

Evaluation of the Physical Fitness test in children and youth with intellectual disabilities in special Elementary and Secondary school classes

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Background. Earlier studies have demonstrated poor physical fitness outcomes and reduced level of physical activity in children and youth with intellectual disabilities compared with their peers within general population.

Objective. The main aim of this study was to examine how physical fitness developed over time in 4 groups of children and youths: those in upper elementary school classes, and those in special secondary school classes.

Design and Methods. From an initial sample of 129 participants, a group of elementary and secondary school students was grouped in 4 sub-samples, according to class levels. A transversal design was implemented (Cross-sectional), and Test of physical fitness in the four groups was evaluated by measuring different fitness components: explosive strength (jumping, throwing, pushing) running speed, agility, climbing and endurance.

Results. A mixed-effects analysis of variance point out on significant differences among examines groups. Elementary school students in both groups performed less well on all physical fitness measures than the secondary school students.

Conclusions. The differences in physical fitness outcomes between the groups were relatively constant over the time. Given that various physical fitness components are linked to different health outcomes, these consequences are matters of concern for both current health status and later health status in children and youth with intellectual disabilities.

Key Words: PF Test, Children/Youth, Intellectual disability, Motor Development

Introduction

In accordance with the previously established study design in this part of the study the thematic part “*motor development*” in Elementary and Secondary school participants relative to grades/classes was analyzed.

In the first part the basic descriptive statistical parameters (central and dispersive) measures of the Skewness and Kurtosis, relative to the observed variables are presented. Analysis of the within classes differences, relating to the acceptance or rejection of stated hypotheses, regarding the evaluation of estimated results and their application for further consideration, and the estimation of directions and methodological priorities of the data procession, are presented in the second part.

After that the characteristics and homogeneity of every group of the participants relative to the grade/class are defined, and the distance between them is estimated. Finally the graphical presentation of the established results is performed.

Analysis is elaborated on the battery of Physical Fitness Test (PFT), in order to evaluate the motor development in elementary and secondary school participants in 9 items:

(StBJ) standing broad jump, (2S7m) jumping on two feet a distance of 7m, (1S7m) jumping a distance of 7m on one foot, (TenB) throwing a tennis ball with one hand, (MedB) pushing a medicine ball with two hands as far as possible, (Clmb) climbing wall bars, (10X5) shuttle run, (R20m) running 20m as fast as possible, (RCT6) reduced Cooper test.

The sample of 129 participants was divided in 4 sub-samples, according to the grade/class of the Elementary school: (1) grades (V-VI) (n=37), (2) grades (VII-VIII) (n=40), and Secondary school (3) grades (I-II) (n=33), (4) grade (III-IV) (n=19).

Results and interpretation

BASIC STATISTIC PARAMETERS OF MOTOR DEVELOPMENT IN ELEMENTARY AND SECONDARY SCHOOL PARTICIPANTS RELATIVE TO THE GRADE/CLASS

Table 1-2. Basic statistics and measures of Skewness and Kurtosis of Physical Fitness in Upper Elementary school students [V-VI (n=37); VII-VIII (n=40)]

(PFT)	Group	Mean	SD	Min	Max	CV%	CI		Skw	Kur	p
StBJ	V-VI	101.65	23.37	27.0	150.0	22.99	93.86	109.44	-.70	1.40	.927
	VII-VIII	109.05	35.94	15.0	178.0	32.96	97.55	120.55	-.18	.33	.444
2S7m	V-VI	5.39	1.52	3.2	8.9	28.30	4.88	5.90	.59	-.42	.419
	VII-VIII	5.37	2.21	2.6	14.1	41.16	4.66	6.08	1.75	4.50	.507
1S7m	V-VI	5.01	1.61	2.8	8.8	32.16	4.47	5.54	1.01	-.01	.029
	VII-VIII	4.36	1.59	2.2	8.3	36.39	3.86	4.87	.61	-.56	.429
TenB	V-VI	13.15	4.75	2.7	23.0	36.14	11.57	14.74	.34	-.40	.502
	VII-VIII	11.75	5.86	3.2	26.4	49.90	9.88	13.63	.86	-.12	.175
MedB	V-VI	4.98	1.34	1.8	8.4	26.79	4.54	5.43	-.25	.69	.945
	VII-VIII	5.43	1.53	1.9	9.1	28.12	4.95	5.92	.24	.45	.957
Clmb	V-VI	20.70	7.80	7.7	50.0	37.71	18.10	23.30	1.04	3.69	.668
	VII-VIII	18.44	12.61	4.0	60.0	68.38	14.41	22.48	2.07	4.11	.022
10X5	V-VI	29.16	3.65	24.7	43.6	12.52	27.94	30.37	2.29	6.41	.044
	VII-VIII	32.95	19.08	22.7	114.5	57.90	26.85	39.06	3.81	13.41	.000
R20m	V-VI	7.45	3.51	4.3	17.5	47.17	6.28	8.62	1.67	2.02	.053
	VII-VIII	8.01	4.95	2.8	18.7	61.76	6.43	9.60	.89	-.58	.058
MCT6	V-VI	659.11	167.02	450.0	1080.0	25.34	603.41	714.81	1.21	1.15	.247
	VII-VIII	655.92	184.15	330.0	1010.0	28.07	597.02	714.83	.02	-.89	.251

Note: Values of *Skewness* and *Kurtosis* in interval up $-.04$ to $.04$ are not interpreted/discussed

Legend (Table 1-2 and Table 3-4): *Mean*-mean value; *SD*-standard deviation; *Min*-minimal value; *Max*-maximal value; *CV%* - coefficient of variation – *CI* (Confidence Interval)-range of mean; *Skw*-skewness; *Kur*-kurtosis; (*PFT*) variables: *StBJ*-standing broad jump (cm); *2S7m*-jumping on 2 feet (s); *1S7m*-Jumping on 1 foot (s); *TenB*-Throwing tennis ball (m); *MedB*-Putting medicine ball (m); *Clmb*-Climbing wall bars (s); *10X5*- Shuttle sprint (s); *R20m*-running 20m (s); *MCT6*-Reduced Cooper test (m).

