Motor Knowledge and Process of Learning Basic Gymnastic Elements in Students of Faculty of Kinesiology

Marijo Možnik, Lucija Milčić, Kamenka Živčić Marković

Faculty of Kinesiology University of Zagreb

Abstract

The purpose of this study was to find out the level motor knowledge of forward and backward roll before and after the process of learning, and if there are any differences between male and female students in knowledge of basic gymnastics elements. Research was conducted on a sample of 141 2nd year students, 106 male and 35 female students, which have listened to the subject of Artistic Gymnastics, on the Faculty of Kinesiology, University of Zagreb. Examination of the elements was done by three gymnastics experts, who have evaluated forward and backward roll. Examination of the elements was conducted on the floor at the beginning of lectures of Artistic Gymnastics and after six weeks of motor learning of forward and backward roll. Students participated in the process of learning forward and backward roll, with specific methodical exercises. Statistica 12 was used for data analysis. Basic descriptive parameters, t-test for dependent samples were calculated for differences between initial and final stage of treatments and t-test for independent samples were calculated to find differences between men and women. Results of t-test for dependent samples at the level of statistical significance <,05 have shown that there were difference between forward and backward roll in men and women in initial and final grades. Women had better initial and final motor knowledge than men. Results of t-test for independent samples at the level of statistical significance <,05 had differences between male and female students in initial and final measurement of forward roll, there were no differences in the measurement of backward roll. This is because forward roll is a more complex element and contains more details of successful execution. This study can provide an insight into one way of learning basic gymnastic elements.

Keywords: *artistic gymnastics, forward roll, backward roll, students, motor knowledge, motor learning*

1. Introduction

Artistic gymnastics is a sport branch in which aesthetically designed acyclic movement structures are evaluated according to previously prescribed convention of movement defined by rules for evaluation proposed by the International Gymnastics Organization (Živčić, 2000). Gymnastics is not only a professional sport, but also a very popular recreational activity. It is one of three basic sports and one of the most recommended sport for healthy growth and maturation, especially for children. This is the reason why gymnastics content appears in the curriculum in each year of education in primary and high schools (Vican, Milanović & Litre, 2006). Although primary and high school curriculum contains different gymnastics elements on different apparatus, inadequate school facilities are the main reason why children do not acquire full curriculum prescribed knowledge about gymnastics. However, almost every primary and high school has the adequate conditions and reconciliations for learning basic gymnastics and motor skills such as a forward roll and backward roll on the floor. Motor learning is a set of internal processes associated with practice and experience that lead to relatively permanent changes in an individual's ability in performing the motor task goal of every motor learning process (Schmidt & Lee, 2005). In artistic gymnastics, the aim of the motor learning process is to practice motor skills until perfect execution. Execution of all elements in artistic gymnastics is prescribed by the rules (FIG, 2017). Rolls are basic acrobatic elements where a performer makes a 360° rotation around the transversal axis of the body while gradually changing the support of body parts on the surface, and can be divided into forward and backward rolls (Živčić Marković & Krističević, 2016). Execution of forward roll begins from standing position with arms up, after which the gymnast squats and bends forward while placing the hands in front of the body, hips move upwards, take off is performed with both legs and chin placed on the chest, starting the rolling on the back in a tucked position, arms touching the legs, when both feet touch the floor at the same time performer stands up into a balanced position through squat. Backward roll starts from the same position as forward roll with the difference being that the performer's back is facing the direction of rolling. While going through a squat position, chin is placed on the chest, hands are placed on shoulders with palms facing upwards. Performer rolls backwards, hands are placed on the floor, and the performer stands up into a balanced position through squat. Importance of basic gymnastics elements lies in the fact that they are also utilized in other sports like swimming, diving and combat sports. Goal of application of basic

