.

Factorial analysis showed that the first main component for most of the tests used in group A covers over 84% of the total variance (except for the MFLPRU test where it covers 67.3% of variance. In group R, the first main component covers over 77% of the total variance in all the tests. This shows that the target dimension was measured in all the tests, in both student populations[13]. Their factorial validity justifies the use of the here checked motor tests in both groups of students, those attending an adapted or a regular study program. It should be emphasized that students of the A group, enrolled in this study had global intellectual functioning below average, mild CNS dysfunction, mild emotional difficulties, less developed graphomotor skills, difficulties in concentrating and learning, specific reading difficulties, hearing impairment, motor slowness, difficulty coping in new situations and difficulties with the respiratory system (asthma, rhinitis). However, they were all able to physically perform daily school obligations independently. They therefore performed the motor task of the test, but they did it at a lower level than their peers of the R group, which was confirmed through means of a t-test for independent samples. Results showed that the R group performed better than the A group in all motor tests ($p = 0{,}004 – 0{,}000$). This shows that despite the same chronological age, the level of their motor abilities varies considerably and should be therefore interpreted separately. Such large and statistically significant differences emphasize the fact that the usually used motor tests are more demanding for the students attending an adapted study program. A possible reason for this is the well-documented lower level of daily physical activity of adolescents with disabilities compared to their healthy peers[14,15]. Both, their cognitive status as well as possible less involvement in organized physical exercise may play a role in the significantly lower motor abilities of children attending an adapted study program[15,16]. Their current cognitive and motor abilities may affect the risk for developing more severe forms of dementia later in life[16], which highlight the importance of studying the motor status of students with disabilities but also planning possible strategies for their inclusion in regular physical exercise programs.

Within the conducted research, the distribution of test scores was normal for both populations. This actually points to the fact that students who attend classes according to an adapted program achieve a distribution of results similar to other students, but at lower absolute values. Based on that it is possible to assume that the tests that are regularly used in Croatian high schools are able to discriminate students with mild cognitive difficulties who attend an adapted study program, in a given motor ability[17]. However, as the distribution of their results occurs at lower values than those of their peers, it is not possible to compare their results with the norms of the so-called standard student population. Rather, their own earlier results should be taken in consideration in order to monitor the long-term trend of motor development, stagnation, or deterioration. Nevertheless, the fact that high school children of the same age but different cognitive abilities achieve different results in motor tests reopens the question of the extent to which the level of cognitive abilities affects a child's motor ability, and vice versa, which is certainly a matter for future research.

The results obtained in this study represent the basis for different approaches in measuring motor abilities (and thus potentially in their development) in high school students with mild intellectual disabilities. Metric characteristics of the tests used to assess motor abilities in high school students attending an adapted study program is still an under-explored area and every step in that direction shed more light on objective measurement tools leading to a higher quality of Physical Education classes. Despite the fact that they are physically capable individuals, their motor abilities still differ from their healthy peers, and this indicates the importance of approaching them individually even in the motor domain. A possible limit of this research is a relatively small sample and future research performed on a larger sample is needed, also taking in consideration possible factors that can affect motor performance such as the student's current health status or the level of concentration when performing the test.

The obtained results show good metric characteristics of the tests used to evaluate motor abilities of high school students attending an adapted or regular study program. Subject's motor abilities were evaluated by means of motor tests for high school students usually used in regular Physical Education classes. The observed variables had a satisfying sensitivity, homogeneity, and factorial validity. This indicates that these motor tests can be used in high school children attending regular study program as well as on those attending an adapted program based on global intellectual, emotional, and learning abilities below average and motor slowness. However, between groups comparison showed significantly lower results for students engaged in an adapted program than those from a regular one. The actual assumption that students enrolled in a standard high school but attending an adapted study program predominantly differ from their peers attending a regular program based on their cognitive rather than motor abilities, emphasize the importance of the present find-

ings. Although high school students enrolled in adapted study program of regular schools are physically capable and independent, their results in standard motor tests were significantly lower than those of their peers. Since different motor abilities correlate to a greater or lesser extent with cognitive abilities, there is a possibility that their motor slowness, difficulty to concentrate and couple in new situations, had to a certain extent influenced their ability to solve a given motor task. Overall, the results of the present study point out that the used motor tests may be implemented in the work with high school children enrolled in regular schools but with an adapted study program however the interpretation of their results should only rely on their earlier obtained results, rather than on given normative values. Future research should work on measuring a larger number of students attending regular schools according to adapted study programs, in order to precisely set expected values for this specific population of high school students.

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ČINIMO LI ISPRAVNU STVAR? PROCJENA MOTORIČKIH SPOSOBNOSTI KOD UČENIKA UKLJUČENIH U PRILAGOĐENI PROGRAM NASTAVE TJELESNE I ZDRAVSTVENE KULTURE

S A Ž E T A K

U školskom sustavu u Republici Hrvatskoj učenici su, temeljem svojih kognitivnih sposobnosti, raspoređeni u redoviti ili prilagođeni program tjelesne i zdravstvene kulture TZK. Osnovna je pretpostavka da se učenici razlikuju pretežno na temelju svojih kognitivnih, ali ne i na temelju svojih motoričkih sposobnosti. Stoga se njihove motoričke sposobnosti vrednuju kroz istu bateriju motoričkih testova. Cilj ovog istraživanja je utvrditi metričke karakteristike testova kojima se ocjenjuju motoričke sposobnosti srednjoškolaca iz prilagođenog programa te usporediti njihove rezultate s rezultatima studenata uključenih u redovitu nastavu TZK. Uzorak ispitanika čini 28 učenika srednjih škola; 14 učenika iz prilagođenog programa (eksperimentalna skupina) i 14 učenika iz redovitog programa (kontrolna skupina). Motorički testovi korišteni su za procjenu njihove mišićne izdržljivosti, eksplozivne snage, koordinacije i fleksibilnosti. Normalnost raspodjele provjerena je Kolmogorov-Smirnov testom (KS), dok je obrada podataka uključivala faktorsku analizu, koeficijent unutarklasne korelacije i t-test za nezavisne uzorke. Razina statističke značajnosti postavljena je na $p<0,05$. Dobiveni podaci potvrdili su homogenost, osjetljivost i faktorijalnu valjanost testova za obje promatrane grupe. Rezultati t-testa za neovisne uzorke jasno su pokazali razliku između aritmetičkih sredina skupina. Učenici iz eksperimentalne skupine imali su bolje rezultate na svim testovima od učenika kontrolne skupine. Rezultati upućuju na značajno različite rezultate motoričkih sposobnosti među srednjoškolcima koji pohađaju nastavu po prilagođenom ili standardnom programu. Ovo ukazuje na potrebu individualne interpretacije rezultata, a ne puke usporedbe s postavljenim standardima koji su temeljeni na rezultatima zdrave populacije. Također, treba razmotriti validaciju prilagođenih motoričkih testova za populaciju učenika uključenih u prilagođeni program nastave tjelesne i zdravstvene kulture.