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Motor Abilities in Dance Structure Performance in Female Students

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A B S T R A C T

The aim of the study was to analyze the relation between motor abilities and performance in folk dances originating from the island of Hvar and modern social dances. Two groups of variables were used in a sample of 78 female students of the Teacher Training College from Split: 7 motor variables as a battery of predictors, and performance evaluation of 4 dances (2 folk dances, i.e. ciciliona and pašavijen, and 2 social dances, i.e. cha-cha-cha and rock-'n'-roll) as criterion variables. Canonical correlation analysis between the groups of variables yielded two canonical correlations of 0.94 and 0.73, with a level of significance of $p<0.001$. The first canonical correlation was based on marked determination of coordination and ciciliona dance, and the second one on explosive strength of the running type with below-average coordination and the cha-cha-cha, rock-'n'-roll and pašavijen dances. Regression analysis indicated the battery of motor variables used to be a good predictor of performance in all study dances, with multiple correlation of 0.93 in ciciliona, 0.84 in pašavijen, 0.75 in rock-'n'-roll and 0.73 in cha-cha-cha. In ciciliona and pašavijen, the latent dance structure is predominantly explained by coordination, in rock-'n'-roll by explosive strength, and in cha-cha-cha by explosive strength and speed. Discriminative analysis revealed the general dance performance to mostly depend on coordination, then on explosive strength, and to a lesser extent on speed (movement frequency). Dance is an irreplaceable educational tool in kinesiologic education of female students, among others for its considerable contribution to the development and maintenance of basic motor abilities.

***Key words**: female students, motor abilities, folk and social dances, relations*

Introduction

Dance is a primordial source of all arts. Dance mirrors man in general, his feelings, tendencies, wishes and needs in all stages of mankind development, and all these reflections have remained accumulated in man to the present. The art of dancing is closely related to all human traditions, including war, work and love. Over centuries, dances with pronounced artistic aspirations have been identified from the primordial dances through mystic, magic, war and erotic dances characterized by rough movements and jumps. The use of dance structures in kinesiologic education has multiple educational effects, including national, social, aesthetic and health aspects[1,2]. Learning about one's own culture and respect for it helps in developing proper feeling about and tolerance of other cultures[3,4]. The social educational task is fully completed through dancing[5]. Dancing provides equality, connection and harmonization among people, also making individuals members of a group. Through the beauty and wealth of movements, and a great variety of forms and rhythms dances offer an excellent tool for the development of aesthetic awareness and sense for the beauty through motion and movement[6]. Dance is poetry of body movements expressed through most heterogeneous dance rhythms.

Dance has a major role in health care, where dance structures are considered as kinesiologic operators in the transformation and maintenance of the achieved functional level of the anthropologic status[7–11]. The use of dance helps in overcoming the feeling of inferiority, establishment of interpersonal relations and communication, resocialization, and social adaptability[2]. The majority of fascinating rhythms come from Latin American countries, most of them originating from Africa. Many richly colored and exotic dances have been developed to express the exciting and lively music based on these rhythms. Both Latin American dances (samba, rumba, cha-cha-cha, paso doble and jave), standard social dances (English waltz, Viennese waltz, tango, slow fox trot and

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fast fox trot), modern disco dances (rock'-n'-roll) and folk dances have currently been widely included in formal education as well as in recreational and sports activities.

In 2002, Srhoj analyzed the impact of motor abilities on the folk dance ciciliona performance, and found the latter to be limited by the above average psychomotor speed. That is why excellent dancers fill the audience with admiration by the ease of high frequency, rhythm harmonized movements (especially leg movements) with high elegance of body posture. It has been noted that ciciliona implies a true act of art and harmony of movements and rhythm, integrating classic and modern dance concepts[11].

In the present study, two folk dances from the island of Hvar (ciciliona and pašavijen) and two modern social dances (cha-cha-cha and rock'-n'-roll) were analyzed in a non-selected sample of female students from Split to get information on the dancing expression continuity. The specific and overall impact of basic motor abilities on dance structure performance, and use of folk and social dances in kinesiologic education of female students were analyzed.

