METRIC CHARACTERISTICS OF TESTS FOR COORDINATION ESTIMATION

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Abstract

Practice and science confirms every day that the coordination is one of the most important psychomotor abilities. Just for that fact, the coordination is in all formulas and equations of specification of success in sport. There are several definitions of coordination in professional and scientific literature. As a rule, the mentioned definitions are incomplete of partly good. In essence, the coordination is the ability of the central nervous system to manage the musculoskeletal system. This research is dedicated to the metric characteristics of tests for the estimation of coordination with special emphasis on the reliability and validity of these tests. Namely that the any test would be useful and applicable, it must possess the following metric characteristics: reliabiltiy, validity, objectivity and discriminativity. The research has been conducted on a sample of 112 students of high schools, where they have used the three tests for the estimation of coordination. 1. handed dribble between stands (klop), 2 squeezing through and skipping (kpps), 3 polygon backward (kpnt). After completion of exploration, it can be concluded that above mentioned tests have shown high and statistically significant reliability and validity. Crombah's alpha coefficient of reliability has been (.90, .93, .94) and matrix intercorelation of item, or test-retest shows the statistics significant values where the correlation coefficient is ranging from .71 to. 88. In all tests, based on the item of retest has been obtain by a one characteristic root $\Lambda_1 = 2.66$, extracted variace is .89. For test-kpps $\Lambda_1 = 2.70$, and extracted variance is .85. For test-kpnt $\Lambda_1 = 2.70$ and extracted variance is 90. Based on above mentioned values, it can be concluded that mentioned tests have satisfactory factor of validity in addition of high and statistically significant realibility. Objectivity and discriminativity as important metric attributes have been on high level, that are confirmed by th values shown in Tables.

Key words: coordination, metrics, validity, reliability, estimates

Introduction

The coordination is psychomotor ability that participates in all motor activities, or participates in managing the movements of locomotion and the whole body. Coordination has been reflected in the rapid and precise execution of complex motor tasks. Lower levels of the nervous system are included for performing the simplest movements . However, performing of complex motor actions where is necessary adjustment many movements into whole, the higher is required subordination of the lower parts of central nervous system. . Compliance in the functioning of the CNS is transferred to the effects ie. Muscules which over the bone level perform simple and complex movements. Complex movement performes with the involvement of a higher level of awareness, especially in the beginning of learning , the movemet is conditioned by coordination as basic motoric ability. If the movement or motion cause to the level of automatism then you can not talk about coordination, than the learned automatic movements. Automated movements are performed much faster, just they are carried out under the control of lower levels of the CNS. Therefore, the coordination of the basic motoric capacity could be spoken only if a motor task is being set and being resolved through the problem or when need for its perfomance ie higher participation of kortikalni CNS level of awareness. Other divisions of coordination are presented in sports terminology, such as speed coordination, rhytmic coordination, coordination of space and so on.

Just because of mentioned complexity a bit of a clean test of coordination. Tests of coorination saturated with balance and agility, so that they appear two very relevant skills within the cooridnation that have a certain way „became independent". Even though, they are plenty of attempts at claritying the phenomenon of coordination, balance and agility, it is evident that there is still plenty of unkowns, and any new knowledge more or less contributes to the explantion of this ability. When we are talk about coordination as motoric ability, all relevant explorations confirm that there is a number of factors that determine coordination. Compliance of CNS and muscle is inevitable ina all combinations and ability of perception, concentration, pshycomotoric inteligence, balance and quality of muscle mass, sex, age, height, weight and total psycho-somatic status of man.

The problem, scope and purpose of this study
The problem of this research are metric characteristics of tests for estimation of coordination with special emphasis on the validity and reliability tests. Subject - the researchs are the tests used for estimation of coordination. In the present experiment, there are three tests : 1. Handed dribble between stands 2. Sqeezing and skipping, 3. Polygon backward. Aim of the research is to determine the validity and reliability of mentioned tests, and the possibility of valid and reliable usability for diagnosis and prediction of coordination at man. Research Hypothesis - In accordance with previous theoretical and empirical

knowledge obtained on sample of athletes and no-athlets, children, youth, younger and older adolescents, can be set up following hypothesis: **H1**- It is expected that tests for estimation of coordination : hand dribble between the stands, sqeezing and skipping and polygon backwards, possess high and statistically significant coefficient for validity and reliability.

