THE IMPORTANCE OF COORDINATION FOR THE PERFORMANCE OF FALLING TECHNIQUES ENVISAGED IN THE SPECIAL PHYSICAL EDUCATION PROGRAM

Original Scientific Article

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Abstract: This paper examines the relationship between general coordination ability and the acquisition of falling techniques envisaged in the Special Physical Education program on a sample of 84 second-year male students aged 19 ± 0.6 years at the Faculty of Security Studies. The aim of this study was to determine the influence of general coordination on the efficiency of performing falling techniques and to define quantitative differences regarding motor coordination between the students who received poor grades and those who received better grades. The sample of variables consisted of thirteen tests to assess general coordination ability and variables to assess the level of the falling techniques acquired. The results of regression analysis showed that motor coordination is important for performing falling techniques envisaged in the Special Physical Education program, while, based on the results of the Mann-Whitney U test, a statistically significant difference in coordination between the students with law and high test scores was found in three variables: cushioning the ball (MKAAML), air agility (MKTOZ) and striking horizontal pads (MKRPLH) in favor of the students with high test scores. The results obtained could contribute to the economy of learning through better organization of the teaching process and the selection of a battery of tests to test motor skills during the student selection process for admission to the Faculty of Security Studies.

Keywords: coordination, falling techniques, special physical education, students

INTRODUCTION

Special Physical Education (SFO) is a narrowly specialized field, which, as a subject of study, has developed from the field of physical culture. It deals

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with the laws of motor space, which study the process of locomotion from the aspect of movement, control and management in relation to human physical characteristics. Blagojević, Dopsaj and Vucković 2006). As a combat system based on practice within the process of education, it studies structures related to movement necessary for the performance of professional tasks by security agency personnel from the aspect of general, focused and specific professional preparation of individuals, special groups and teams for the performance of tasks encompassing the application of specific means of force (Milošević and Zulić, 1988; Milošević, Gavrilović and Ivančević, 1988; Božić, Milošević and Zulić, 1990; Mudrić, Jovanović, Milošević and Ćirković, 1994; Blagojević, 1996; Vucković, 2002; Janković, Vucković and Blagojević, 2014). It is dominated by martial arts techniques: judo, karate, and jiu-jitsu, with the fact that during more complex training in more complex motor programs, it is open to other martial arts, depending on previous experience, morphological characteristics, motor skills, the student's preference and mental structure (Gužvica and Paspalj, 2020). Based on the above, it can be concluded that the SPO is a highly intensive activity of discontinuous movements and motion, which requires certain technical and tactical skills that are manifested in complex conditions, which are aimed at the destruction of and complete control over the opponent. A successful implementation of techniques and their practical applicability largely depends on the quality of their performance and when they are performed, which is why it is very important that techniques are continuously improved and harmonized with biomechanical requirements, and to be effectively modified under situational conditions. In order for this to be possible, it is necessary for students, in addition to other adaptive characteristics, to have a very high level of motor skills. This is supported by previous research conducted in this area, which confirms that a successful application of the SPE techniques is conditioned by a number of factors in spatial-temporal relationships of which motor skills play a dominant role in relation to other adaptive characteristics and abilities – not only faster learning and acquisition of complex motor programs envisaged by the SPE, but also the possibilities of their practical application in a real life situation: (Milošević, 1985; Blagojević et al., 1994; Dopsaj, Milošević, Arlov, Blagojević and Stefanović, 1996; Dopsaj, Milošević, Blagojević and Vucković, 2002; Amanović, Mudrić and Jovanović, 2002; Subotički, 2003; Amanović, Milošević and Mudrić, 2004; Milošević, Mudrić, Jovanović, Amanović and Dopsaj, 2005; Blagojević, Dopsaj and Vucković, 2006; Gužvica, 2008; Paspalj, 2009; Šuica and Koropanovski, 2015), where the role of coordination as a qualitative motor ability is very important.

