THE INFLUENCE OF MOTOR ABILITIES ON BELLY DANCE EFFICIENCY OF FEMALE STUDENTS IN THE THIRD AND FOURTH GRADE OF SECONDARY SCHOOL

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Original scientific paper

Abstract

The aim of the study was to determine the relation of motor abilities and belly dance performance in female high school students, 3rd to 4th graders aged 17–18 years. A battery of 19 motor tests was used and nine belly dance elements evaluated in the study sample that included 103 students. Through factor analysis of motor space, we isolated six factors and these are: movement speed, leg explosiveness, flexibility, coordination in rhythm, equilibrium and arm strength. Through factor analysis of belly dance elements evaluation, we isolated one factor as the factor of general specific ability for belly dance efficiency. Regression analysis in the latent space showed that in the third- and fourth-grade high school female students the best efficiency predictor in belly dance is the factor of coordination in rhythm, the equilibrium factor, the speed factor and the flexibility factor.

Key words*: kinesiological education, belly dance, motor status, female high school students*

Introduction

Dance is an irreplaceable teaching tool in kinesiological education of female subjects from primary school to university since it gives significant contribution to, among other things, development and maintenance of basic motor abilities. Therefore, many teachers use dance as an unavoidable kinesiological operator with transformational values manifested in practice, but also scientifically proved by a number of studies (Srhoj & Miletić, 2000; Srhoj, 2002; Miletić et al., 2004; Srhoj et al., 2006). The above mentioned and other studies revealed that dance aerobics syllabuses significantly influence changes in the morphological structure in terms of adipose tissue reduction, the development of flexibility and the development of dynamic strength. The implementation of dance in medical purposes is of particular significance – treating dance structures as kinesiological operators in transformation and maintenance of the achieved level of the anthropological status functions (Delaš et al., 2007; Malina & Bouchard, 1991; Mihaljević et al., 2007; Schmidt & Wrisberg, 2000). Oriental dance has been created for a female body with focus on abdominal muscles, movements of hips and chest. This dance is characterised by its smooth, articulate, complex, sensual movements articulated with swaying, twisting movements. The conductor of the dance tempo is characteristic music, extremely emotionally stimulating, which inspires movements.

Aim

The aim of this study is to establish mutual determination of motor abilities in belly dance efficiency of secondary school female students, aged between 17 and 18.

Within the given global aim, there are some partial aims such as: establishing latent structure of basic motor space, establishing latent structure of evaluated elements in belly dance in the students and establishing their mutual connection.

Methods

Subject sample

Study subjects were selected from a population defined as clinically healthy female high school students attending 3rd and 4th grades at Healthcare Education Center, aged 17–18 years, able to attend physical training classes. The research has been done on the sample of 103 students. According to the experimental procedure protocol, kinesiologic treatment with belly dance structures was performed during physical training classes, two periods weekly per class for six weeks.

Variable sample and statistical analysis

Motor variables were so chosen as to provide the best possible assessment of the basic motor abilities considered relevant for dance performance (Srhoj, 2002; Srhoj et al., 2008; Srhoj & Miletić, 2000; Srhoj et al., 2006; Viskić-Štalec et al., 2007). The following variables were employed on motor status evaluation: polygon backward (POLB) and sidesteps (SS) (coordination); hand tapping (HTAP) and foot tapping (FTAP) (movement frequency); non-rhythmic tapping (NRTAP) and hand and foot tapping (HFTAP) (rhythm coordination); forward bow (FB) and bench touch-toe (BTT) (flexibility); bench standing – eyes closed (BSEC) and bench standing – eyes open (BSEO) (equilibrium);

standing jump (SJ), 20-m run (R20M) and medicine ball supine throw (MBST) (explosive strength); sit-ups (SU), prone sit-ups (PSU) and crouch (CR) (repetitive strength); bent arm hang (BAH) and lever hang (LH) (static strength); and 6-min run (R6MIN) (functional ability, i.e. aerobic endurance). The following 9 variables were used on assessment of the belly dance motor skills (performance scores for three arm, trunk and hip elements each): isolation of upper extremities, isolation of trunk, breathing and chest movements, hip circle, hip bounce, horizontal figure 8, vertical figure 8, Egyptian shimmy and shoulder shimmy. Three independent evaluators (professors of kinesiology) ranked performance of 9 belly dance elements on a 1–5 scale by analysis of video records. Within the descriptive analysis context basic descriptive parameters have been calculated: arithmetic means (AM), standard deviations (SD) and minimum and maximum result value (MIN, MAX) and Cronbach alpha - Cronbach coefficient (α) reliability of criterion variable. Normality distribution testing has been conducted according to Kolmogorov-Smirnov method.