Sample
Sample included 112 students of high school. Because of it is electro scope and only male population, taken by a first, second, third fourth grade, random sample group. The conditions that someone would be selected in sample are respondents- students belong to the selected classroom, and student agree to be tested. The students were at the time of testing were clinically healthy and are not freed from physical education classes. Respondents testing students involved were the all results of all tests. All methodogical, spatial and material-technical requirements for the purposes of this study are completely fulfilled.

Sample variables
The sample consists of manifest variable tests fo estimation of coordination: Dribble hand between stands (klop), Sweezing and skipping (kpps) and Polygon backwards (kpnt). In the order of greater accuracy in reaching conclusions and comparison obtained below is described in detail the methodology of each motor test.

Methods of data processing
According to the set out the aim and problem of experimental research in this experimental work beside the standard –basic statistic, coefficients have been calculated – reliability. It is applied the Crombah-alpha coefficient of reliabiltiy, known as lower limit of reliability. Factor validity has been checked in each test and retest which were three. So there were three test for estimation of coordination, where each test has been repeted three times. The factor validity has been determined by method of principal components for each test. In addition to the factor validity, it has been made predictive validity in all combinations. Criteria and Predictor variables have been varied in the example, that the three multiple regression analysis have been calculated. Predictive validity has been determined by applying of multiple regression analysis.

Results and discussion

Analysis of the results of basic statistic tests of coordination table 1., it could be noticed a tendency of improving the results from the first to the third measuring of the same test. Just such a tendency that the positive trend has been expected, and could be explained by the fact that the tests of coordination were burdened by the time i.e. the fast execution of complex and unfamiliar motor actions. After the first attempt, the experience is being gained, and after another even more, that is shown by arithmetic mean of all test.

Table 1. Descriptive Statistics

Tests	Min	Max	Mean	Std. dev/error	
klop1	6.72	14.3	9.45	.13	1.37
klop2	6.91	15.0	8.89	.11	1.20
klop3	6.80	12.0	8.66	.10	1.05
kpps1	9.55	31.0	14.78	.29	3.07
kpps2	8.78	25.3	13.83	.29	3.02
kpps3	8.38	26.2	13.01	.26	2.77
kpnt1	7.16	20.8	11.56	.22	2.36
kpnt2	6.84	20.3	10.63	.20	2.12
kpnt3	6.78	18.0	10.10	.20	2.07

The main task was to determine the reliability and validity of test coordination. The hypothesis is that the media expects high and statistically significant reliabiltiy and validity of test coordination. In addition to the tables: (2, 3 and 4) accurately and credibly have confirmed that the three tests of coordination showed a high and statistically significant reliability. Combah alpha coefficient of reliability is: (90, 93, 94) Matrix of inter-correlation of item i.e. test- retest is statistically important, where the correlation coefficient rangs from (71. to 88).

The analysis of variance anova and statistical significance of F ratio is too high. Namely, this method established that there is a statistically significant difference between the achieved results in test-retest. It could be assumed on the basis of basic statistics where the improing of the results have been already agreed from the first to the third measurements. At the first glance, these results seem paradoxical, but not if it is known that the relationship between the repondents in any attampt to be linear, which confirms the correlation matrix between items. Based on the statistical procedures performed in terms of reliability tests for the estimation of the coordination, hypotesis can be verified and concluded that these tests have high statistically significant reliability.

According to the presented, it can be applied, and to them we can rely on in the process of estimation of coordination as psyshomotoric capabiltiy. The aforementioned conclusion is valid provided that such tests have satisfactory validity. The results of validity of tests for estimation of coordination are shown in the tables: 5,6,7. It should be noted that reliable and valid tests are reliable and valid only if they are precisely defined (bounded) by time, space, sex and age. By changing of these factors, probably it is changing the reliabilty and validity tests, thus their sense of use. The conclusion is that a valid test in one time, space and sex, age, does not mean valid test in some other time, space, age and sex. The above mentioned facts shows to us, that there is no permanently and universally valid and reliable test, especially when they are not complex psychomotoric skills such as coordination.