Subjects and Methods

Subjects

Study sample consisted of 78 first-year female students of the Teacher Training College in Split, Croatia, mean age 19 years (±6 months). Study subjects attended a 10-period experimental program consisting of two folk dances from the island of Hvar (ciciliona and pašavijen) and two modern social dances (cha-cha-cha and rock'-n'-roll) as part of kinesiologic curriculum. The only criterion for student selection for experimental program was that they were clinically healthy and free from any aberrant manifestation.

Study variables

Upon completion of the experimental program, two groups of variables were used in study subjects. A group of 7 motor variables served as the group of predictors, whereas the score on specific motor skills in performance of the two folk dances and two social dances performance were considered as criterion variables.

Predictor variables

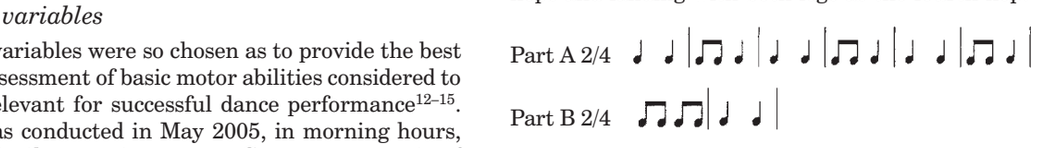
Motor variables were so chosen as to provide the best possible assessment of basic motor abilities considered to be most relevant for successful dance performance[12–15]. Testing was conducted in May 2005, in morning hours, according to the preset sequence. Seven components of physical fitness were tested:

– polygon backward (s) to estimate coordination in resolving a complex motor task (the task was to cover a 10-m distance at the »go« signal by walking backward on all fours, passing across a low box and through the frame of the box, the results being recorded in tenths of second);
– hand tapping (taps/min) to estimate psychomotor speed (the task was to touch, within 15 s, both panels on the tapping board alternately by finger as quickly as possible, the result being the number of cycles, where each cycle represented touching of both round panels);
– forward bow (cm) to estimate flexibility (from the sitting position on the floor, where the legs were extended at an angle of 45°, the subject had to lean forward as deep as possible, so that the tips of the fingers of the clasped hands glided along a meter on the floor, the result being the distance from the original touch, i.e. from zero to the ultimate touch recorded in centimeters);
– standing jump (cm) to estimate the explosive strength of the jump type (the task was to jump from the spot forward as far as possible, the result being recorded in cm);
– 20-m run (s) to estimate the explosive strength of the running type (from high start, the result being recorded with an accuracy of 0.1 s);
– sit-ups (*per* min) to estimate the repetitive strength of the body (the task was to make as many lifts of the body as possible from the supine position with legs at 90°); and
– bent arm hang (s) to estimate the static strength of the arms (the task was to endure as long as possible hanging by arms with the chin above the bar, the result being recorded in s).

Criterion variables

A group of 4 variables, i.e. scores on 4 dances, were used on evaluation of specific motor skills. Five independent evaluators (professors of kinesiology) ranked performance of the four dances (4 dance structures) on a 1–5 scale by analysis of video records.

Ciciliona (island of Hvar) is a pair dance. Pairs of dancers perform the dance in the closed, classic hold. The dance begins with a spitz-polka performed as follows: hopping on one leg, touching the floor with the heel of the other, extended leg obliquely outwards, then hopping again to touch the floor with toes of the same leg. This is followed by three fast sidewise steps to free the other leg and starting spitz-polka with this leg. All these actions are repeated twice, followed by three sidewise gallop hops and landing with both legs as the fourth hop.



Pašavijen (island of Hvar) is a pair dance. The dance begins with lateral outward bow, with weight transfer to the outer leg, followed by fast weight transfer to the inner leg and standing still. This is repeated once, then the man leads his partner to the other side, so that she makes the whole circle to face the same direction as her partner. Coming into closed hold (as in standard dances),

they start intensive rotation with marked left- to-right hip swaying. This dance requires quick reaction both in the first segment of weight transfer to the outer leg and then to the inner leg with hip swaying, and in intensive rotation with pronounced hip swaying. Rhythm:

Part A 3/4 

Part B 2/4 

Part C = A to the other side
Part D = B the other leg to the other side
Part E = B
Part F = D

Part G 2/4 

Cha-cha-cha is a Latin American dance. The main structure of the dance are three fast steps and two slow steps with forward-backward and backward-forward weight transfer. The first three steps require coordinated movement of one-leg take-off, two-leg knee-bends and light one-leg push. The synchronized forward-backward weight transfer that follows is accompanied by a wide, aesthetic free hand motion.