Factor analysis was used to determine factor structure in the sample of motor variables (with calculation of the following variables: V – significant varimax factors according to Guttman-Kaiser criterion of I>1; Lambda – characteristic values; and Variance % – percentage of variance explained by each latent dimension). Regression correlation analysis was employed to determine correlation between the set of motor variables and criterion variable, with calculation of the regression coefficient (b), coefficient of multiple correlation of the set of predictors with the criterion (r), and level of significance of multiple correlation.

Results and discussion

Tables 1 and 2 display basic descriptive and distribution parameters of the predictor, i.e. motor set of variables and the evaluation of the realisation of belly dance elements as criterion variable. It is evident all the criterion space variables are normally distributed as well as the variables of predictor space except in test of equilibrium with the eyes opened which deviates from the normal distribution to a smaller extent.

Table 1. Descriptive statistics of basic motor abilities (Test=0.16)

Variables	AM	MIN	MAX	SD	KS
Polygon backward#	14.60	8.85	2600	3.33	0.07
Sidesteps#	15.73	12.40	22.21	2.05	0.13
Hand tapping	38.12	30.00	50.00	3.77	0.08
Foot tapping	19.23	15.00	25.00	2.24	0.10
Non-rhythmic tapping	14.29	7.00	20.00	2.15	0.10
Hand and foot tapping	13.38	8.00	19.00	2.28	0.12
Forward bow	81.45	59.00	111.00	12.01	0.05
Bench touch-toe	3.00	0.27	12.71	6.64	0.07
Bench standing-eyes closed	1.87	0.60	3.41	0.59	0.09
Bench standing-eyes open	3.47	0.95	10.00	2.09	0.18
Standing jump	165.68	100.00	250.00	23.58	0.09
20-m run#	4.15	2.40	5.06	0.41	0.08
Medicine ball throw	204.79	100.00	330.00	46.72	0.09
Sit-ups	41.58	28.00	60.00	7.29	0.10
Prone sit-ups	43.92	10.00	75.00	10.53	0.07
Crouching	26.12	20.00	36.00	2.78	0.11
Bent arm hang	25.36	0.00	61.00	15.15	0.09
Lever hang	41.02	0.00	120.00	30.04	0.13
6-min run	1035.9	700.00	1350.0	125.8	0.08

#variable with opposite metric orientation TEST= 0,16

Table 2. Descriptive statistics Belly dance element scores (Test=0.16)

Variables	AM	MIN	MAX	SD	KS	α
Isolation of arms	3.31	1.00	5.00	0.85	0.13	0.91
Isolation of chest	3.29	1.33	5.00	0.80	0.13	0.91
Breathing and chest move.	3.46	1.33	5.00	0.79	0.16	0.90
Hip circle	3.49	1.33	5.00	0.76	0.15	0.89
Hip bounce	3.49	1.00	5.00	0.80	0.12	0.91
Horizontal figure	3.49	1.00	5.00	0.76	0.10	0.90
Vertical figure	3.22	1.00	5.00	0.84	0.13	0.92
Egyptian shimmy	3.47	1.00	5.00	0.83	0.10	0.91
Shoulder shimmy	3.79	1.33	5.00	0.71	0.12	0.92