Given that coordination is an ability that covers a wide field of motor activity, there are several definitions that specify its concept, meaning and structure, but in most cases scholars agree that coordination is the motor ability to control body movements, which is reflected in fast and precise performance of complex motor tasks, that is, in solving motor problems as quickly as possible. Drabik (1996) believes that coordination represents the ability to accomplish movement tasks that demand cooperation of several parts of the body without

mental tension or mistakes with a minimum of effort. According to Drabik, coordination can be described as the ability to perform simple and complex movements, learn new movements and quickly switch from one set of movements to another. Malacko and Rađo (Malacko & Rađo, 2004) are almost in complete agreement with the aforementioned definition, stating that coordination is characterized by the ability to perform complex movements in the shortest possible, acquire new motor skills, and perform non-stereotypical movements. Zoranić and Čović (Zoranić & Čović, 2012), believe that coordination is an expression of the interaction of the central nervous system and skeletal muscles in performing a purposeful motor act. It follows that coordination is reflected in the synchronization of the neuromuscular system and the transmission of stimuli from one motor center to other motor centers that control certain parts of the body, which is why Metikos, Milanović, Prot, Jukić and Marković (Metikos, Milanovic, Prot, Jukic & Markovic, 2003), believe that in order to solve coordination problems, complete synchronization of higher control centers and peripheral parts of the locomotor system is necessary. According to Karalić, Ljubojević, Gerdijan and Vukić (2016), the breadth and diversity of coordination ability are proven by its further divisions, while a number of studies (Brodani & Šimonek, 2010; Idrizović, 2011; Macner, 2011; Njaradi, 2011; Vučetić, Sukreški, Zuber & Sporiš, 2011; Yasumitsu & Nogawa, 2013; Button, Wheat & Lamb, 2014), mainly confirm the assumption that coordination means the precision of task performance, rhythmicity, balance, the ability to react, the ability of kinesthetic differentiation, orientation in space, movement economy and movement synchronization in time. Based on the above issues, it may be concluded that motor coordination is indisputably an important ability which is manifested in most motor activities.

Falling techniques are complex motor structures, which aim to prevent injuries that can occur as a result of a collision of the body with the ground in appropriate situations, that is, positions to break the fall when being thrown by the opponent or independently executing the fall as a result of tripping or slipping. In the initial phase of a training session, the execution of falls is not conditioned by an interaction with the opponent, where it is necessary to connect a number of elements and perform them in a predefined order, in order to, bring the body into such a position when performing a fall, which is the most successful in cushioning the fall. In the subsequent phase of training session, falling techniques are performed after the opponent has performed throwing technique, whereby during the successful throwing technique by the opponent, the body of a person falling gains great acceleration due to the force exerted by the opponent performing the throwing technique, and gravity and one's own reactive force. Given that all these forces act in the same direction, their assembly gives the body great acceleration, so that any fall as a result of such action, without fall braking, represents a potential risk of injury (Blagojevic, Dopsaj and Vuckovic, 2006). in addition to judo, falling techniques are also used in other sports to enable the body to land on the ground safely. There are several techniques for cushioning a fall, but the most common classification is made

