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THE METRIC CHARACTERISTICS OF SOME FITNESSGRAM TESTS AND THE POSSIBILITIES OF APPLICATION IN THE PRIMARY EDUCATION

ABSTRACT

In this research the metric characteristics of newly applied tests of motor skills were established on primary school pupils. The research was carried out on a sample of male and female pupils of 3rd and 4th grade of elementary school, which territorially belong to the urban area of Sisak and Moslavina County and were schooled in cities of Petrinja and Sisak. Altogether 327 pupils were involved in this research. The sample of variables consisted of 2 anthropometric variables (body height and body weight), and 4 tests for motor skills assessment (Shuttle run, Curl up test, Push up 90° test and Sit and reach test). In composite tests Cronbach's α varied from 0,939 – 0,978, which is considered to be a satisfactory level of reliability. Interclass coefficient of correlation (ICC) in these tests of motor skills was very high, ranging from 0,94 – 0,98. The coefficient of homogeneity was assessed by average correlation between items (AVR), and ranged from minimum value of 0,839 in the test Shuttle run to the highest value of 0,978 in the Sit and reach (left leg) test. The reliability in the Push up 90° test was $r=0,74$, and in the test Curl up was 0,63. In both tests, t – test results as a way of establishing homogeneity did not show statistically significant differences. After the analysis, the tests Shuttle run and Sit and reach can be suggested as tests for motor skills assessment, unlike the Curl up and Push up 90° test are not recommended to use in this form.

Keywords: elementary school, pupils, kinanthropologic characteristics, measuring

1. INTRODUCTION

For the majority of children, the physical education classes represent the first important and organized contact with kinesiological activity. From there on, starts the further guiding of the pupils from their teachers, toward kinesiological

cal activities based on the development of kinanthropological characteristics of the pupils themselves and affirmative acceptance concerning pupil's preferences and showed interest. The motor development of children from the earliest days was interesting to many researchers and

was often concentrated on different deficiencies and disabilities which appear during growth and maturation. Moreover, very interesting is also actual level of development of certain skills in children, as well as their comparison and also an insight in the direction of development and the permanent level of development in order to intervene at the right moment, since the motor development has the role of the control parameter in the overall development of the child (Bushnell and Boudreau, 1993; Piek et al., 2008). A child has a natural need for moving, and it is necessary to guide that need in a proper way in the kinesiological activities adequate to child's growth and maturation and in harmony with kinanthropological characteristics.

The methodology of monitoring and evaluating kinanthropologic characteristics of pupils in elementary school includes different procedures of insight in actual state of development of kinanthropologic characteristics through different procedures of measuring and application of suitable tests concerning the population (Vidranski, 2020).

Measuring allows joining numbers or markings according to subjects in compliance with set rules and in line with the development of certain characteristics (Dizdar, 2006). The tests for assessing kinanthropologic characteristics of pupils in Physical education classes which are applied in Croatia, started their application by the methodology made by Mraković et al. 1986. Afterwards an update was made by new values published in the book *Applied kinesiology in school - Norms* (Findak et al., 1996) and 2008. a large project was carried out for assessment of kinanthropologic characteristics in grades 5 to 8 in elementary school and in high school, after which a booklet *Methodology of evaluation of kinanthropologic characteristics of pupils in Physical education CROFIT NORMS* (Neljak et al. 2011) was published. Based on this methodology 2020. Vidranski determined reliability and orientational values of CROFIT tests in elementary school,

Different approach in assessing kinanthropological characteristics of pupils in the world

offer different tests with different metric characteristics. The tests for assessing latent dimensions of repetitive strength, agility and flexibility FITNESSGRAM battery of tests which is administered for the assessment of levels of physical status in American children offers practically applicable tests of good metric characteristics. With the goal to enlarge the base of tests for assessing kinanthropologic characteristics of pupils in elementary school, in this research the metric characteristics of newly administered tests of motor skills from FITNESSGRAM battery of tests have been established on pupils in primary education in Croatia.