Rhythm: 

On scoring, the assessors paid special attention to correct performance of the following: basic step, basic step forward and backward, promenade forward and backward, turn (to both sides).

Rock-'n'-roll is a dance of high intensity.

Rhythm: 

Male dancer holds the female partner's right hand with his left hand, at the arm distance. Male dancer begins the basic step with his left leg, and female dancer with her right leg. On crossing, the dancers quickly outreach their hands and turn them back alongside the body. On scoring, the assessors paid special attention to correct performance of the following: basic step of the rock-'n'-roll dancing structure and basic step and step on changing the rock-'n'-roll dancing structure.

Statistical analysis

On data processing, the basic descriptive parameters of motor variables (arithmetic means and standard deviation) were calculated for the sample as a whole and for each group according to the level of dancing structure performance (scored 1–5). Correlation between the group of predictor motor variables and group of criterion variables (scores on particular dances) was determined by canonical correlation analysis using the classic Hotelling procedure. Correlation between the group of motor variables and each individual criterion variable was determined by regression correlation analysis, with calculation of the coefficient of correlation (r), coefficient of multiple correlation of the group of predictors with the criterion (ρ), coefficient of determination (δ), and level of significance of multiple correlation and coefficient of determination. Canonical discriminative analysis was used to assess differences in motor abilities between the groups of students determined according to pooled result on the four dances. This analysis included calculation of discriminative function (DF), F-test for ANOVA, significance for ANOVA (p^A) and coefficient of canonical discrimination (Delta) with the level of significance set at $p<0.001$.

Results

Canonical correlation analysis between the group of motor variables (as predictor variables) and scoring of dance structure performance (as criterion variables) revealed two significant canonical correlations ($p<0.001$), and thus two significant linear combinations represented as pairs of canonical dimensions of the groups of variables used (Table 1).

The first pair of canonical dimensions yielded a very high correlation of 0.94, whereas the second pair showed high yet lower correlation of 0.73. The first dimension in the group of motor variables was predominantly defined by above average and maximal projection of the variable of coordination evaluation, whereas the first canonical dimension in the group of dance structures was predominantly and maximally defined by performance of the ciciliona dance. Thus, the impact of coordination on the

TABLE 1
BASIC DESCRIPTIVE PARAMETERS OF VARIABLES (X, SD) AND CANONICAL CORRELATION ANALYSIS BETWEEN THE SET OF PREDICTOR MOTOR VARIABLES AND SET OF CRITERION VARIABLES

Variable	(n=78)		CAN1	CAN2
	X	SD		
Polygon backward#	12.14	2.12	–0.99	–0.33
Hand tapping	34.42	4.71	–0.18	–0.23
Forward bow	65.87	11.82	–0.04	–0.05
Standing long jump	173.82	20.43	–0.13	–0.28
20 m run#	4.42	0.40	–0.05	0.78
Sit–ups (*per* min)	22.33	4.29	–0.02	–0.01
Bent arm hang	29.13	19.64	–0.07	–0.03
Ciciliona	3.27	1.20	0.98	0.61
Pašavijen	3.04	1.11	–0.02	–0.23
Rock-'n'-roll	2.87	1.32	0.12	–0.54
Cha–cha-cha	2.87	0.97	–0.23	–0.57
CANR			0.94*	0.73*

variable with the opposite metric orientation, *$p<0.001$, CAN – canonical variable, CANR – canonical correlation

ciciliona dance performance was the basis of correlation in the first pair of canonical dimensions.

The second canonical dimension in the group of motor variables was bipolar, defined by above average projection of the test of explosive strength of the sprint type, followed by the test of explosive strength of the jump type and test of movement frequency at the negative pole; and by above average projection of the test of coordination assessment at the positive pole. This canonical dimension discriminated two student types: those above average according to the explosive strength of sprint type but below average in coordination, and those above average in coordination but below average in sprint abilities.