according to the surface of the body on which it falls, the direction of the fall and the relationship between the height of the shoulder and hip axis at the time of body contact with the ground. The main goal of falling techniques is to protect the body of a person from negative vibrations harmful to the organism, which are inevitably created by the body hitting the ground. A well-executed fall ensures that a person rises up quickly and establishes a stable equilibrium position, which is extremely important for the continuation of further fighting. There are several ways and principles for performing falling techniques, but in practice the most common are: the principle of forming an arches shape with individual parts of the body to perform rolling, the principle of reaction of a solid surface to simultaneous impact of body parts on the surface and the principle of controlled flexion in the elbow joint, and knees. A breakfall in the first principle is performed by rolling over arched surfaces, so that the weight of the body during the fall is gradually transferred from one point of the body to another, where the body forms a roller, due to which the shock impulse of the collision of the body with the ground decomposes into several smaller collisions of individual points of the arch with the ground (Milošević, Zulić and Božić, 1989). The purpose of fall breaking with the second principle is that after the contact of the hands with the ground, as many points on the body as possible (palms, forearms and soles) touch the ground at the same time. In this way, the body's impact on the ground is distributed over as large an area as possible, whereby the principle of the ground reaction force happens when the body comes into contact with the ground, which slows down the velocity of the body toward the ground (because the pressure per unit area becomes lower, which in practice results in cushioning the fall). Regarding the third principle, when cushioning the collision of the body with the ground, a very important role is played by controlled flexion in the elbow and knee joint (performed by eccentric contractions of the extensor muscles of the elbow and knee joints), which has an effect that causes a significant slowdown. When performing a number of falling techniques, a combination of the above principles is most often applied. In addition to other techniques within the SPE program, judo falling techniques are also taught such as falling forward, falling backwards, falling to the side in order to prevent injuries that may occur as a result of a collision of the body with the ground in appropriate situations, that is, body positions when executing a fall. When performing a forward fall, the body of the performer receives the force of the horizontal direction and the reverse direction from the speed, whereby the body is informed of the rotational movement, as a result of which it rolls in order to participate with as much body surface as possible in cushioning a fall. A backward fall is performed by eccentric reflection (backwards obliquely and upwards), where the position of the arms provides optimal decomposition of pressure forces, which occur when the body falls to the ground and at the same time provides a favorable position of the body for the rolling phase in terms of further decomposition of pressure. When performing a fall to the side (since the longitudinal axis of the body is parallel to the ground), the absorption of most of the kinetic energy of a fall, due to reaction impulses, is wasted on the stroke

of the outstretched arm on the mat just before the whole body falls on the mat. In order to successfully perform falling techniques, the performer is required to constantly improve techniques, coordination and integrate information from the muscles, tendons and joints into the motor cortex and cerebellum, based on which the technique is corrected almost immediately until it is completely stabilized, which requires neuromuscular coordination, that is, the coordination of the upper and lower body parts. What is common for these falls during a training session is the use of several auxiliary exercises, which are very similar in structure to the falls themselves or their individual phases of movement.

Given the fact that knowledge of falling techniques is related to throwing techniques training and the progress of other techniques within the SPE program, the research *problem* was focused on studying the effects of general coordination on the adoption of falling techniques. The main subject of this research was to determine the links between the ability to coordinate and the quality of falling techniques acquisition, which are included in the SPE program. In this sense, the aim of the research was to determine the impact of motor coordination on the performance of falling techniques in the SPE program, in order to possibly change the training of these techniques and select appropriate tools to improve them. Also, the aim of this research was to determine the differences in the level of coordination between the students who received poor grades and those who received better grades according to the result achieved on the falling techniques test, which were included in the SPE program. The basic assumption of the research was that there would be a statistically significant difference in the level of motor coordination between the students who received poor grades and those who received better grades on the basis of which it is possible to predict the efficiency of the implementation of falling techniques envisaged in the SPE programs.

RESEARCH METHODS

This study was conducted at the Faculty of Physical Education and Sports of the University of Banja Luka at two locations: in the athletics hall and the martial arts practice hall covered with tatami mats. The assessment of coordination ability was conducted in the athletics hall, while the assessment of the achieved level of falling techniques was conducted in the martial arts practice hall of the Faculty of Physical Education and Sports. The measurement of tests for the assessment of motor ability of coordination was performed at the beginning of the fourth semester with the aim of determining their impact on the efficiency of performing falling techniques envisaged in the SPE program. Falling techniques were taught a total of eight 45-minute lessons, after which an expert assessment by three examiners (SPE teachers) determined the achieved level of success in performing falling techniques. The falling techniques that were graded maintained a certain order that did not change during the grading. All techniques were performed three times from the basic position, whereby the

respondents stood sideways in relation to the examiners. Regarding the acquisition of falling techniques, it should be noted that, during the assessment, our experiment took place only in the first two phases of the formation of a motor habit, while the third phase was omitted, which is logical, given the student population who were required by the current the SPE I program to exclusively follow the standard form of performing a technique. The assessment of the level of falling techniques acquisition was performed according to the following model:

Table 1. Model for assessing the acquisition of falling techniques

Grade	Biomechanical principles	Speed and rhythm	Contact with the ground	Lifting and posture	Cushioning	Height TT
10	+	+	+	+	+	+
9	+	+	+	+	+	-
8	+	+	+	+	-	-
7	+	+	+	-	-	-
6	+	+	-	-	-	-
5	-	-	-	-	-	-

Sample of respondents

The sample consisted of 84 second-year male students aged 19 ± 0.6, Faculty of Security Studies. The basic anthropomorphological indicators of the tested sample are as follows: TV = 181.85 ± 6.13 cm, TM = 78.43 ± 9.83 kg, and BMI = 23.71 ± 2.43 kg / m^2. For the purposes of this study, the sample of respondents was divided into two groups according to the score achieved on the falling techniques test envisaged in the SFO program. The first group consisted of 40 students who achieved a lawer score on the fall techniques test and whose range of grades ranged from 5.00 to 7.50, while the second group consisted of 44 students who achieved a higher score on the fall techniques test with grades ranging from 7.60 to 10.00. The basic anthropomorphological indicators of the respondents in the first group were as follows: TV = 182.20 ± 6.38 cm, TM = 78.84 ± 9.36 kg and BMI = 23.71 ± 2.03 kg/m^2, while the basic anthropomorphological indicators of the respondents in the second group were: TV = 181.54 ± 5.95 cm, TM = 78.06 ± 10.32 kg and BMI = 23.70 ± 2.76 kg/m^2.

Sample of variables

A battery of thirteen tests representing predictor or independent variables was used to assess motor ability to coordinate: ball control (MKAVLR) – intended to assess hand dexterity; ball cushioning (MKAAML) – intended to assess hand dexterity; slalom with two balls (MKLSNL) – intended to assess leg dexterity; crawling and jumping (MBKPOP) – intended to assess the speed of complex movement performance, ascending and descending a bench and a Swedish

ladder (MBKPIS) – intended to assess the speed of complex movement performance; figure eight running (MAGOS) – intended to assess the rapid change of movement mode and direction; backward obstacle course (MREPOL) – intended to assess the speed of movement in an unusual manner; side steps (MAGKUS) – intended to assess the ability to change direction of movement quickly; ground agility (MAGONT) – intended to assess the ability to quickly perform complex movements; air agility (MKTOZ) – intended to assess the ability to master complex motor tasks; arrhythmical drumming (MKRBUB) – intended to assess the sense of rhythm; striking horizontal pads (MKRPLH) – intended to assess the sense of rhythm; hand and foot drumming (MKRBNR) – intended to assess the performance of rhythmic structures. All variables used to assess motor coordination ability have the necessary metric characteristics and were applied according to the standardization and measurement process described by Metikoš, Hoffman, Prot, Pintar and Oreb (Metikoš, Hofman, Prot, Pintar & Oreb, 1989). The criterion variable (FALLS) was the assessmnet of the performance of falling techniques envisaged in the SFO program, which was formed by calculating an average score on a scale of 5.00 to 10.00 by experts who teach SPE, after performing forward falls, backward falls techniques and side falls.

Data processing methods

As a part of descriptive statistical analysis, the basic measures of the central tendency and the measures of the spread of results were calculated and presented, as well as the values of the minimum and maximum results of each variable observed. In order to test correct distribution of the data obtained, the Kolmogorov-Smirnov test was used. Since a certain number of variables used to assess motor ability to coordinate values within the sample do not follow the normal distribution, instead of using the Student's t-test for independent samples, the statistical significance of differences in the variables observed between the students with lower and higher grades was determined based on nonparametric statistical methods using the Mann-Whitney U test. Multiple linear regression analysis was applied to determine the influence of the system of predictor variables on the criterion variable. All statistical analyses were performed using the statistical software program SPSS Statistics 17.0. (Hair, Anderson, Tatham, & Black, 1998).