Table 2. The reliability of test polygon backward – klop (test, correlations, ANOVA)

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.904	0.909	3

	klop1	klop2	klop3
klop1	1.00	0.83	0.71
klop2	0.83	1.00	0.77
klop3	0.71	0.77	1.00

Variance		Sum of Squares	df	Mean Square	F	Sig
Between People		412.66	111	3.72		
Within People	Between Items	37.35	2	18.68	52.50	0.00
	Residual	78.99	222	0.36		
	Total	116.34	224	0.52		
Total		529.00	335	1.58		
Grand Mean = 9.001						

Table 3. The reliability of test swezing and skipping – kpps (test, correlations, ANOVA)

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.934	0.935	3

	kpps1	kpps2	kpps3
kpps1	1.00	0.79	0.84
kpps2	0.79	1.00	0.86
kpps3	0.84	0.86	1.00

Variance		Sum of Squares	df	Mean Square	F	Sig
Between People		2571.80	111	23.17		
Within People	Between Items	175.13	2	87.57	56.99	0.00
	Residual	341.14	222	1.54		
	Total	516.27	224	2.31		
Total		3088.06	335	9.22		
Grand Mean = 13.872						

Table 4. The reliability of test polygon backwards –kpnt (test, correlations, ANOVA)

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.944	0.946	3

	kpnt1	kpnt2	kpnt3
kpnt1	1.00	0.87	0.81
kpnt2	0.87	1.00	0.88
kpnt3	0.81	0.88	1.00

Variance		Sum of Squares	df	Mean Square	F	Sig
Between People		1430.18	111.00	12.88		
Within People	Between Items	123.00	2.00	61.50	85.06	0.00
	Residual	160.51	222.00	0.72		
	Total	283.51	224.00	1.27		
Total		1713.69	335.00	5.12		
Grand Mean = 10.764						

Table 5. Factor analysis of dribble hand – klop

Component	Initial Eigenvalues			Comunalities	
	Total	% of Variance	Cumulative %	SMC	H2 - 1 eigen
1	**2.54**	**84.67**	**84.67**	0.85	0.92
2	0.30	9.91	94.58	0.89	0.94
3	0.16	5.42	100.00	0.80	0.90

Table 6. Factor's analysis test of squeezing and skipping – kpps

Component	Initial Eigenvalues			Comunalities	
	Total	% of	Cumulative	SMC	H2 - 1
1	**2.66**	**88.55**	**88.55**	0.87	0.93
2	0.21	7.02	95.57	0.88	0.94
3	0.13	4.43	100.00	0.91	0.96

Table 7. Factor's analysis test of polygon bacwards - kpnt

Component	Initial Eigenvalues			Comunalities	
	Total	% of	Cumulative	SMC	H2 - 1
1	**2.71**	**90.27**	**90.27**	0.89	0.94
2	0.19	6.20	96.47	0.93	0.96
3	0.11	3.53	100.00	0.89	0.95

Table 8. Regression analysis test (kpnt - kpps) on klop (ANOVA, coefficients)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	200.08	2	100.04	**10.51**	**.000ᵃ**
	Residual	1037.90	109	9.52		
	Total	1237.98	111			
a. Predictors: (Constant), kpnt, kpps						
b. Dependent Variable: klop						

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	19.62	1.64		**11.97**	**0.00**
	kpps	0.09	0.05	0.22	**1.75**	**0.08**
	kpnt	0.12	0.07	0.22	**1.71**	**0.09**
a. Dependent Variable: klop						

Table 9. Regression analysis test (kpnt - klop) on kpps (ANOVA, coefficients)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4050.75	2	2025.38	**60.24**	**.000ᵃ**
	Residual	3664.64	109	33.62		
	Total	7715.39	111			
a. Predictors: (Constant), kpnt, klop						
b. Dependent Variable: kpps						

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.26	4.67		**0.91**	**0.36**
	klop	0.31	0.18	0.12	**1.75**	**0.08**
	kpnt	0.90	0.10	0.67	**9.41**	**0.00**
a. Dependent Variable: kpps						