gymnastic movements is an all-round development, adoption of motion habits and improving health status; or to acquire basic motor skills and abilities which are useful in everyday life (Živčić Marković & Krističević, 2016). At Faculty of Kinesiology in Zagreb, students have artistic gymnastics as a compulsory subject on 2nd year of their study. It is divided on Artistic Gymnastics 1 in 3rd semester and Artistic Gymnastics 2 in the 4th semester. Artistic Gymnastics 1 contains most basic elements of the women´s apparatus. This includes elements such as forward roll and backward roll on the floor. In Croatia, Osijek and Baranja county teachers of physical education (5th-8th grade), per grade, spent 20 hours on the gymnastic contents which corresponds to 30% of all gymnastic contents, especially elements which do not present any danger of falling or injury (forward and backward rolls, handstands and cartwheels etc.) (Badić, Živčić Marković**,** Sporiš, Milanović & Trajković, 2012). In Slovenia, Physical Education teachers spend 9.8 hours on gymnastics per academic year, and they mostly teach basic content like forward roll, backward roll, cartwheel, handstand, etc.), where supporting assistance is not necessary and the likelihood of falls and injuries is small (Bučar Pajek, Čuk, Kovač, & Jakše, 2010). Hours intended for learning of gymnastic content should be more numerous, especially in primary school, because it is easier to learn gymnastics elements to children when they are smaller. Živčić Marković & Čavar, (2011) conducted research on a sample of 153 students of three different generations of faculty of Kinesiology, University of Zagreb, and concluded that during the primary education, female students of the Faculty of Kinesiology did not have enough motor information about artistic gymnastics. The reason for this lies in fact that student knowledge is a good indicator about learning elements in schools, and it can be monitored if basic elements can be learned about six weeks, using simple exercises. The purpose of this study was to find out the level of motor knowledge of forward and backward roll before and after the process of learning, and if there are any differences between male and female students in knowledge of basic gymnastics elements.

2. Materials and methods

Participants

Research was conducted on a sample of 141 2nd year students, 106 male and 35 female students who have listened to the subject Artistic Gymnastics. Examination of the elements was done by three gymnastics experts who

evaluated forward roll and backward roll. It was conducted on the floor at the beginning of the lectures of Artistic Gymnastics and after a period of six weeks of learning forward and backward roll. Students participated in the process of learning forward and backward roll, with specific methodical exercises.

Measurements

Variable FORWRI is used for forward roll at the beginning of motor learning and variable FORWRF for forward roll at the end of motor learning. Variable BACWRI is used for backward roll at the beginning of motor learning and variable BACWRF for backward roll at the end of motor learning. Variable FORWRIMW is used for a forward roll at the beginning of motor learning in men and women together, variable FORWRFMW for forward roll at the end of motor learning in men and women together. Variable BACWRIMW is used for backward roll at the beginning of motor learning in men and women together and BACWRFMW is used for backward roll at the end of motor learning in men and women together. Variable FORWRIM is used for forward roll at the beginning of motor learning in men, and variable FORWRIW is used for forward roll at the beginning of motor learning in women. FORWRFM is used for forward roll at the end of motor learning in men and variable FORWRFW for forward roll at the end of motor learning in women.

Procedure

On the first class of Artistic Gymnastic three gymnastics expert scored the technique of forward and backward roll with marks, on a scale from 1 to 5. Proceeding exercises for learning forward roll: 1. tucked "rocking"; 2. rolling on the back from squat to mat and back; 3. rolling on the back from squat on the floor; 4. forward roll on a slope from squat; 5. forward roll on a slope from standing (with and without assistance – for all exercises); 6. Forward roll on the floor with assistance; 7. Forward roll on the floor; 8. Forward roll on the floor over obstacles (the ball). Proceeding exercises are similar for backward roll: 1. tucked "rocking"; 2. rolling on the back from squat on the floor with placement of palms beside shoulders; 3. backward roll from squat on a slope; 4. backward roll on a slope from standing; 5. backward roll on the floor with assistance; 6. backward roll on the floor. After six weeks of learning process, experts examined execution of elements.

For forward roll grades were: 1 – forward roll finished in a sitting position, or when using hands to finish in a standing position; 2 – forward roll with placing the hands too wide, chin is not lowered on the chest, so the roll is performed on forehead, or over one shoulder; 3 – forward roll without extended knees after the take-off; 4 – good execution, but with a lack of rotation; 5 – correctly executed forward roll (Živčić Marković & Breslauer, 2011). For backward roll grades were: 1 – backward roll executed without lowering the chin on the chest; 2 – backward roll executed over one shoulder; 3 – backward roll executed with a landing on knees; 4 – good execution, but with a lack of rotation; 5 – correctly executed backward roll (Živčić Marković & Breslauer, 2011).