Table 3. Factor analysis of motor abilities

Variables	V1	V2	V3	V4	V5	V6
Polygon backward#	-0.60	-0.07	-0.30	-0.05	-0.23	-0.17
Sidesteps#	0.22	-0.47	-0.31	-0.37	-0.21	-0.43
Hand tapping	0.63	0.10	0.14	-0.03	0.18	-0.03
Foot tapping	0.74	0.11	0.11	0.20	0.13	-0.04
Non-rhythmic tapping	0.04	0.14	0.22	0.76	-0.06	0.09
Hand and foot tapping	0.16	-0.23	0.09	0.80	0.02	-0.09
Forward bow	0.36	0.09	0.73	0.19	0.01	-0.07
Bench touch-toe	0.17	-0.02	0.76	0.13	0.11	0.02
Bench standing-eyes closed	0.11	0.09	0.26	-0.03	0.84	0.05
Bench standing-eyes open	0.17	0.03	-0.06	0.04	0.80	0.04
Standing jump	0.13	0.69	0.28	0.04	-0.01	0.26
20-m run#	-0.09	-0.73	0.15	0.05	-0.10	0.13
Medicine ball throw	0.21	0.44	0.22	0.06	-0.13	-0.61
Sit-ups	0.58	0.39	0.06	0.07	0.03	0.18
Prone sit-ups	0.29	0.43	-0.20	-0.10	0.40	0.03
Crouching	0.44	0.03	0.16	0.14	0.15	0.49
Bent arm hang	0.16	0.14	0.05	-0.12	-0.01	0.59
Lever hang	-0.26	-0.15	0.47	-0.51	-0.02	-0.16
6-min run	0.60	0.05	-0.16	0.14	-0.13	0.49
Lambda	2.72	1.93	1.92	1.79	1.72	1.59
Variance%	14.36	10.14	10.09	9.43	9.07	8.38

To have a complete information on the latent structure of belly dance in the space of motor abilities, we first presented the results of factor analysis of the motor set of variables and the factor analysis of the variables to evaluate specific motor knowledge of belly dance (tables 3 and 4) and further on, relations between thus formed latent motor and specific motor variables (table 5). In the third- and fourth-grade female students, factor analysis has isolated six factors in the motor space (table 3). The first factor is characterised by high projections of test for evaluating frequency movements, test for evaluating coordination, test for evaluating aerobic endurance and test for evaluating repetitive power of trunk. The basis of this factor is a mechanism regulating the speed of all body parts, which is based on the integration of coordination and the movement frequency speed. In these students, the function of serial processor (movement frequency) is regulated by the simultaneous processor function (the structuring of moving). The referred factor integrates information and energy component of moving which can broadly be defined as general motor efficiency based primarily on the integration of mechanisms for maintenance and regulation of the intensity of stimulus. The second factor is defined by tests for the evaluation of explosive power of sprint and jump; therefore it can be called the factor of legs explosiveness. The basis of this factor is the mechanism of energy mobilisation intensity. The third factor is defined by test for evaluation of flexibility, the basis of which is the regulation of muscle tonus. The largest projections on the fourth factor have the tests for the evaluation of coordination in rhythm, so we can call it the factor of coordination in rhythm, and its basis is largely simultaneous information processing.

The fifth factor is predominantly defined by equilibrium and is responsible for synergy regulation of muscle function. The sixth factor is bipolar and contrasts absolute power from the aspect of throwing from tests of relative power of upper and lower extremities saturated by muscle and aerobic endurance. Factor analysis in the space of evaluating the belly dance elements (table 4) has isolated only one factor defining efficiency in its realisation. Namely, all the evaluated belly dance elements have significant projections on the isolated factor which means the performance of every element is strongly connected and that the object of measuring in all belly dance elements is the same.

Table 4. Factor analysis of Belly dance scores

Variable	V1
Isolation of arms	0.84
Isolation of chest	0.90
Breathing and chest movements	0.91
Hip circle	0.92
Hip bounce	0.91
Horizontal figure	0.90
Vertical figure	0.89
Egyptian shimmy	0.90
Shoulder shimmy	0.88
Lambda	7.21
Variance%	80.11

To determine relations of the obtained latent motor variables and criterion variable (efficiency in belly dance performance), we applied regression correlation analysis on the sample of the third- and fourth- grade female students (table 5). Averagely high multiple correlation ($p = 0.45$) with the significance level of $p<0.01$ was obtained between predictor variables and the criterion variable, so the formed set of motor factors is a good efficiency predictor in belly dance in female high school students.

All four factors responsible for information component of movement have a significant efficiency determination in belly dance and these are consecutively: the factor of coordination in rhythm, the factor of movement frequency (speed regulator), the equilibrium factor (synergy regulation of movement) and the flexibility factor (muscle tone regulation). Factors responsible for energy component of movement do not influence the performance of belly dance elements which may imply that students at this stage of development have developed their basic power factors to an appropriate degree, so these will not limit belly dance efficiency in addition to the fact that belly dance treatment is not sufficiently energy demanding to cause changes in basic strength factors.