The second canonical dimension in the group of dance structure was also bipolar, differentiating students superior in performing cha-cha-cha, rock-'n'-roll and pašavijen but inferior in performing ciciliona, and those superior in performing ciciliona but inferior in other dancing structures.

Correlation in the second pair of canonical dimensions was underlain by the considerable positive effect of explosive strength of the sprint type with below average coordination on the dancing structures of cha-cha-cha, rock-'n'-roll and pašavijen, and by the positive effect of coordination with markedly below average explosive strength of the sprint type on ciciliona performance. Accordingly, a motor structure with pronounced explosive strength of the sprint type and below average coordination favored performance of the dancing structures of cha-cha-cha, rock-'n'-roll and pašavijen but not of ciciliona. In contrast to this, the performance of ciciliona was favored by the motor structure (at the opposite pole of the second canonical variable) with an average ability of coordination and below average sprint ability. Thus, after the first canonical variable properly explained, the second canonical variable verified the performance of ciciliona to be predominated by coordination, and other dance structures by explosive strength of the sprint type.

Table 2 shows the results of regression analysis between the group of motor variables and each individual dance structure (4 regression analyses in total). Multiple correlations (ρ) and coefficients of determination (δ) indicate the performance of dance structures to be highly significantly determined by basic motor abilities. So, the ciciliona and pašavijen dances were mostly determined by coordination, and rock-'n'-roll and cha-cha-cha by explosive strength and psychomotor speed. The former two dance structures were predominated by the information component of movement, and the latter two by the energy component of movement.

Correlation coefficients (r) pointed to latent structure of a particular dancing structure in motor space. The higher the contribution of coordination to a particular la-

TABLE 2
RESULTS OF REGRESSION ANALYSIS BETWEEN THE SET OF PREDICTOR MOTOR VARIABLES AND EACH OF CRITERION VARIABLES

Variable	r			
	Ciciliona	Pašavijen	Rock-'n'-roll	Cha-cha-cha
Polygon backward#	–0.92	–0.80	–0.44	–0.44
Hand tapping	0.17	0.32	0.29	0.54
Forward bow	0.04	–0.00	0.00	–0.02
Standing long jump	0.21	0.39	0.51	0.49
20 m run#	–0.34	–0.55	–0.72	–0.64
Sit–ups (*per* min)	0.37	0.36	0.22	0.14
Bent arm hang	0.17	0.15	0.11	0.04
ρ	0.93*	0.84*	0.75*	0.73*
δ	0.87*	0.71*	0.57*	0.53*

#variable with the opposite metric orientation, *p<0.00, r – correlation coefficient, ρ – multiple correlation, δ – coefficient of determination,

TABLE 3
RESULTS OF DISCRIMINATIVE ANALYSIS IN MOTOR ABILITY TESTING BETWEEN STUDENT GROUPS ACCORDING TO DANCE PERFORMANCE

Variable	(n=78)			DF	F^A	p^A
	X_1 (n=25)	X_1 (n=28)	X_3 (n=25)			
Polygon backward#	10.58	11.78	14.42	–0.72	39.54	0.00
Hand tapping	36.12	34.37	32.55	0.21	3.56	0.03
Forward bow	67.04	62.37	69.32	–0.09	2.43	0.09
Standing long jump	183.72	175.63	160.09	0.35	9.74	0.00
20 m run#	4.14	4.39	4.77	–0.55	23.35	0.00
Sit-ups (*per* min)	23.60	22.97	20.01	0.25	5.06	0.01
Bent arm hang	33.04	30.11	23.36	0.14	1.48	0.23
Delta				0.82*		

#variable with the opposite metric orientation, *p<0.001, X_1, X_2, X_3 – means for groups 1, 2 and 3, DF – discriminant function, F^A – F-test for ANOVA, p^A – probability for ANOVA, Delta – canonical discrimination

tent motor structure of the criterion variable, the better the predicted performance in this criterion variable, i.e. dance structure. The highest determination of the motor group of variables was found in ciciliona, followed by pašavijen, rock-'n'-roll and cha-cha-cha. A higher demand for information in a dance structure means a lower energy demand; in pašavijen, the energy component and movement frequency are more pronounced than in ciciliona. In rock-'n'-roll and cha-cha-cha, explosive strength predominates over coordination, with explosive strength prevailing in rock-'n'-roll as compared with cha-cha-cha, and speed (movement frequency) prevailing in cha-cha-cha as compared with rock-'n'-roll.