Minimal (Min) and **maximal** (Max) values of the Physical Fitness Tests in Upper Elementary school students within grades (V-VI) and (VII-VIII) point out that the values are placed in the inspected interval.

Higher values of the **Variation coefficient** (CV%) point at the differences of both (V-VI) and (VII-VIII) grades according to: standing broad jump [StBJ - (22.99), (32.96)] jumping on two feet a distance of 7m [2S7m (28.30), (41.16)] jumping a distance of 7m on one foot [1S7m (32.16), (36.39)] throwing a tennis ball with one hand [TenB (36.14), (49.90)] pushing a medicine ball with two hands as far as possible [MedB (26.79), (28.12)] climbing wall bars, [Clmb (37.71), (68.38)] running 20m, as fast as possible [R20m (47.17), (61.76)] reduced Cooper test [MCT6 (25.34), (28.07)].

Lower values of **Skewness** (Skw) point out that the distribution is *positive asymmetrical*, which means that the curve of results distribution incline to low values, or has more low values relative to normal distribution at variables: standing broad jump [StBJ (-.70), (-.18)] pushing a medicine ball with two hands as far as possible [MedB (-.25)]. **Reduced Cooper test [MCT6 (.02)]** has normal distribution.

A higher values of the **Skewness** (skw) point out that the distribution is *negative asymmetrical*, which means that curve of the results distribution inclines to the high values, or has more high values relative to normal distribution in the following variables: jumping on two feet a distance of 7m (2S7m) (1.75), jumping a distance of 7m on one foot (1S7m) (.61), throwing a tennis ball with one hand (TenB) (.86), pushing a medicine ball with two hands as far as possible (MedB) (.24), climbing wall bars, (Clmb) (2.07), shuttle run (10X5) (3.81), running 20 m as fast as possible (R20m) (.89).

Higher values of the **Kurtosis** (Kur) point out that the curve is leptosome-type for these variables: standing broad jump [StBJ (1.40), (.33)] pushing a medicine ball with two hands as far as possible [MedB (.69), (.45)] climbing wall bars, [Clmb (3.69), (4.11)] shuttle run [10X5 (6.41), (13.41)] running 20m as fast as possible [R20m (2.02)] reduced Cooper test [MCT6 (1.15)] **jumping on two feet a distance of 7m [2S7m (4.50)]**.

Negative values of **Kurtosis** (kur) point on plato-type curve of distribution at these variables: jumping on two feet a distance of 7m [S7m (-.42)], throwing a tennis ball with one hand [TenB (-.40), (-.12)] **jumping a distance of 7m on one foot [1S7m (-.56)] running 20m as fast as possible [R20m (-.58)], reduced Cooper test [MCT6 (-.89)]**.

Distribution values are mainly placed in the range of normal distribution (p) in these variables: standing broad jump [StBJ (.93), (.44)] jumping on two feet a distance of 7m [2S7m (.42), (.51)] throwing a tennis ball with one hand [TenB (.50) (.17)], **jumping a distance of 7m on one foot [1S7m (.43)]** pushing a medicine ball with two hands as far as possible [MedB (.94), (.96)] climbing wall bars, [Clmb (.67)], reduced Cooper test [MCT6 (.25), (.25)].

The values distribution declines from the normal distribution (p) in these variables: jumping a distance of 7m on one foot [1S7m (.03)], shuttle run [10X5 (.04), (.00)] climbing wall bars, [Clmb (.02)] running 20m as fast as possible [R20m (.05), (.06)].

Table 3-4. Basic statistics and measures of Skewness and Kurtosis of Physical Fitness in Secondary school students [I-II (n=33); III-IV (n=19)]

(PFT)	Group	Mean	SD	Min	Max	CV%	CI		Skw	Kur	p
StBJ	I-II	135.39	40.86	69.0	205.0	30.18	120.90	149.88	-.17	-1.20	.932
	III-IV	130.05	38.38	74.0	214.0	29.51	111.55	148.56	.52	-.51	.775
2S7m	I-II	3.88	2.09	1.7	13.0	53.83	3.14	4.62	2.88	9.56	.012
	III-IV	3.61	1.24	2.4	7.8	34.35	3.01	4.21	2.10	4.62	.251
1S7m	I-II	3.65	2.11	1.9	13.0	57.71	2.90	4.40	2.86	9.83	.042
	III-IV	3.55	.95	2.0	5.2	26.93	3.09	4.01	.00	-.97	.946
TenB	I-II	20.56	11.32	4.0	40.0	55.07	16.54	24.58	.37	-.86	.860
	III-IV	19.88	5.41	13.0	30.0	27.23	17.27	22.49	.49	-.88	.536
MedB	I-II	7.42	2.23	3.0	13.2	30.04	6.63	8.21	.15	.06	.959
	III-IV	6.65	2.12	2.8	11.0	31.85	5.63	7.67	.26	-.38	.683
Clmb	I-II	12.15	4.23	4.2	23.6	34.82	10.65	13.65	.44	.12	.943
	III-IV	14.37	7.61	4.4	30.4	52.94	10.70	18.04	.68	-.84	.232
10X5	I-II	27.90	4.22	20.6	39.0	15.12	26.41	29.40	.63	-.04	.498
	III-IV	27.56	3.73	23.2	36.7	13.56	25.76	29.36	1.00	.51	.812
R20m	I-II	4.24	1.25	3.1	10.2	29.59	3.79	4.68	3.39	13.73	.058
	III-IV	4.21	.77	3.2	6.3	18.32	3.84	4.58	1.05	1.03	.637
MCT6	I-II	713.82	227.52	132.0	1182.0	31.87	633.13	794.51	-.47	-.08	.515
	III-IV	764.84	128.52	462.0	1056.0	16.80	702.88	826.80	-.21	1.33	.409

Minimal (Min) and **Maximal** (Max) values of variables for the evaluation of Physical Fitness Tests in Secondary school students within group of (I-II) and (III-IV) grades point out that the values are placed in the inspected range/interval.