FINDINGS

Table 2 shows the results of descriptive statistics of dependent and independent variables for the entire sample of respondents. According to the results presented, it was found that, for most of the variables applied, the results are well grouped. Increased values of the standard deviation in the variables MKLSNL and MKRBUB indicate a large variability of the results around the mean value, but this phenomenon can be considered normal considering the sample

size. Based on the results of the Komogorov-Smirnov test, a deviation from the normal values of the results achieved was found in five variables: MKAVLR, MAGKUS, MAGONT, MKTOZ and MKRBNR. The largest range of results was found in the variable MAGONT, while the largest deviation from the mean value was found in the variable MKLSNL. The range of grades received based on falling techniques performance ranged from 5.33 to 10.00 with a mean of 7.56 and a standard deviation of 1.18.

Table 2. Descriptive statistical parameters of predictor variables and falling techniques for the entire sample of respondents

Variables	Number of respondents	Minimum result	Maximum result	Mean value	Standard deviation	Significance of K-S test
MKAVLR	84	7.00	20.50	10.34	2.07	0.00
MKAAML	84	1.00	10.00	7.39	2.31	0.07
МКЛСНЛ	84	19.00	50.00	27.93	4.43	0.28
MKLSNL	84	8.65	20.37	12.97	2.44	0.31
MBKPOP	84	9.90	22.30	16.35	2.85	0.93
MBKPIS	84	7.27	11.06	8.93	0.79	0.46
MAGOSS	84	6.10	11.95	8.80	1.17	0.69
MREPOL	84	7.66	17.21	9.24	1.40	0.02
MAGKUS	84	9.19	42.25	12.87	3.70	0.00
MAGONT	84	3.12	9.19	4.06	0.71	0.00
MKTOZ	84	7.00	20.00	14.95	3.10	0.30
MKRBUB	84	16.00	30.00	23.54	2.93	0.29
MKRPLH	84	7.00	17.00	11.87	2.29	0.01
FALLS	84	5.33	10.00	7.56	1.18	0.39

Key: MKAVLR – ball control; MKAAML – ball cushioning; MKLSNL – leg slalom with two balls; MBKPOP – crawling and jumping; MBKPIS – ascending and descending a bench and a Swedish ladder; MAGOSS – figure eight running; MREPOL – backward obstacle course; MAGKUS – side steps; MAGONT – ground agility; MKTOZ – air agility; MKRBUB – arrhythmical drumming; MKRPLH – striking horizontal pads; MKRBNR – hand and foot drumming; FALLS – mean score for techniques: forward falls, backward falls, and side falls.

Analysis of the results achieved by the first and second groups of respondents in Table 3 indicates that the results for most variables are homogeneous. In the first and second groups, increased deviations from the mean value were observed in the variables MKLSNL, MKRBUB, MBKPOP, MBKPIS, MKRPLH and MKRBNR, which indicates some variability around the mean value of the results, but considering the sample size, this phenomenon can be considered normal. The first group of respondents showed a significant dispersion of results in the variables MAGONT and MKTOZ, while in the second group of respondents, a deviation from the normal distribution was observed in the variables MKAVLR and MKAAML. The largest deviation from the mean value of the results for the first group of respondents was found in the variable MAGONT,

while the largest deviation for the second group of respondents was observed in the variable MKLSNL. The mean value of the results achieved when performing falling techniques amounted to 6.53 for the first group of respondents with a standard deviation of 0.54, while for the second group of respondents, the mean value of the results achieved when performing falling techniques amounted to 8.49 with a standard deviation of 0.73.

Table 3. Descriptive statistical parameters of predictor variables and falling techniques in the first and second group of respondents

Variables	Results of the first group of respondents				Results of the second group of respondents			
	Number of respondents	Mean value	Mean deviation	Significance of K-S test	Number of respondents	Mean value	Mean deviation	Significance of K-S test
MKAVLR	40	10.14	1.51	0.18	44	10.51	2.48	0.04
MKAAML	40	6.87	2.31	0.44	44	7.86	2.23	0.04
MKLSNL	40	27.65	3.64	0.43	44	28.19	5.07	0.41
MBKPOP	40	12.93	2.51	0.91	44	13.00	2.40	0.17
MBKPIS	40	16.79	2.75	0.82	44	15.95	2.92	0.83
MAGOSS	40	9.03	0.80	0.73	44	8.84	0.77	0.75
MREPOL	40	8.99	1.33	0.89	44	8.63	0.99	0.81
MAGKUS	40	9.61	1.79	0.10	44	8.90	0.81	0.59
MAGONT	40	13.66	5.04	0.00	44	12.16	1.52	0.97
MKTOZ	40	4.32	0.89	0.02	44	3.82	0.36	0.56
MKRBUB	40	15.10	2.95	0.51	44	14.82	3.27	0.91
MKRPLH	40	22.60	2.72	0.47	44	24.39	2.89	0.53
MKRBNR	40	12.33	2.12	0.41	44	11.45	2.38	0.05
FALLS	40	6.53	0.54	0.38	44	8.49	0.73	0.11