Statistica 12 was used for data analysis. Basic descriptive parameters and t-test for dependent samples were calculated for differences between initial and final stage of treatments and t-test for independent samples was used to find differences between men and women.

3. Results

Table 1. Descriptive indicators of forward and backward roll in men and women

Variable	Valid N	Mean	Minimum	Maximum	Std.Dev.
FORWRIMW	141	2,37	1,00	5,00	1,05
FORWRFMW	141	4,05	1,00	5,00	0,85
BACWRIMW	141	2,35	1,00	5,00	1,00
BACKWRFMW	141	4,04	2,00	5,00	0,89

K-S test has shown that data was distributed normally. Descriptive indicators of forward and backward roll in men and women together (Table 1) show us that initial grades in men and women together for forward roll (FORWRIMW) were 2,37, and 2,35 for backward roll (BACWRIMW). FORWRFMW= 4,05, final grades for forward roll in men and women, and final grades for backward roll was 4,04 (BACWRFMW).

Table 2. T-test for Dependent Samples in men and women with level of statistical significance of p < ,05

Variable	Mean	Std. Dv.	N	Diff.	Std.Dv. Diff.	t	df	p	Confidence -95,000%	Confidence +95,000%
FORWRIMW	2,37	1,05								
FORWRFMW	4,05	0,85	141	-1,68	1,14	-17,50	140	0,00	-1,87	-1,49
BACWRIMW	2,35	1,00								
BACWRFMW	4,04	0,89	141	-1,68	1,17	-17,09	140	0,00	-1,88	-1,49

T-test for dependent samples together in men and women (Table 2) with the level of statistical significance p < ,05 has shown that differences exist in men and women in initial and final measurements.

Table 3. Descriptive indicators of forward and backward roll in men

Variable	Valid N	Mean	Minimum	Maximum	Std.Dev.
FORWRIM	106	2,26	1,00	5,00	0,98
FORWRFM	106	3,93	1,00	5,00	0,88
BACWRIM	106	2,28	1,00	5,00	0,94
BACWRFM	106	3,98	2,00	5,00	0,89

Descriptive indicators for male students (Table 3) show that the initial grade for forward roll was 2,26 (FORWRIM), and 2,28 for backward roll (BACWRIM). Final grade for forward roll in men was 3,93 (FORWRFM), and 3,98 for backward roll (BACWRFM).

Table 4. T-test for Dependent Samples in men with level of statistical significance of p < ,05

Variable	Mean	Std.Dv.	N	Diff.	Std.Dv. Diff.	t	df	p	Confidence -95,000%	Confidence +95,000%
FORWRIM	2,26	0,98								
FORWRFM	3,93	0,88	106	-1,68	1,20	-14,37	105	0,00	-1,91	-1,44
BACWRIM	2,28	0,94								
BACWRFM	3,98	0,89	106	-1,70	1,24	-14,16	105	0,00	-1,94	-1,46

T-test for dependent samples in men (Table 4) with the level of statistical significance p < ,05 has shown that differences exist in initial and final measurements for forward and backward roll.

Table 5. Descriptive indicators of forward and backward roll in women

Variable	Valid N	Mean	Minimum	Maximum	Std.Dev.
FORWRIW	35	2,70	1,00	4,67	1,19
FORWRFW	35	4,40	3,00	5,00	0,65
BACWRIW	35	2,58	1,00	5,00	1,15
BACWRFW	35	4,20	2,00	5,00	0,87

Descriptive indicators for female students (Table 5) show that the initial grade for forward roll was 2,70 (FORWRIW), and 2,58 for backward roll (BACWRIW). Final grade for forward roll in women was 4,40 (FORWRFW), and 4,20 for backward roll (BACWRFW).

Table 6. T-test for Dependent Samples in women with level of statistical significance of p < ,05

Variable	Mean	Std. Dv.	N	Diff.	Std.Dv. Diff.	t	df	p	Confidence -95,000%	Confidence +95,000%
FORWRIW	2,70	1,19								
FORWRFW	4,40	0,65	35	-1,70	0,95	-10,55	34	0,00	-2,02	-1,37
BACWRIW	2,58	1,15								
BACWFW	4,20	0,87	35	-1,62	0,94	-10,19	34	0,00	-1,94	-1,30

T-test for dependent samples in women (Table 6) with level of statistical significance p < ,05 has shown that differences exist in initial and final measurements for forward and backward roll.