Higher values of the **Variation coefficient** (CV%) point out on heterogeneity of grades (I-II) and (III-IV) according to: standing broad jump [StBJ (30.18), (29.51)] jumping on two feet a distance of 7m [2S7m (53.83), (34.35)] jumping a distance of 7m on one foot [1S7m (57.71), (26.93)] throwing a tennis ball with one hand [TenB (55.07), (27.23)] pushing a medicine ball with two hands as far as possible [MedB (30.04), (31.85)] climbing wall bars, [Clmb (34.82), (52.94)] running 20m as fast as possible [R20m (29.59)] reduced Cooper test [MCT6 (31.87)] climbing wall bars, crossing over two columns to the right, and down the fourth column as fast as possible [Clmb (52.94)].

The values of the **Variation coefficient** (CV%) point out on homogeneity of the variable shuttle run [10X5 (15.12), (13.56)] running 20m as fast as possible [R20m (18.32)] reduced Cooper test [MCT6 (16.80)].

Higher values of **Skewness** (skw) point out that the distribution is *negative asymmetrical*, which means that curve of results distribution inclines to the higher values, respectively that it has more of the higher values, relative to normal distribution in these variables: jumping on two feet a distance of 7m [2S7m (2.88), (2.10)] jumping a distance of 7m on one foot [1S7m (2.86)] throwing a tennis ball with one hand [TenB (.37), (.49)] pushing a medicine ball with two hands as far as possible [MedB (.15), (.26)] standing broad jump [StBJ (.52)] climbing wall bars, [Clmb (.44), (.68)] shuttle run [10X5 (.63), (1.00)] running 20m as fast as possible [R20m (3.39), (1.05)]. Lower values of the **Skewness** (skw) point out that the distribution is *positive asymmetrical*, which means that the curve of the results distribution inclines toward lower values, respectively that has more of the lower values relative to *normal distribution* in: standing broad jump [StBJ (-.17)] reduced Cooper test [MCT6 (-.47), (-.21)]. Values of the **Skewness** (skw) point out that the distribution is not asymmetrical in: jumping a distance of 7m on one foot [1S7m (.00)].

Higher values of the **Kurtosis** (Kur) point out that that curve is leptosome-type in: jumping on two feet a distance of 7m [2S7m (9.56), (4.62)] jumping a distance of 7m on one foot [1S7m (9.83)] pushing a medicine ball with two hands as far as possible [MedB (.06)] climbing wall bars, [Clmb (.12)] running 20m as fast as possible [R20m (13.73) (1.03)] shuttle run [10X5 (.51)] reduced Cooper test [MCT6 (1.33)]. Negative values of the **Kurtosis** (kur) point out that the curve is plato-type in: standing broad jump [StBJ (-1.20), (-.51)] throwing a tennis ball with one hand [TenB (-.86), (-.88)] reduced Cooper test [MCT6 (-.08)] jumping a distance of 7m on one foot [1S7m (-.97)] pushing a medicine ball with two hands as far as possible [MedB (-.38)] climbing wall bars, crossing [Clmb (-.84)].

The values' distribution is mainly placed in a range of *normal distribution* (**p**) in: standing broad jump [StBJ (.93), (.77)] throwing a tennis ball with one hand [TenB (.86), (.54)] pushing a medicine ball with two hands as far as possible [MedB (.96), (.68)] climbing wall bars, [Clmb (.94), (.23)] shuttle run [10X5 (.50), (.81)] reduced Cooper test [MCT6 (.51)] jumping on two feet a distance of 7m [2S7m (.25)] jumping a distance of 7m on one foot [1S7m (.95)] running 20 m as fast as possible [R20m (.64)] reduced Cooper test [MCT6 (.41)]'

The values of results distribution decline from *normal distribution* (**p**) in: jumping on two feet a distance of 7m [2S7m (.01)] jumping a distance of 7m on one foot [1S7m (.04)] running 20m as fast as possible [R20m (.06)].

Discussion

ANALYSIS OF THE BETWEEN GRADES DIFFERENCES IN PHYSICAL FITNESS TEST WITHIN UPPER ELEMENTARY AND SECONDARY SCHOOL STUDENTS

In this part of study the procedure in regard to the acceptance or rejection of the statements that there are evidently significant between grades differences, relative to the motor development in elementary and secondary school participants has to be provided.

Table 5. Significance of the between grades difference in Physical Fitness Test of the Upper Elementary and Secondary school students

Analysis	n	F	p
MANOVA	9	3.736	.000
DISCRA	9	4.044	.000

Legend: MANOVA – Multivariate Analysis of Variance; DISCRA – Discriminative analysis; **n** – number of variables; **F**-ratio; **p** - probability

On the bases of the $p = .000$ value of (MANOVA) and $p = .000$ of (DISCRA) analyses, hypothesis H_1 and hypothesis H_2 has to be rejected and an alternative hypothesis A_1 , as well as A_2 have to be accepted which means that there are evidently significant between grades differences and clearly defined range of the Upper Elementary and Secondary school students.