Key: MKAVLR – ball control; MKAAML – ball cushioning; MKLSNL – legs slalom with two balls; MBKPOP – crawling and jumping; MBKPIS – ascending and descending a bench and a Swedish ladder; MAGOSS – figure eight running; MREPOL – backward obstacle course; MAGKUS – side steps; MAGONT – ground agility; MKTOZ – air agility; MKRBUB –arrhythmical drumming; MKRPLH – striking horizontal pads; MKRBNR – hand and foot drumming; FALLS – mean score for techniques: forward falls, backward falls, and side falls.

Differences in the values of the achieved results of the variables used to assess coordination and falling techniques of the first and second group of respondents are shown in Table 4. Based on the analysis of the presented results, it can be seen that the first group of respondents achieved better results in five variables, while the second group of respondents achieved better results in eight variables. The first group of respondents achieved better results in the following the variables: MKAVLR, MKLSNL, MBKPOP, MKRBUB and MKRBNR, while the second group achieved better results in the variables: MKAAML, MBKPIS, MAGOSS, MREPOL, MAGKUS, MAGONT, MKTOZ and MKRH. Based on the Mann-Whitney U test results, it can be concluded that the results of the subsamples differ statistically significantly in three variables in favor of the sec-

ond group, which are used to measure: hand dexterity (MKAAML), dexterity in performing complex tasks (MKTOZ) and the sense of rhythm (MKRPLH), while the air agility variable (MAGONT) used to assess the ability to perform complex movements quickly is at the border of statistical significance. The results obtained show that the respondents who achieved better results in these variables have better results in performing falling techniques envisaged in the SPE program, based on which we can assume that these variables are important for performing falling techniques in the SFO program, and there is a great connection between them and the result achieved when performing falling techniques.

Table 4. Values of differences between the results achieved by the first and second group of respondents

Variables	Groups	Number of respondents	Medium rank value	Rank sum	Median	U Value	Z Value	Level of significance
MKAVLR	First	40	43.63	1745.00	9.93	835.00	- 0.40	0.68
	Second	44	41.48	1825.00	9.76			
MKAAML	First	40	36.83	1473.00	7.00	653.00	-2.06	0.03
	Second	44	47.66	2097.00	8.00			
MKLSNL	First	40	42.03	1681.00	27.10	861.00	-0.17	0.86
	Second	44	42.93	1889.00	27.90			
MBKPOP	First	40	42.41	1696.50	12.83	876.50	-0.03	0.97
	Second	44	42.58	1873.50	12.49			
MBKPIS	First	40	45.24	1809.50	16.33	770.50	-0.98	0.32
	Second	44	40.01	1760.50	16.00			
MAGOSS	First	40	45.25	1810.00	9.05	770.00	-0.98	0.32
	Second	44	40.00	1760.00	8.71			
MREPOL	First	40	46.48	1859.00	8.97	721.00	-1.42	0.15
	Second	44	38.89	1711.00	8.59			
MAGKUS	First	40	47.64	1905.50	8.98	674.50	-1.84	0.06
	Second	44	37.83	1664.50	8.73			
MAGONT	First	40	47.88	1915.00	12.75	665.00	-1.92	0.05
	Second	44	37.61	1655.00	12.08			
MKTOZ	First	40	53.89	2155.50	4.12	424.50	-4.08	0.00
	Second	44	32.15	1414.50	3.90			
MKRBUB	First	40	43.71	1748.50	15.50	831.50	-0.43	0.66
	Second	44	41.40	1821.50	15.00			
MKRPLH	First	40	35.43	1417.00	23.00	597.00	-2.55	0.01
	Second	44	48.93	2153.00	24.00			
MKRBNR	First	40	46.99	1879.50	12.00	700.50	-1.63	0.10
	Second	44	38.42	1690.50	12.00			