In order to assess the impact of motor abilities on dance performance in general, dancing performance was defined as a unique criterion, i.e. as the pooled result in performing all dance structures used in the study. Then, discriminative analysis of motor abilities was performed between the groups of students defined as above average, average and below average performance of all dance structures analyzed. Thus, the overall dancing result depended on the general ability of performing different dance structures based on their motor structures. These motor structures of dance structure were predominantly determined by relations among coordination, explosive strength and speed (movement frequency) (Tables 2 and 3).

Results of F-test for ANOVA and discriminative function (DF) clearly showed the groups of students defined according to performance of dance structures to differ significantly in motor abilities of coordination and explosive strength (especially of the sprint type), and to a considerably lesser extent in the repetitive strength of the trunk and movement frequency (Table 3).

The performance of dancing structures is a complex task that primarily depends on the basic motor abilities that are mostly congenital, underlaying the general motor function efficiency. Thus, appropriate integration of coordination, explosive strength and speed occurs relative to performance of particular specific motor skills and abilities.

Discussion

Study results showed above average coordination to be crucial for performance of the ciciliona dance. In the operational sense, coordination is known to be the ability of integrating various movement routines into an integral, single movement structure[11,14,15,17,18]. The performance of complex movements activates the mechanisms responsible for manifestation of the basic motor abilities in terms of strength and force regulation, synergistic regulation and muscle tone regulation[14–16]. Description of the ciciliona dance reveals it to consist of specific motor routines, i.e. a very complex motor (dancing) structure in which a number of dance routines have to be integrated into a harmonious unity (steps and hops to the left and to the right, and semi-circular position exchange with the partner). Ciciliona is a lively dance that requires synchronized, coordinated movements, of lower extremities in particular, all this performed in pair, where any, even minor oscillation considerably impairs the performance and overall impression. This dance requires elegant and refined bearing of the trunk and upper extremities while using repetitive strength of the trunk, which makes the harmonious and concerted performance even more difficult.

In ciciliona the dance structure to be completely performed without any oscillations is strictly defined, whereas pašavijen dance is more free in performance, especially so as the partners are not tied tightly, at least in the first part of the dance, and dancing structure is different between the male and female dancers, with fast weight transfer from one leg to another and relaxed hip swaying. That is why the impact of coordination is less pronounced and not so predominant for acquiring and performing motor skills in pašavijen as it is the case in ciciliona; on performing pašavijen, there is greater activation of the mechanisms of force (explosive strength) and speed.

In modern social dances, performance predominantly occurs at the subcortical level, with the explosive strength and movement frequency prevailing over coordination in dances such as rock-'n'-roll and cha-cha-cha. In these dances, there is an integration of coordination into explosiveness and speed of dancing routine performance. Upon mastering dancing routines, the performance of complete dance structures is facilitated, entailing improved creativity and expressiveness through rhythm and movement. In contrast to this, performance and especially learning in folk dances occur predominantly at the cortical level, with the ability of coordination prevailing on performing dances like ciciliona and pašavijen.

In modern social dances, the latent motor structure is more complex and includes a significantly greater body of basic motor abilities on performance (Table 2). Thus, in addition to coordination, the abilities of explosive strength and psychomotor speed contribute significantly to the latent strucure of these dances. These results could only in part be explained by the mean scores obtained for particular dance performance, presented in Table 1; lower scores were obtained for modern dance than for folk dance performance, suggesting the result to be determined by more motor abilities in modern dances than in folk dances. However, a different level of mastering a particular dancing structure, i.e. of specific motor skills, could determine their association with the respective latent motor structure. Therefore, motor potential can only be used in relations that are optimal for a particular dancing structure upon having completely mastered that dancing structure.