Table 6. Significance of the between-grades differences in Physical Fitness Tests in Upper Elementary and Secondary school students

(PFT)	F	p	c.disc
StBJ	7.123	.000	.059
2S7m	7.592	.000	.048
1S7m	5.108	.002	.068
TenB	12.121	.000	.090
MedB	13.245	.000	.245
Clmb	6.223	.001	.023
10X5	1.686	.173	.050
R20m	11.115	.000	.245
MCT6	2.007	.116	.000

Legend: (PFT) variables: **StBJ**-standing broad jump (cm); **2S7m**-jumping on 2 feet (s); **1S7m**-Jumping on 1 foot (s); **TenB**-Throwing tennis ball (m); **MedB**-Putting medicine ball (m); **Clmb**-Climbing wall bars (s); **10X5**- Shuttle sprint (s); **R20m**-running 20m (s); **MCT6**-Reduced Cooper test (m); **c.disc** - discriminative coefficient

While is ($p < .1$) an alternative hypothesis A_3 has to be accepted, which means that significant differences among some groups of grades exists in: standing broad jump (.000), jumping on two feet a distance of 7m (.000), jumping a distance of 7m on one foot (.002), throwing a tennis ball with one hand (.000), pushing a medicine

ball with two hands as far as possible (.000), climbing wall bars (.001), running 20m as fast as possible (.000). While is ($p>.1$) there is no reason not to accept hypothesis H_3 which means that there are no significant between grades differences in Upper Elementary and Secondary school students in: shuttle run (.173), and reduced Cooper test (.116). The Discrimination Coefficient points out that the highest contribution to the between grades discrimination (the highest differences) in Upper Elementary and Secondary school students relative to Physical Fitness Tests is as follows: pushing a medicine ball with two hands as far as possible (.245), running 20m as fast as possible (.245), throwing a tennis ball with one hand (.090), jumping a distance of 7m on one foot (.068), standing broad jump (.059), shuttle run (.050), jumping on two feet a distance of 7m (.048), climbing wall bars (.023), reduced Cooper test (.000).

It must be noted, that those latent variables, where between grades differences are not estimated, apart from the discriminative, which point at the structure with significant between grades differences, are: shuttle run (.173), reduced Cooper test (.116).

CHARACTERISTICS AND HOMOGENEITY OF THE GRADES, RELATIVE TO THE PHYSICAL FITNESS TEST OF UPPER ELEMENTARY AND SECONDARY SCHOOL STUDENTS

On the bases of the presented consideration and analysis of the total sample of 129 participants, and in accordance with the applied methodology, logical order of the research is estimation of characteristics and homogeneity for every grade of Elementary and Secondary school participants and distance between them. The fact that is ($p=.000$) of the discriminative analysis means that clearly defined range between different grades of participants exists, respectively it is possible to establish the characteristics of every grade, relative to motor development in elementary and secondary school children. In **standing broad jump** (StBJ) is evident that *grade-1* and *grade-3* differ, while ($p=.000$), and *mean* (101.649cm) of the *grade-1* is lower then *mean* (135.394cm) of the *grade-3*. Same applies for the elementary and secondary school participants in: **standing broad jump** between *grade-1* and *grade-4* (.007), *mean* (101.649) is lower then (130.053), **standing broad jump** between *grade-2* and *grade-3* (.005) *mean* (109.050) is lower then (135.394). In **jumping on two feet a distance of 7m** (2S7m) difference between *grade-1* and *grade-3* (.001) is evident, while *mean* (5.389) of the *grade-1* is higher then (3.876) of the *grade-3*. The same applies for the evaluation of participants in **jumping on two feet a distance of 7m** between *grade-1* and *grade-4* (.000), *mean* (5.389) is higher then (3.609), **jumping on two feet a distance of 7m** between *grade-2* and *grade-3* (.004) *mean* (5.370) is higher then (3.876). In **jumping a distance of 7m on one foot** (1S7m) the difference between *grade-1* and *grade-2* (.082) is evident, while *mean* (5.005) of the *grade-1* is higher then (4.363) of the *grade-2*. The same applies for the evaluation of participants

in **jumping a distance of 7m on one foot** between *grade-1* and *grade-3* (.003), while *mean* (5.005) is higher then (3.650), and **jumping a distance of 7m on one foot** between *grade-1* and *grade-4* (.001), while *mean* (5.005) is higher then (3.546).

Table 7a. Between-grades difference in PFT among Children and Youth

PFT	sub-samples		Mean		t	p
StBJ	grade-1	grade-3	101.649	135.394	4.175	.000
StBJ	grade-1	grade-4	101.649	130.053	2.956	.007
StBJ	grade-2	grade-3	109.050	135.394	2.930	.005
StBJ	grade-2	grade-4	109.050	130.053	2.052	.045
2S7m	grade-1	grade-3	5.389	3.876	3.429	.001
2S7m	grade-1	grade-4	5.389	3.609	4.392	.000
2S7m	grade-2	grade-3	5.370	3.876	2.947	.004
2S7m	grade-2	grade-4	5.370	3.609	3.230	.002
1S7m	grade-1	grade-2	5.005	4.363	1.762	.082
1S7m	grade-1	grade-3	5.005	3.650	3.043	.003
1S7m	grade-1	grade-4	5.005	3.546	3.627	.001
1S7m	grade-2	grade-4	4.363	3.546	2.066	.043

Legend: (Table 7a,b): PFT - variables: StBJ-standing broad jump (cm); 2S7m-jumping on 2 feet (s); 1S7m-Jumping on 1 foot (s); TenB-Throwing tennis ball (m); MedB-Putting medicine ball (m); Clmb-Climbing wall bars (s); 10X5- Shuttle sprint (s); R20m-running 20m (s); MCT6-Reduced Cooper test (m).