Table 7. T-tests for independent samples between men and women in initial and final state in forward roll with level of statistical significance of p < ,05

(Grouping variable: M-1 W-2 Group 1: 2 Group 2: 1)

Variable	Mean 2W	Mean 1M	t-value	df	p	Valid N 2	Valid N 1	Std.Dev. 2	Std.Dev. 1	F-ratio Variances	p Variances	Levene F(1,df)	df Levene	p Levene
FORWRI	2,70	2,26	2,22	139	0,03	35	106	1,19	0,98	1,48	0,13	6,04	139	0,02
FORWRF	4,40	3,93	2,89	139	0,00	35	106	0,65	0,88	1,81	0,05	0,58	139	0,45

T-test for independent samples between men and women (Table 7) with level of statistical significance p < ,05 has shown that differences exist in initial and final grade in forward roll.

Table 8. T-tests for independent samples between men and women in initial and final state in backward roll with level of statistical significance of p < ,05

(Grouping variable: M-1 W-2 Group 1: 2 Group 2: 1)

Variable	Mean 2W	Mean 1M	t-value	df	p	Valid N 2	Valid N 1	Std.Dev. 2	Std.Dev. 1	F-ratio Variances	p Variances	Levene F(1,df)	df Levene	p Levene
BACWRI	2,58	2,28	1,55	139	0,12	35	106	1,15	0,94	1,49	0,13	2,82	139	0,10
BACWRF	4,20	3,98	1,26	139	0,21	35	106	0,87	0,89	1,06	0,87	0,33	139	0,57

T-test for independent samples between men and women (Table 8) with level of statistical significance p < ,05 has shown that there are no differences in initial and final grade in backward roll.

4. Discussion and conclusion

Descriptive indicators of forward and backward roll in men and women together indicate that there was a progress in motor learning, because the initial grade was 2, and final grade was 4. Results of t-test show that initial and final grades in men and women together for forward and backward roll have significant differences. As expected, a six-week period of learning elements caused an improvement in final execution as opposed to initial one. That is a consequence of application of special proceeding exercises for forward and backward roll. A previous study has shown that students of the 2nd year on Faculty of Kinesiology in Zagreb have weak motor knowledge before the start of lectures and exercises of artistic gymnastics (Možnik, Krističević, Milčić, Živčić Marković, & Šolja, 2017). It can be seen from descriptive indicators that

in the example of 106 male students, mean grade at the initial examination for forward roll was 2,26 and 2,28 for backward roll. On final examination, mean grade for forward roll was 3,93 and 3,98 for backward roll. T-test for dependent samples has shown that although mean grades are lower when only results of male students are observed, differences between initial and final grades are still significant. T-test for dependent samples has shown that although the sample of female students is 3 times smaller than male students, and mean grades are higher when only female students are observed, differences between initial and final grades are still significant. Unlike forward roll, the differences between men and women in the initial and final state of backward roll are not significant. Backward roll is a less complex element than forward roll, because forward roll contains more details which are needed for a successful execution. This could be the reason why the differences are more pronounced in a more complex element like forward roll. Živčić Marković, Sporiš, & Čavar, (2011) state that the second-year students of Faculty of Kinesiology did not gain practical information about fundamental gymnastic movement skills during their primary school, and that their knowledge about artistic gymnastics is at an insufficient level, based on the eight fundamental gymnastic movement structures (forward roll, backward roll, right cartwheel, left cartwheel, handstand, pullover, forward walk on the balance beam and safety walk on the balance beam. This study indicates that there is no improvement in initial motor knowledge of 2nd year students at the Faculty of Kinesiology in Zagreb at the beginning of the 2nd year of study in relation to previous researches. Still, significant improvement was observed in motor knowledge of basic gymnastic elements such as forward and backward roll after the process of learning those elements.

Forward and backward roll in men and women were different in initial and final grades. Women had better initial and final motor knowledge than men. The differences between male and female students when observed as independent samples was found in the initial and final state in forward roll, while there was no differences in the backward roll. This is because forward roll is a more complex element and contains more details needed for successful execution. Level of motor knowledge of other basic gymnastic elements should be tested on the same population, to acquire an insight of proceeding exercises efficiency.

5. References

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Author info

Marijo Možnik: marijo.moznik@kif.hr