More exact information on the effect of motor abilities on dance performance was obtained by the analysis of differences among the groups of students scored above average, average and below average in overall performance of dance structures in the four dances under study (Table 3).

As motor coordination integrates different movements into a unique movement structure, so the result in motor skills integrates various dancing routines into a unique dance structure, indicating the complexity of dance coordination and skill. Motor coordination is primarily saturated by two regulatory mechanisms, i.e. force regulation (explosive strength) and speed regulation (movement frequency), and as such it predominantly determines performance of dance structures. It is followed by a significant impact of explosive strength, which is considerably saturated by coordination[16], and only then by movement frequency. On performing dance structures, quick, successive and harmonious movements are required, with a predominant action of lower extremities. Repetitive strength of the trunk has a significant effect on dance performance, ensuring adequate force to perform lower extremity movements. Coordination in terms of cortical regulation of movements and as a mechanism superior to the mechanisms of force and speed regulation is always present on performing any dance structure[16].

In a study conducted by Srhoj in 2002 in female elementary schoolchildren aged 11, who underwent a 9-month experimental dance course, regression analysis demonstrated the performance in ciciliona dance to be predominantly determined by the abilities of movement frequency and rhythmical structure performance[11]. Accordingly, when the development of coordination and explosive strength has reached a satisfactory level, the dance performance will be limited by psychomotor speed.

Considering the interactive relations of motor abilities and dance structure performance, the results obtained showed the inclusion of dance in kinesiologic education of female students to be desirable and necessary, because dance influences the development of basic motor functions that are related to all other segments of the anthropologic system. The interlacement of rhythmical structures in folk and social dances enables more complex aesthetic and emotional expression through movements.

In order to get complete and comprehensive information on the influence of motor abilities on dance performance, similar studies were also carried out in selected samples of both sexes, and these results will be subsequently published. In addition, the impact of dance on the functional, conative and social status of subjects of all age groups will be analyzed.

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MOTORIČKE SPOSOBNOSTI U IZVOĐENJU PLESNIH STRUKTURA KOD STUDENTICA

SAŽETAK

Cilj rada je bio analizirati relacije motoričkih sposobnosti i uspjeha u izvođenju narodnih plesova otoka Hvara i društvenih modernih plesova. U tu svrhu na uzorku od 78 studentica Učiteljske akademije u Splitu primijenjena su dva skupa varijabli i to: skup od 7 motoričkih varijabli kao skup prediktora i ocjene izvedbe 4 plesa (2 narodna Ciciliona i Pašavijen, 2 društvena plesa Cha-cha-cha i Roc'n'roll) kao varijabli kriterija. Kanoničkom korelacijskom analizom između skupova varijabli dobivene su dvije kanoničke korelacije od 0.94 i 0.73 uz razinu značajnosti od $p<0.001$. U osnovi prve kanoničke korelacije je izrazita determiniranost koordinacije i plesa Ciciliona, a u osnovi druge je determiniranost

eksplozivne snage tipa trčanja uz ispod prosječnu koordinaciju i plesova: Cha-cha-cha, Rock'n'roll, te Pašavijen. Regresijskom analizom je utvrđeno da je primijenjeni motorički skup varijabli dobar prediktor uspjeha u svim plesovima uz multiplu korelaciju: 0.93 za Ciciliona, 0.84 za Pašavijen, 0.75 za Roc'n'roll i 0.73 za Cha-cha-cha. U objašnjenju latentne strukture plesova Ciciliona i Pašavijen dominira koordinacija, u plesu Rock'n'roll eksplozivna snaga, a u plesu Cha-cha-cha eksplozivna snaga i brzina. Na kraju, diskriminativna analiza je pokazala da generalni uspjeh u plesu kod studentica ovisi dominantno o koordinaciji, zatim o eksplozivnoj snazi, te u manjoj mjeri o brzini (frekvencije pokreta). Ples je nezamjenjivo nastavno sredstvo u kineziološkoj edukaciji studentica, jer među ostalim značajno doprinosi razvoju i održavanju temeljnih motoričkih sposobnosti.