Table 7b. Between-grades difference in PFT among Children and Youth

TenB	grade-1	grade-3	13.152	20.560	3.494	.001
TenB	grade-1	grade-4	13.152	19.879	4.783	.000
TenB	grade-2	grade-3	11.752	20.560	4.044	.000
TenB	grade-2	grade-4	11.752	19.879	5.094	.000
MedB	grade-1	grade-3	4.983	7.420	5.467	.000
MedB	grade-1	grade-4	4.983	6.647	3.123	.005
MedB	grade-2	grade-3	5.435	7.420	4.343	.000
MedB	grade-2	grade-4	5.435	6.647	2.507	.015
Clmb	grade-1	grade-3	20.699	12.150	5.599	.000
Clmb	grade-1	grade-4	20.699	14.373	2.896	.005
Clmb	grade-2	grade-3	18.444	12.150	2.739	.008
R20m	grade-1	grade-3	7.447	4.238	4.970	.000
R20m	grade-1	grade-4	7.447	4.208	3.954	.000
R20m	grade-2	grade-3	8.014	4.238	4.267	.000
R20m	grade-2	grade-4	8.014	4.208	3.318	.002
MCT6	grade-1	grade-4	659.108	764.842	2.413	.019

Table 8. Characteristics and homogeneity of the different classes of Upper Elementary and Secondary school students, relative to (PFT) variables

(PFT)	grade (V-VI)	grade (VII-VIII)	grade (I-II)	grade (III-IV)	ctr %
	Upper Elementary School Classes		Secondary School Classes		
MedB	the lowest	lower	the highest* ²	higher* ²	29.589
R20m	higher* ²	the highest* ²	lower	the lowest	29.589
TenB	lower	the lowest	the highest* ²	higher* ²	10.870
1S7m	the highest* ³	higher* ¹	lower	the lowest	8.213
StBJ	the lowest	lower	the highest* ²	higher* ²	7.126
10X5	higher	the highest	lower	the lowest	6.039
2S7m	the highest* ²	higher* ²	lower	the lowest	5.797
Clmb	the highest* ²	higher* ¹	the lowest	lower	2.778
MCT6	lower	the lowest	higher	the highest* ²	.000
n/m	23/37	26/40	28/33	17/19	
hmg%	62.16	65.00	84.85	89.47	

Legend: hmg% - homogeneity; ctr % - contribution of the variable to the grade's characteristics; (PFT) variables: **StBJ**-standing broad jump (cm); **2S7m**-jumping on 2 feet (s); **1S7m**-Jumping on 1 foot (s); **TenB**-Throwing tennis ball (m); **MedB**-Putting medicine ball (m); **Clmb**-Climbing wall bars (s); **10X5**- Shuttle sprint (s); **R20m**-running 20m (s); **MCT6**-Reduced Cooper test (m).

Eigenvalue of every sub-sample of the **grade** is the highest defined with (MedB) *pushing a medicine ball with two hands as far as possible*, while the variable contribution to the characteristics is (29.59%) followed by: (R20m) *running 20m as fast as possible* (29.59%), (MedB) *throwing a tennis ball with one hand* (10.87%), (1S7m) *jumping a distance of 7m on one foot* (8.21%), (StBJ) *standing broad jump* (7.13%), (10X5m) *shuttle run* (6.04%), (2S7m) *jumping on two feet a distance of 7m* (5.80%), (Clmb) *climbing wall bars, crossing over two columns to the right, and down the fourth column as fast as possible* (2.78%) and (MCT6) *reduced Cooper test* (.00%). Homogeneity, within grade (V-VI) is 62.16%, within grade (VII-VIII) is 65.00%, within grade (I-II) is 84.85%, and within grade (III-IV) is 89.47%.

On the bases of presented data it is possible to say that characteristics of grade (V-VI) have 23/37 participants, homogeneity is 62.2 % (higher), which means that 14 participants have other characteristics, not those of their own group, and characteristics of grade (VII-VIII) have 26/40 participants, homogeneity is 65.0 % (higher) while 14 participants have other characteristics.

Characteristics of grade (I-II) have 28/33 participants, homogeneity is 84.8% (higher) while only 5 participants have other characteristics, also that characteristics of the grade (III-IV) have 17/19 participants, homogeneity is 89.5% (higher) while only 2 participants have other characteristics.

This means that participants whose characteristics are similar to those characteristics of grade (V-VI), and their grade orientation is anonymous, it is possible to

expect with the confidence of 62.2 % that they belong to the grade (V-VI), respectively it is possible to estimate the prognosis with certain probability/confidence.

On the bases of the participants' motor development evaluation in elementary and secondary school the following statements are possible, relative to grades:

- **grade (V-VI)** has these Eigenvalues for: (MedB) pushing a medicine ball with two hands as far as possible is *the lowest*, for (R20m) running 20m as fast as possible is *Higher*²*, for (TenB) throwing a tennis ball with one hand is *lower*, for (1S7m) jumping a distance of 7m on one foot is *the highest*³*, for (StBJ) standing broad jump is *the lowest*, for (10X5m) shuttle run is *Higher*, for (2S7m) jumping on two feet a distance of 7m is *the highest*²*, for (Clmb) climbing wall bars is *the highest*²*, for (MCT6) reduced Cooper test is *lower*.

- **grade (VII-VIII)** has Eigenvalues for: (MedB) pushing a medicine ball with two hands as far as possible is *lower*, for (R20m) running 20 m as fast as possible is *the highest*²*, for (TenB) throwing a tennis ball with one hand is *the lowest*, for (1S7m) jumping a distance of 7m on one foot is *Higher*¹*, for (StBJ) standing broad jump is *lower*, for (10X5m) shuttle run is *the highest*,

for (2S7m) jumping on two feet a distance of 7m is *Higher*²*, for (Clmb) climbing wall bars is *Higher*¹*, for (MCT6) reduced Cooper test is *the lowest*.