Key: MKAVLR – ball control; MKAAML – ball cushioning; MKLSNL – leg slalom with two balls; MBKPOP – crawling and jumping; MBKPIS – ascending and descending a bench and a Swedish ladder; MAGOSS – figure eight running; MREPOL – a backward obstacle course; MAGKUS – side steps; MAGONT – ground agility; MKTOZ – air agility;

MKRBUB –arrhythmical drumming; MKRPLH – striking horizontal pads; MKRBNR – hand and foot drumming.

Table 5 shows the relationships between the dependent variable FALLS and associated independent variables used to assess motor coordination, while Table 6 shows the values of Beta coefficients, which provide information on the individual impact of variables used to assess motor coordination on the efficiency of falling techniques.

Table 5. Parameters of coordination regression and criterion variables FALLS

Correlation coefficient	Determination coefficient	Standard estimation error	F test	Statistical significance
0.57	0.33	1.05	2.71	0.00

a. Dependent variable FALLS

b. Predictors: MKRBNR, MKAAML, MREPOL, MKAVLR, MKSNL, MKRPLH, MAGOSS, MAGKUS, MKBPIS, MKRBUB, MKRPOP, MAGONT, MKTOZ

Table 6. *Coefficients of coordination regression and criterion variables FALLS*

Model		Nonstandardized coefficient		Standardized coefficient	T	Level of significance
		B	Standard error	Beta		
1	(Constant)	7.13	2.15		3.31	0.01
	MKAVLR	0.03	0.06	0.05	0.55	0.58
	MKAAML	0.02	0.05	0.04	0.42	0.67
	MKLSNL	0.01	0.02	0.07	0.66	0.50
	MBKPOP	0.03	0.06	0.07	0.58	0.55
	MBKPIS	-0.00	0.04	-0.00	-0.08	0.93
	MAGOSS	0.14	0.16	0.09	0.88	0.38
	MREPOL	-0.16	0.13	-0.16	-1.23	0.22
	MAGKUS	-0.06	0.11	-0.07	-0.52	0.60
	MAGONT	0.02	0.05	0.08	0.54	0.59
	MKTOZ	-0.68	0.28	-0.41	-2.36	0.02
	MKRBUB	-0.06	0.04	-0.16	-1.43	0.15
	MKRPLH	0.13	0.04	0.34	3.23	0.00
	MKRBNR	-0.02	0.06	-0.03	-0.33	0.74

a. Dependent variable FALLS

Based on the results of the regression analysis shown in Table 5, it can be concluded that motor coordination significantly affects the efficiency of performing falling techniques contained in the SPE program. The values of the

coefficient of multiple determination suggest that 33% of the total variability of the dependent variable is determined by the variability of the system of independent variables. Since the remaining 67% of the total variability of the dependent variable is not explained by the regression model, it is assumed that it is affected by other factors which were not the subject of this study. As show in Table 6, the variables MKTOZ and MKRPLH, individually, had a statistically significant impact on the criterion variable explanation, while other variables did not make a unique contribution to the prediction of the dependent variable. Also, it can be seen that, based on the values of the Beta coefficients, the variables MKTOZ (-0.41) and MKRPLH (0.34) individually highly contribute to the dependent variable explanation, when the variance explained by all other independently variables in the model is subtracted. Other variables did not make a unique contribution to the prediction of the dependent variable, which may be due to their overlap, it is also possible that certain tests, in addition to motor coordination, were to some extent saturated with other abilities incompatible with the falling techniques.