2. METHODOLOGY

2.1. *The subject sample*

This research was conducted on a sample of male and female pupils of the 3rd and 4th grade from 4 different elementary schools, which territorially belong to the urban area of Sisak and Moslavina County, and are being schooled in the cities of Petrinja and Sisak. The overall number of participating pupils was 327, out of which 186 boys and 141 girls at the age 10,5, with average body height 145cm, and average body mass 38,7 kg.

The survey was conducted under the doctoral dissertation research named *The effects of different metric protocols on assessing the motor status in primary education*, and was approved by ethical and scientific committee of the Faculty of Kinesiology in Zagreb and University of Zagreb Senate. The principals of the schools engaged in the survey gave their written consent in order to be included in the research. Afterwards, the pupil's parents gave their written consent for the child's participation in the survey in which they were acquainted with the goal and the subject of the research.

All pupils who participated in this research were regularly going to the PE classes and had no prior experience with the most part of the presented motor tasks, and were completely healthy during the survey.

2.2 The variable sample

The variable sample was consisted of two anthropometric variables (body height and body weight). The measuring protocol was conducted under the guidance of the International biological program and were administered once. There were also 4 tests for assessing motor skills (Shuttle run, Curl up test, Push-up 90° test and Sit and reach (Malina et al., 2004; Welk & Meredith, 2010; Vrbik, 2015). The Sit and reach and Shuttle run tests were performed 3 times, and other two tests were performed once with the time span of one week.

2.3. Data analysis

The data analysis was carried out with the statistical software program SPSS (Statistical Package for the Social Sciences), version 13.0., SPSS, Inc. (2003).

The normality of distribution was tested with Kolmogorov-Smirnov test.

In order to determine reliability as a metric characteristic which deals with the consistency between measures, i.e. the independence of measuring from nonsystematic of accidental errors (Dizdar, 2006), the method of internal consistency (Cronbach's α was used), and for establishing reliability

between treatments an interclass correlation coefficient (ICC) in composite tests was used. In one item tests, the coefficient of reliability was determined by test – retest method, and was represented by the correlation between the test and the redone test (retest) (Jukić et al., 2008). The homogeneity was established by t-test.

In composite tests after every treatment a standard error of measuring was calculated (SEM):

$$SEM = \sqrt{1-\alpha}$$

The homogeneity as a metric characteristic of the test, measures that from item to item the measuring of the subject of the measuring does not change, and an average correlation between items was used (AVR) and a coefficient of variability was calculated (CV):

$$CV = s2/x \cdot 100$$

3. RESULTS

The normality of distribution of data for every variable concerning the protocol was tested with Kolmogorov – Smirnov test. The test confirmed that distributions did not significantly differ from the normal distribution.

Table 1. Metric characteristics of the composite measuring tests.

	Cronbach α	AVR	CV	SEM	ICC	95% CI
Shuttle run	0,939	0,839	10,56	0,247	0,939	0,927-0,950
Sit and Reach (R)	0,976	0,931	24,32	0,155	0,976	0,971-0,980
Sit and Reach (L)	0,978	0,936	25,79	0,148	0,978	0,973-0,982

Cronbach α - coefficient of reliability; AVR – average correlation between items; CV - variability coefficient; SEM – standard error of measurement; Sit and Reach (R) – the sit and reach test on the right foot; Sit and Reach (L) - the sit and reach test on the left foot; ICC - interclass correlation coefficient; 95% CI – ICC interval

Table 1. shows the results of metric characteristics, reliability and homogeneity of the composite motor test as well as the interclass correlation coefficient and an interval in which an ICC

varies. The results of all metric characteristics of the composite measuring tests showed satisfactory high level of reliability, homogeneity and sensitivity.

Table 2. The metric characteristics of 1-item tests.