- **grade (I-II)** have Eigenvalues for: (MedB) pushing a medicine ball with two hands as far as possible is *the highest*²*, for (R20m) running 20m as fast as possible is *lower*, for (TenB) throwing a tennis ball with one hand is *the highest*²*, for (1S7m) jumping a distance of 7m on one foot is *lower*, for (StBJ) standing broad jump is *the highest*²*, for (10X5m) shuttle run is *lower*,

for (2S7m) jumping on two feet a distance of 7m is *lower*, for (Clmb) climbing wall bars is *the lowest*, for (MCT6) reduced Cooper test is *Higher*.

- **grade (III-IV)** have Eigenvalues for: (MedB) pushing a medicine ball with two hands as far as possible is *Higher*²*, for (R20m) running 20m as fast as possible is *the lowest*, for (TenB) throwing a tennis ball with one hand is *Higher*²*, for (1S7m) jumping a distance of 7m on one foot is *the lowest*, for (StBJ) standing broad jump is *Higher*²*, for (10X5m) shuttle run is *the lowest*, for (2S7m) jumping on two feet a distance of 7m is *the lowest*, for (Clmb) climbing wall bars is *lower*, for (MCT6) reduced Cooper test is *the highest*²*.

Table 9. Mahalanobis Distance in between-grades differences of Upper Elementary and Secondary school students, relative to (PFT) variables

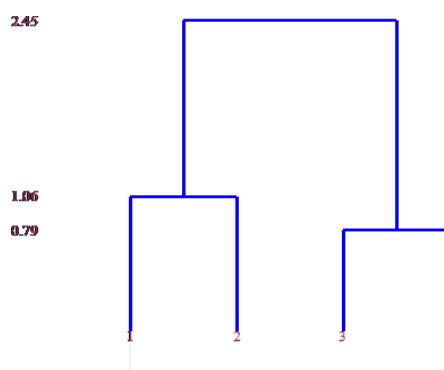
Elementary - Secondary	grade (V-VI)	grade (VII-VIII)	grade (I-II)	grade (III-IV)
grade (V-VI)	.00	1.06	1.96	1.51
grade (VII-VIII)	1.06	.00	1.92	1.69
grade (I-II)	1.96	1.92	.00	.79
grade (III-IV)	1.51	1.69	.79	.00

Calculating of the Mahalanobis distance between different grades of participants gave another single indicator of the similarity/closest or difference/distance. The distance of the different segments can be compared. The distance (Table 16) point out the lowest distance between grades: grade (III-IV) and grade (I-II) (.79) (moderate) and the highest distance is for grade: (I-II) and grade (V-VI) (1.96) (higher).

Table 10. Grouping of the grades/classes relative to Physical Fitness Test in Upper Elementary and Secondary school students

level	Closeness/distance
(3) grade (I-II), (4) grade (III-IV)	.79
(1) grade (V-VI), (2) grade (VII-VIII)	1.06
(1) grade (V-VI), (3) grade (I-II)	2.45

On the bases of presented data in Tab. 10, and dendrogram it is evident that the closest are grades (I-II) and grades (III-IV) of the Secondary school students with the distance of (.79), and the highest difference is between group of upper elementary school grade (V-VI) and secondary school grade (I-II), with the distance of (2.45).

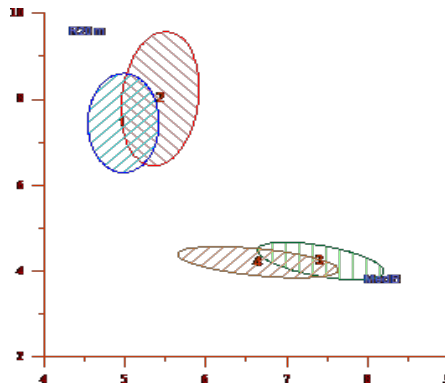


Legend: grade (V-VI) (1) grade (VII-VIII) (2) grade (I-II) (3) grade (III-IV) (4)

THE GRAPHICAL PRESENTATION OF BETWEEN GRADE DIFFERENCES, RELATIVE TO 3 THE MOST DISCRIMINATIVE VARIABLES OF MOTOR DEVELOPMENT IN ELEMENTARY AND SECONDARY SCHOOL PARTICIPANTS

On the bases of graphical presentation of ellipses (confidence interval) the scope illustrates mutual position and characteristics of participants in every of 4 grades of Elementary: **(1) grade (V-VI), (2) grade (VII-VIII), and Secondary School (3) grade (I-II), (4), grade (III-IV)**, relative to 3 (three) the most discriminative (variables) of motor development in: pushing a medicine ball with two hands as far as possible (MedB), running 20m as fast as possible (R20m), throwing a tennis ball with one hand (TenB).

Graph 1. Ellipses (confidence interval) of the participants in variables: (MedB) and (R20m) in different grades

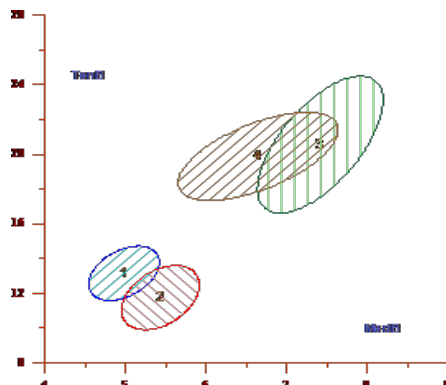


Legend: grade (V-VI) (1); grade (VII-VIII) (2); grade (I-II) (3); grade (III-IV) (4); pushing a medicine ball with two hands as far as possible (MedB); running 20m as fast as possible (R20m)

On the Graph (1) abscise (horizontal axe) is pushing a medicine ball with two hands as far as possible (MedB), and ordinate (vertical axe) is running 20m as fast as possible (R20m).

It is possible to observe that variable **pushing a medicine ball with two hands as far as possible**, within grade (V-VI) (1) has the lowest value, relating to the evaluation of the motor development in elementary school children, and the highest value is in grade (I-II) of secondary school children (3). Observing variable **running 20m as fast as possible**, within grade (III-IV) (4) have the lowest value relating to the evaluation of the motor development in secondary school children, and the highest value is estimated within grade (VII-VIII) in elementary school participants (2).