Table 10. Regression analysis test (kpps - klop) on kpnt (ANOVA, coefficients)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2250.28	2	1125.14	**60.11**	**.000ᵃ**
	Residual	2040.25	109	18.72		
	Total	4290.53	111			
a. Predictors: (Constant), kpps, klop						
b. Dependent Variable: kpnt						

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.26	4.67		**0.91**	**0.36**
	klop	0.31	0.18	0.12	**1.75**	**0.08**
	kpnt	0.90	0.10	0.67	**9.41**	**0.00**
a. Dependent Variable: kpps						

Conclusion

Like most other psychomotoric capabilities, coordination could be improved and perfected by systematic work. The work on developing of coordination, the tasks are set so that they are flexible and can be carried out in unpredictable and unexpected circumstances. It shoul offer the different selection of movements and excercises so that motoric experience be inriched, which later in the phase of complex coordination activity influences more easier and better overcoming of moving tasks and sport's technique.

It is very important and and essential to determine and assess the state of coordination and there is a large number of tests. Some of them have been used in this study and to assess the coordination of high school students.

On the basis of carried out statistical procedures and received results, it could be concluded that mentioned tests for estimation of coordination have showed high and statisticaly important reliability and validity. Crombah Alpha reliability coefficient is (90, 93, 94) and matrix intercorelation items or test-retest, shows statistically significant correlation coefficient values from (71. to 88). Test that are used to assess of coordination in addition of demostrated high and statistically significant reliability , after the application of methods of factor and predictive validity generally proved satisfactory and a high factor and predictive validity. Therefore, the assumption that the tests has been used in this experimentala work possess a high and statistically significant reliability and validity has been verified.

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METRIJSKE KARAKTERISTIKE TESTOVA ZA PROCJENU KOORDINACIJE

Sažetak

Praksa i znanost svakodenvno potvrđuju da je koordinacija jedna od najvažnijih psihomotoričkih sposobnosti. Baš zbog te činjenice, koordinacije je u svim formulama i jednadžbama specifikacije uspjeha u sportu. Postoji više definicija koordinacije u stručnoj i znanstvenoj literaturi. U pravilu, spomenute definicije su necjelovite ili tek djelomično dobre. Esencijalno, koordinacija je sposobnost središnjeg živčanog sustava da upravlja skeltno-mišićnim sustavom. Ovo istraživanje je posvećeno metrijskim karakteristikama testova za procjenu koordinacije s posebnim naglaskom na pouzdanost i valjanost takvih testova. Naime, bilo koji koristan i primjenjiv test mora posjedovati slijedeća metrijska svojstva: pouzdanost, valjanost, objektivnost i diskriminativnost. Istraživanje je provedeno na uzorku od 112 studenata koji su izvodili tri testa za procjenu koordinacije: 1. Vođenje lopte oko stalaka (klop), 2. Provlačenje i preskakivanje (kpps) i 3. Poligon natraške (kpnt). Nako završenog istraživanja, može se zaključiti da spomenuti testovi pokazuju visoku i statistički značajnu pouzdanost i valjanost. Crombahov alfa koeficijent pouzdanosti je bio visok (.90, .93, .94) a matrica korelacija čestica (ili test-retest) pokazuje statistički značajne vrijednosti, pri čemu su koeficiienti korelacija u rasponu od .71 do .88. Kod svih testova, na temelju čestica retesta dobiven je uvijek samo jedna značajna eigen vrijednost ($\Lambda_1 = 2.66$) uz ekstrahiranu varijanca od .89 za klop test, ($\Lambda_1 = 2.70$) uz ekstrahiranu varijancu od .85 za kpps test i ($\Lambda_1 = 2.70$) uz ekstrahiranu varijancu od .90 za kpnt test. Na temelju rečenih vrijednosti može se zaključiti da analizirani testovi imaju zadovoljavajuću faktorsku valjanost uz dodatnu visoku i statistički značajnu pouzdanost. Objektivnost i diskriminativnost kao značajni metrijski atributi su bili na visokojk razini, što je potvrđeno vrijednostima u tablicama.

Ključne riječi: *koordinacija, metrika, valjanost, pouzdanost, procjena*