Table 5. Regression analysis

Latent motor variables	β	
Universal motor efficiency	0.22	b
Explosive strength feet	0.01	
Flexibility	0.20	b
Rhythm coordination	0.23	a
Equilibrium#	0.22	b
Diff. abs. from relatively strength	0.05	
P	0.45	a

(β – regression coefficient, ρ - multiple correlation, a $p<0.01$, b $p<0.05$)
#variable with opposite metric orientation

In accordance with belly dance performance, adequate motor structures-systems are also formed in high school students. Belly dance performance is predominantly connected to the abilities of information component of movement regulation in terms of involving certain muscles and/or muscle systems, starting with lower legs, upper legs, hips, lower trunk, upper trunk, shoulders, upper arms, lower arms and hands. Belly dance is only ostensibly predominated by movements of hips and trunk, i.e. the central body regions, since belly dance activates the muscles of all body regions in a way to involve muscles of a certain region and to exclude the muscles of other regions or to involve certain muscles or a muscle of one region while excluding other muscles of that region, or by involving successively all muscle systems of the body in a complete dance structure.

Therefore, this is about the abilities of inter-muscle and intra-muscle coordination, the abilities of fine synergy regulation and the muscle tone regulation. All the mentioned abilities should be integrated for an efficient realisation of belly dance. The results show that the manifestation of coordination from the aspect of coordination in rhythm is clearly manifested only when other relevant motor abilities, to which coordination is saturated, have reached a satisfactory development level (Katić, 2003; Katić et al., 2001, 2004, 2005).

Evidently, the result of any kinesiological activity including belly dance depends on the function of general motor mechanism which integrates and regulates functions of all other mechanisms, if we are discussing information and energy components of movement (Katić, 1995, 2003; Miletić et al., 2004; Malina & Bouchard, 1991; Schmidt & Wrisberg, 2000). By the beauty and luxury of its movement, in addition to a large diversity of structures and rhythms, dances offer enough material and abilities to develop aesthetic awareness and the sense of beauty through movement and moving.

Conclusion

The aim of this study was to establish mutual determination of motor abilities and belly dance efficiency in the third- and fourth-grade female high school students aged 17-18. For this purpose, we applied the battery of 19 motor tests on the sample of 103 students and we evaluated nine belly dance elements. Through factor analysis of motor space, we isolated six factors and these are: movement speed, leg explosiveness, flexibility, coordination in rhythm, equilibrium and arm strength. Through factor analysis of belly dance elements evaluation, we isolated one factor as the factor of general specific ability for belly dance efficiency.

Regression analysis in the latent space showed that in the third- and fourth-grade high school female students the best efficiency predictor in belly dance is the factor of coordination in rhythm, the equilibrium factor, the speed factor and the flexibility factor.

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UTJECAJ MOTORIČKIH SPOSOBNOSTI NA USPJEH U TRBUŠNOM PLESU UČENICA TREĆEG I ČETVRTOG RAZREDA SREDNJE ŠKOLE

Sažetak

Cilj ovoga istraživanja bio je utvrditi međusobnu determiniranost motoričkih sposobnosti i uspjeha u trbušnom plesu kod učenica trećeg do četvrtog razreda srednje škole u dobi od 17–18 godina. U tu svrhu je na uzorku od 103 učenice primijenjen skup od 19 motoričkih testova, te izvršeno ocjenjivanje devet elemenata trbušnog plesa. Faktorskom analizom motoričkog prostora izolirano je šest faktora: brzina pokreta, eksplozivnost nogu, fleksibilnost, koordinacija u ritmu, ravnoteža i snaga ruku. Faktorskom analizom ocjena elemenata trbušnog plesa izoliran je jedan faktor kao faktor generalne specifične sposobnosti za uspjeh u trbušnom plesu. Regresijska analiza u latentnom prostoru je pokazala da je kod učenica 3 i 4 razreda najbolji prediktor uspjeha u trbušnom plesu faktor koordinacije u ritmu, faktor ravnoteže, faktor brzine, te faktor fleksibilnosti.

***Ključne riječi**: kineziološka edukacija, trbušni ples, motorički status, učenice*

Received: August, 11, 2009.
Accepted: November 22. 2009.
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