Graph 2. Ellipses (confidence interval), of the participants in variables: (MedB) and (TenB) in different grades



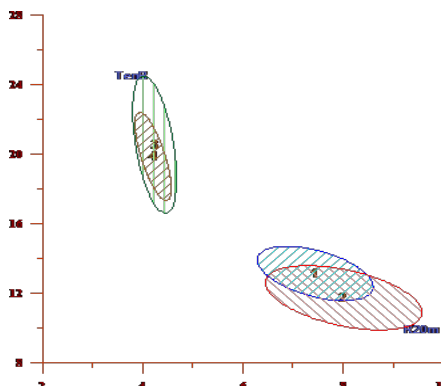
Legend: grade (V-VI) (1); grade (VII-VIII) (2); grade (I-II) (3); grade (III-IV) (4);; pushing a medicine ball with two hands as far as possible (MedB); throwing a tennis ball with one hand (TenB)

On the Graph (2) abscise (horizontal axe) is pushing a medicine ball with two hands as far as possible (MedB), and ordinate (vertical axe) is throwing a tennis ball with one hand (TenB).

It is possible to observe that variable **pushing a medicine ball with two hands as far as possible**, within grade (V-VI) (1) have the lowest value, relating to the evaluation of motor development in elementary school children, and the highest value is in grade (I-II) of secondary school children (3).

Observing variable **throwing a tennis ball with one hand**, grade (VII-VIII) (2) have the lowest value relating to the evaluation of motor development in elementary school children, and the highest value is in grade (I-II) of secondary school children (3).

Graph 3. Ellipses (confidence interval), of the participants in variables (R20m) and (TenB) in different grades

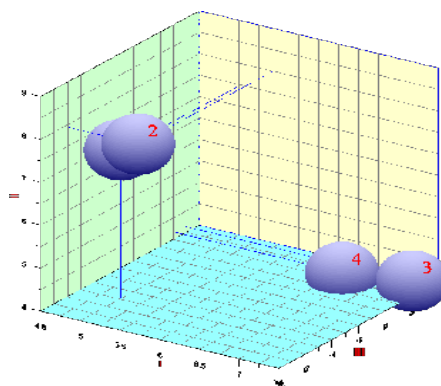


Legend: grade (V-VI) (1); grade (VII-VIII) (2); grade (I-II) (3); grade (III-IV) (4);; running 20 m as fast as possible (R20m); throwing a tennis ball with one hand (TenB)

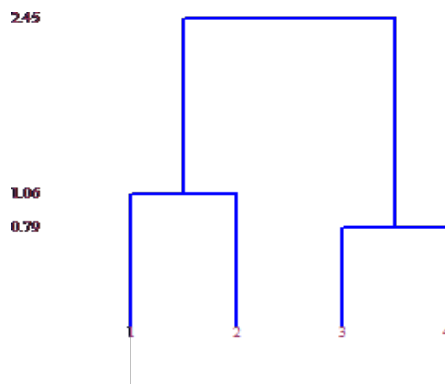
On the Graph (3) abscise (horizontal axe) is running 20m as fast as possible (R20m), and ordinate (vertical axe) is throwing a tennis ball with one hand (TenB).

It is possible to observe that variable **running 20m as fast as possible**, within grade (III-IV) (4) has the lowest value, relating to the evaluation of motor development in secondary school children, and the highest value has grade (VII-VIII) in elementary school participants (2). Observing variable **throwing a tennis ball with one hand**, within grade (VII-VIII) (2) participants of elementary school have the lowest value relating to the evaluation of motor development, and the highest value is estimated within grade (I-II) of secondary school children (3).

Graph 4. Three dimensional presentation of the distance/closeness of the different grade-levels of upper elementary and secondary school students



Legend: grade (V-VI) (1) grade (VII-VIII) (2) grade (I-II) (3) grade (III-IV) (4)

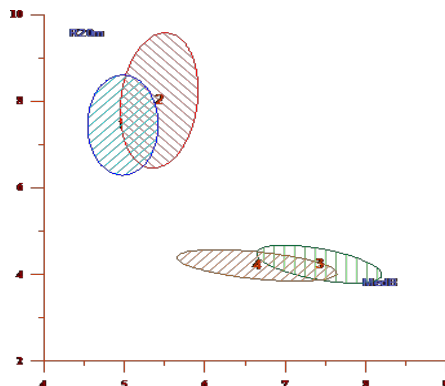


Legend: grade (V-VI) (1) grade (VII-VIII) (2) grade (I-II) (3) grade (III-IV) (4)

THE GRAPHICAL PRESENTATION OF BETWEEN GRADE DIFFERENCES, RELATIVE TO 3 THE MOST DISCRIMINATIVE VARIABLES OF MOTOR DEVELOPMENT IN ELEMENTARY AND SECONDARY SCHOOL PARTICIPANTS

On the bases of graphical presentation of ellipses (confidence interval) the scope illustrates mutual position and characteristics of participants in every of 4 grades of Elementary: **(1) grade (V-VI), (2) grade (VII-VIII), and Secondary School (3) grade (I-II), (4), grade (III-IV)**, relative to 3 (three) the most discriminative (variables) of motor development in: pushing a medicine ball with two hands as far as possible (MedB), running 20m as fast as possible (R20m), throwing a tennis ball with one hand (TenB).