DISCUSSION

Previous research confirms that basic motor skills (as a basis on which specific motor skills are improved) are largely important for a successful performance of certain elements of the given SPE techniques. (Milošević and Zulić, 1988; Milošević, Gavrilović and Ivančević, 1988; Božić, 1989; Božić, Milošević and Zulić, 1990; Blagojević et al., 1994; Mudrić, Jovanović, Milošević and Ćirković, 1994; Blagojević, 1996; Dopsaj, Milosevic, Arlov, Blagojevic and Stefanovic, 1996, Dopsaj, Milosevic, Blagojevic and Vuskovic, 2002, Amanovic, Mudrić and Jovanović, 2002, Subotički, 2003, Amanović, Milosević and Mudrić, 2004, Milosević, Mudrić, Jovanović, Amanović and Dopsaj, 2005; Blagojević, Dopsaj and Vučković, 2006; Janković, Vučković and Blagojević, 2014). Based on the results of this research, it is evident that there is a significant statistical prediction of the performance of falling techniques envisaged in the SFO program, based on the variables used to assess coordination. The results obtained demonstrated that the variables MKTOZ and MKRPL greatly contributed to explaining falling techniques. An explanation of the results obtained can be found in the structure of these variables. The air agility variable (MKTOZ) is intended to assess skills in performing complex motor tasks, whereby, in addition to the coordination of the whole body when performing complex motor movements, the coordination of alternating movements of arms and legs in performing the given structure of movement are expressed, while the variable (MKRPLH) – striking horizontal pads is intended to assess hand coordination according to a certain rhythm. Also, the explanation of the results obtained can be sought in the kinematics and dynamics of performing the falling techniques examined. Specifically, falling techniques are performed in accordance with biomechanical principles, the maximum speed and optimal level of force, whereby the re-

lations of individual body segments change. As stated in the introductory part, the basic purpose of falls, as technical elements of body movement, is to lower the weight of the body to the ground by rolling on as large an area as possible. From the above, it can be concluded that for the successful execution of falling techniques, the coordination of coupled hand and foot movements is very important, both in bringing the body into position to fall, and in performing support, torque and depreciation, cushioning during the performance of falling techniques, and rising up after the fall. The falling techniques assessed fall into the category of complex structures of movement, given the fact that they are made up of different but complex movements combined into one whole. If we compare the structure of movement contained in the variables MKTOZ and MKRPLH and the structure of movement contained in the falling techniques assessed, it is clear that these variables represent a good motor basis for the performance of falling techniques, because in their structure they contain a certain part of the movement structure, which occur during the performance of falling techniques. Also, it should be noted that the respondents who achieved better test results in these variables also achieved better results when performing falling techniques based on which we may conclude that these variables are important for performing falling techniques, and the students who have a higher level of skill in mastering complex motor tasks and a better sense of rhythm have a greater predisposition to achieve better results when performing falling techniques envisaged in the SPE program. It has long been known that the coordination of the whole body, the reorganization of the motor stereotype, the speed of performing complex motor tasks, the ability to change direction of movement quickly, the speed of learning new motor tasks and sense of rhythm are very important for quality performance of motor tasks in the area of judo.

CONCLUSION

The impact of motor coordination on the efficiency of performing falling techniques envisaged in the SPE program was examined on a sample of 84 first-year students at the Faculty of Security Studies, University of Banja Luka. The results obtained showed that motor coordination is important for performing falling techniques and there is a statistically significant difference in the level of coordination between the students who received poor grades and those who received better grades. The average values of the results achieved show that this difference is defined by better values of the results in three variables: MKAAML, MKTOZ and MKRPLH in favor of the students who received better grades, while the variable MAGONT is on the border of statistical significance. Based on the results obtained, we can assume that the mentioned variables are important for performing falling techniques. The reason why the other selected variables used to assess motor coordination did not take a greater part in explaining the common variability of the criterion variable, may be due to their overlap and the explanation can be found in the fact that some coordina-

tion tests were, to some extent, saturated with other abilities which were not compatible with the performance of falling techniques. The results obtained indicate that consistent, specific tests should be designed or selected in similar future research, which would more precisely explain the connection between coordination and the quality of performing falling techniques. The assumption is that specific tests could contribute to not only easier and faster acquisition of SFO content knowledge and more efficient training, but also the development of a battery of tests to assess motor skills, during the selection process of candidates for admission to the Faculty of Security Studies

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