	M	SD	t	p	Confidence (-95,000%) Lower	Confidence (+95,000%) Upper
PU 1	8,612022	8,039550				
PU 2	8,049180	6,999434	1,379168	0,169535	-0,242378	1,368061
CU 1	16,13770	10,69712				
CU 2	15,19945	10,48205	1,386282	0,167357	-0,397154	2,273657

M-mean; SD-Std.Dv.; t-t value; *p<.05; PU 1- Push up 1st measuring; PU 2- Push up 2nd measuring; CU 1- Curl up test, 1st measuring; CU 2- Curl up test, 2nd measuring.

The repetitive strength of arms and shoulders, assessed as latent dimension of motor abilities, one item test Push-up 90° was used, but did not show satisfying metric characteristics. As a measure of reliability, the correlation coefficient between treatments totaled $r = 0,739$. The results ranged from 0 (not being able to perform a single repetition) to 34 repetitions concerning the range of deflection of the arithmetic mean which is relatively high and amounted 7,53. The value of asymmetry was 1,16, and the value of tailness was 1,12 indicating a platykurtic distribution.

The test for the assessment of the latent dimension of the motor skill repetitive strength of the core (Curl up test) did not show satisfying metric characteristics, and one of the indicators is the result of the correlation as a measure of the test reliability which was between test $r = 0,626$. The results ranged from 0 (not being able to perform a single repetition) to 75 repetitions concerning the range of deflection of the arithmetic mean which is relatively high and amounts 10,59. The value of asymmetry was 10,59, and the value of tailness was 2,23 indicating a platykurtic distribution.

The Table 2. shows the results of the t-test for both one item test as a measure of the homogeneity. The t-test did not show statistically significant differences, and based on that it can be concluded that the tests are homogenous but without satisfactory accuracy of measuring.

4. DISCUSSION

The tests used in this research were taken from the FITNESSGRAM battery of tests (Welk & Meredith, 2010), and were used for the assessment of the level of physical condition in children in United States. The construct of the test includes the assessment of the latent dimensions of repetitive strength, agility and flexibility. In order to broaden the base of test for assessing kinanthropological characteristics of the pupils in primary school in Croatia, some of the mentioned new tests were administered. Tests went through analysis of metric characteristics in order to find out the reliability and homogeneity, and also possible application of the test in assessing motor skills in pupils in primary education.

Certain tests administered in this research (Shuttle run and Curl up test) in earlier studies among different groups of children and youth, showed acceptable coefficients of reliability and homogeneity (Malina et al., 2004), as well as other tests similar in performance structure (Findak et al., 1996; Metikoš et al., 1989; Prskalo & Babin, 2011).

This kind of battery of test for assessing levels of motor skills until now has not been administered in Croatia on population of pupils, nor have the metric characteristics of the tests been investigated until the research made by Vrbik, I. in 2015.

The results of the composite measuring tests which include motor area of agility and flex-

ibility showed high level of reliability, homogeneity and sensitivity in administered tests on this population of pupils. The reliability coefficient (Cronbach α) ranged from 0,939 – 0,978 which is a satisfying level of reliability in tests according to Momirović et al. from 1975. (border value 0,80 and higher), Malacko & Popović from 1997. (0,85 and higher), as well as border value higher than 0,90 and higher according to Mužić (1973) and Hopkins (2000). The interclass coefficient of correlation (ICC) in this test for assessing motor skills was very high and ranged from (0,94-0,98). Similar results were obtained in some similar and same variables for assessing motor skills in their research by Cole et al. (2000) (ICC=0,95-0,98). The reliable test is characterized by a small variability coefficient (CV) and high interclass coefficient of correlation (ICC) along a small error of measurement (Moir et al., 2005), which was mostly determined in this research as well. The coefficient of homogeneity which was assessed by average correlation between items (AVR) ranged from minimum value of 0,839 in the test Shuttle run up to maximum value of 0,978 in the test Sit and reach (left leg).