Graph 4. *Ellipses (confidence interval), of the participants in variables – (MedB) and (R20m) of different grades*

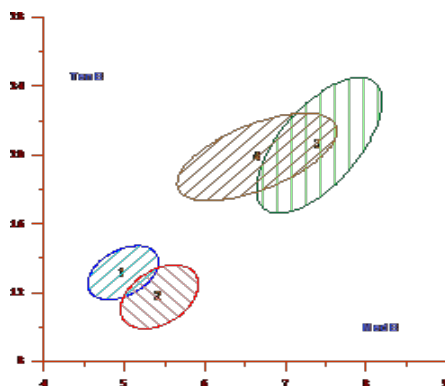


Legend: grade (V-VI) (1); grade (VII-VIII) (2); grade (I-II) (3); grade (III-IV) (4);; pushing a medicine ball with two hands as far as possible (MedB); running 20m as fast as possible (R20m)

On the Graph (4) abscise (horizontal axe) is pushing a medicine ball with two hands as far as possible (MedB), and ordinate (vertical axe) is running 20m as fast as possible (R20m).

It is possible to observe that variable pushing a medicine ball with two hands as far as possible, within grade (V-VI) (1) has the lowest value, relating to the evaluation of the motor development in elementary school children, and the highest value is in grade (I-II) of secondary school children (3). Observing variable running 20m as fast as possible, within grade (III-IV) (4) have the lowest value relating to the evaluation of the motor development in secondary school children, and the highest value is estimated within grade (VII-VIII) in elementary school participants (2).

Graph 5. Ellipses (confidence interval), of the different participants in variables (MedB) and (TenB) in different grades



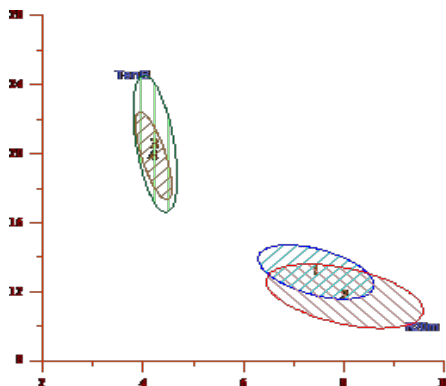
Legend: grade (V-VI) (1); grade (VII-VIII) (2); grade (I-II) (3); grade (III-IV) (4);; pushing a medicine ball with two hands as far as possible (MedB); throwing a tennis ball with one hand (TenB)

On the Graph (5) abscise (horizontal axe) is pushing a medicine ball with two hands as far as possible (MedB), and ordinate (vertical axe) is throwing a tennis ball with one hand (TenB).

It is possible to observe that variable **pushing a medicine ball with two hands as far as possible**, within grade (V-VI) (1) have the lowest value, relating to the evaluation of motor development in elementary school children, and the highest value is in grade (I-II) of secondary school children (3).

Observing variable **throwing a tennis ball with one hand**, grade (VII-VIII) (2) have the lowest value relating to the evaluation of motor development in elementary school children, and the highest value is in grade (I-II) of secondary school children (3).

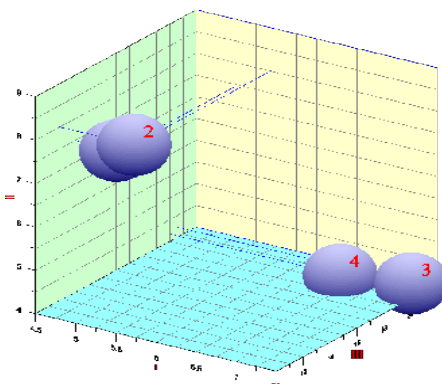
Graph 6. Ellipses (confidence interval), of the participants in variables: (R20m) and (TenB) in different grades



Legend: grade (V-VI) (1); grade (VII-VIII) (2); grade (I-II) (3); grade (III-IV) (4);; running 20 m as fast as possible (R20m); throwing a tennis ball with one hand (TenB)

On the Graph (6) abscise (horizontal axe) is running 20m as fast as possible (R20m), and ordinate (vertical axe) is throwing a tennis ball with one hand (TenB). It is possible to observe that variable **running 20m as fast as possible**, within grade (III-IV) (4) has the lowest value, relating to the evaluation of motor development in secondary school children, and the highest value has grade (VII-VIII) in elementary school participants (2). Observing variable **throwing a tennis ball with one hand**, within grade (VII-VIII) (2) participants of elementary school have the lowest value relating to the evaluation of motor development, and the highest value is estimated within grade (I-II) of secondary school children (3).

Graph 7. Three dimensional presentation of the distance/closeness of the different IQ maturity sub-categories in motor development estimated with Physical Fitness Test (PFT)



Legend: grade (V-VI) (1) grade (VII-VIII) (2) grade (I-II) (3) grade (III-IV) (4)

Final considerations

Evaluating motor development in elementary and secondary school participants with intellectual disabilities MANOVA (.00) and DISCRA (.000) point out that significant *grade-level* differences exist among 4 groups of grades/classe, relating to the following Physical Fitness Test variables: Standing broad jump (.000), Jumping on two feet a distance of 7m (.000), Jumping a distance of 7m on one foot (.002), Throwing a tennis ball with one hand (.000), Pushing a medicine ball with two hands (.000), Climbing wall bars (.001), Running 20m as fast as possible (.000). Differences are not estimated at: Shuttle run (.173), Reduced Cooper test (.116).

Order of discrimination: Pushing a medicine ball with two hands (.245), Running 20m as fast as possible (.245), Throwing a tennis ball with one hand (.090), Jumping a distance of 7m on one foot (.068), Standing broad jump (.059), Shuttle run (.050), Jumping on two feet a distance of 7m (.048), Climbing wall bars (.023), Reduced Cooper test (.000).

Referencess

Popović, Miloš (2011). *The Evaluation of Motor Development in Elementary and Secondary School Children with Intellectual Disabilities*. Unpublished master thesis, Palacky University in Olomouc: Faculty of Physical Culture (Czech Republic).

***Complete List of References** is on disposal complimentary, by copy request to the leading author

Note:

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