The high level of coefficients of reliability and homogeneity in both tests (Shuttle run and Sit and reach (both legs), is related with the precisely defined protocol of measurement which was identical for all subjects. Moreover, it should be taken into consideration possible acquaintance of the subjects with the similar structure and form of movement which was used before in earlier PE classes. The influence of the coefficient of homogeneity could be in the complexity of the task as well as in the performance of pupils of the task, but also in the inadequate shoes which in combination with the floor surface influenced the performance result (Vrbik, 2015). All of these deficiencies led to poorer results and consequently lower

reliability coefficient. In 1-item tests, the coefficient of reliability was determined, by test – retest method. The reliability in the test Push up 90° was $r=0,74$, which cannot be considered reliable, as well as correlation of $r=0,63$ for the test Curl up. In both tests, the t-test as a way of proving homogeneity did not show statistically significant differences. Concerning the stated, it can be concluded that the test are homogenous but with inadequate sensitivity. Furthermore, grounded on the variability of the results, i.e. standard deviation, which in well sensitive test should be 1/3 of arithmetic mean of the subjects' results, the tests did not have good sensitivity. The interesting part of this research which could be established in this two tests was that the subjects were allowed the possibility of performing the task during measuring only once. Since in earlier research the reliability and validity of similar tests (Sit and reach and Curl up test) for assessing motor skills in pupils in primary education (Vlahović et al., 2007) the pupils should have a few trials before the testing in order to familiarize with the task at hand and the structure performance. Along that, the authors accented necessary updating of the measuring protocols and tests with the goal of enhancing diagnostical procedures in the field of kinesiology.

5. CONCLUSION

According to the administered analysis, it is possible to conclude that the Shuttle run test and the test Sit and reach (left leg) can be suggested for application in order to assess motor skills of agility and flexibility in pupils in primary education. The results of the 1-item test Push up 90° and the Curl up test are not applicable in this form in such manner in pupils in primary education. In future studies the application of this test should be investigated through familiarization and standardization of the measuring procedure.

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METRIJSKE KARAKTERISTIKE NOVO PRIMIJENJENIH TESTOVA MOTORIČKIH SPOSOBNOSTI NA UČENICIMA U PRIMARNOM OBRAZOVANJU

SAŽETAK

U ovom istraživanju utvrđene su metrijske karakteristike novo primijenjenih testova motoričkih sposobnosti na učenicima u primarnom obrazovanju. Istraživanje je provedeno na uzorku skupina učenika i učenica trećeg i četvrtog razreda iz 4 osnovne škole koje teritorijalno pripadaju urbanom području Sisačko-moslavačke županije i školuju se u gradovima Petrinji i Sisku. Ukupan broj učenika na kojima je bilo provedeno istraživanje je 327. Uzorak varijabli u ovom istraživanju činile su 2 antropometrijske mjere (tjelesna visina i težina) te 4 testa za procjenu motoričkih sposobnosti (Prenošenje spužve pretrčavanjem, Podizanje trupa iz ležanja kratko s pogrčenim nogama, Sklekovi pod pravim kutem, Pretklon na jednu nogu). Kod kompozitnih mjernih testova koeficijent pouzdanosti (Cronbachova α) kreće se od 0,939 – 0,978, što je zadovoljavajuća razina pouzdanosti testova. Interklasni koeficijent korelacije (ICC) u ovim testovima motoričkih sposobnosti je vrlo visok i ide od 0,94 – 0,98. Koeficijent homogenosti procijenjen je prosječnom korelacijom među česticama (AVR) i kreće se od najmanje vrijednosti 0,839 u testu PSP do najveće vrijednosti 0,978, u testu PLN. Pouzdanost u testu Sklekovi pod pravim kutem iznosila je $r = 0,74$, a u testu Podizanje trupa iz ležanja kratko s pogrčenim nogama $r = 0,63$. Kod oba testa t- test, kao način utvrđivanja homogenosti nije pokazao statistički značajne razlike. Provedenom analizom, test Prenošenje spužve pretrčavanjem i test Pretklon na lijevu i desnu nogu, mogu se predložiti za procjenu motoričke sposobnosti dok se testovi Sklekovi pod pravim kutem i Podizanje trupa iz ležanja kratko s pogrčenim nogama, ne preporučuju za primjenu u ovom obliku.

Ključne riječi: razredna nastava, učenici, kinantropološka obilježja, mjerenje