ORGINAL SCIENTIFIC PAPER

[2]Dusan Micovic [1]Dalibor Fulurija, [1]Tatjana Ceremidzic,
[1] Faculty of Physical Education and Sport, University of East Sarajevo
[2] ŠOSO „Kosovski Božur – Special school" Kosovska Mitrovica

UDK:796.012.1.4-053.5
DOI: 10.7251/SIZ0118055M

CHANGES IN MOTOR ABILITIES OF STUDENTS AGED 11 AND 12 AFTER APPLICATION OF GYMNASTIC–ACROBATIC ACTIVITIES

SUMMARY

Participants in the research were selected from the population of elementary school students in Kosovska Mitrovica, aged 11 and 12, male. Total sample of 104 participants was divided into two sub-samples. The first sub-sample consisted of 52 participants, all taking regular PE classes twice a week and training acrobatics three times a week in additional PE classes (experimental group). The second sub-sample consisted of 52 participants who were taking only regular PE classes twice a week (control group. Research results suggested that the participants in the experimental group had significantly better results in all assessment tests for motor abilities in comparison to the control group, whereas in the area of realized program activities they had statistically significant results in the tests for assessment of repetitive strength and segmentary speed.

Key words: *students, experimental program, motor abilities, acrobatics, additional classes.*

1. INTRODUCTION

Upon performed analysis of available literature in the dedicated scientific area, a problem was noted in optimization of functioning of motor abilities in children and adolescents at PE classes in majority of European countries [4, 6, 7, 11, 22, 27, 31, 33, 45].

One of the requirements for motor ability improvement is good organization of education process [16, 17, 18, 19, 20, 21, 25, 26, 28, 29] and its approximation to the conditions of training activities [5, 15, 24, 26].

Various forms of motor activities play key role in the PE education process [13, 35]. There is a vast number of factors, such as physical activities, which influence growth and development of children [34, 38].

Development of motor abilities and sport skills in students are rendered highly significant in the PE education process [13]. Importance of combining different types of sport is pronounced in terms of practicing every-day physical activities which contribute development of motor abilities [9, 11, 43].

Purpose of Physical Education is to ensure universal and balanced development of children through consolidation and development of their motor skills as ability to gain skills and habits in sport and every-day activities as part of general culture [12, 41, 44].

Motor ability can be defined as ability to perform different activities, including whole body coordination and specific motor activities [10, 13]. Some of the existing tests for motor ability are focused on balance, flexibility, agility. Speed, strength and endurance [3, 8, 13].

Versatile exercises, such as acrobatics as segment of sport gymnastics, are solid ground for development of these characteristics, primarily coordination, strength, flexibility, balance and precision [42, 48, 49].

For the purpose of achieving individualization of activities, being the only efficient manner of achieving interest and motivation as segments of education process, prior to starting with program tasks in acrobatics, students need to be differentiated using diagnostic tools into groups by level of motor skills and knowledge. Differentiated and homogenous groups of practitioners have to be in two or three difficulty levels in order to enable them to adopt programmed acrobatic activities in simple and complex variants.

According to some authors [23, 37, 40, 46] acrobatics program in elementary school has the task of, on one hand, contributing this sport branch and on the other to widen the area of motor-sport culture in student population and contribute by its overall structure proficiency of anthropological values being the dominant characteristic in majority of sports.

2. RESEARCH METHODS

2.1. Sample

Participants in the research were selected from the population of elementary school students in Kosovska Mitrovica, aged 11 and 12, male. Total sample of 104 participants was divided into two sub-samples. The first sub-sample consisted of 52 participants, all taking regular PE classes twice a week and training acrobatics three times a week in additional PE classes (experimental group). The second sub-sample consisted of 52 participants who were taking only regular PE classes twice a week (control group). Participants had never been involved in training process as part of additional PE classes for realization of elements in gymnastics – acrobatics.

2.2. Sample of variables

Repetitive strength:
1. Swedish gym bench sit ups **MDTK**
2. Pull ups **MMZG**
3. Push ups **MSKL**

Explosive strength:
4. Long jump from standing position **MSDM**
5. Vertical jump (Sargent) **MSAR**
6. Triple jump from standing positio **MTRS**

Segmentary speed:
7. Hand tapping **MTAP**
8. Foot tapping **MTAN**
9. Foot tapping against the wall **MTAZ**

Sprint speed:
10. Running – 10m **M10V**
11. Running – 20m **M20V**
12. Running – 30m **M30V**

Applied group of motor variables was taken from research performed by Kurelić, Momirović, Stojanović, Šturm, & Viskić-Štalec (1975).

Table 1. Program of realization of activities in acrobatics: experimental group

PROGRAM UNITS	Classes No.
Initial diagnosis of motor abilities	Before program realization
1. SHAPING EXERCISES	Every class
2. ACROBATICS AND STRECHING	26
Acrobatic exercises: Bridge, half-split and split; Rocking on the back, Rocking on the chest, candlestick, headstand, hanstand, Forward roll, backward roll, flying roll, neckspring, headspring, cartwheel, roundoff (Arabian handspring), front flip, back flip, forward tucked, backward tucked. Streching exercises: dragging both feet with hands; standing hamspring strech; L-sit with bent legs; front hands push; pulling knees towards the chest; pulling feet towards the chest; pulling the foot of the stretched leg; forward bend (legs together) forward bend to side (legs spread), forward bend (legs folded), forward bend towards one streched leg; Streching of short muscles, especially large chest muscles, two-headed shoulder muscles and muscles flexors of hand and fingers.	
3. ACROBATIC EXERCISES	6
4. PLIOMETRIC EXERCISES AND STRECHING	4
Basic jumping exercises: front jumps, lateral jumps, jumps with change in rhythm, jumps with pauses, back jumps jogging. Basic vertical jumps: Hurdles (height 20 - 30 cm, height 30- 40 cm). basic horizontal jumps: Triple, quintuple jump, decouple jump.	
Final diagnosis of motor abilities	After program realization
Total:	36

Program of activities – control group

Research of efficiency of regular classes in Physical Eduction to transformational processes of the control group was performed on the basis of Curriculum for PE formed by teachers in school. There were 24 realized classes in course of 12 weeks. Two measurements were performed: before and after treatment (initial and final measuring). Structure of program activities had mainly transformational character (development of anthropological characteristics and increase in level of motor knowledge). Structure of classes was identical as in experimental group (introduction, preparation, main part and closing part of class). In planning the class activities, aims, tasks and time cycles were defined (periodization), technical requirements and material conditions. Programming of activities was oriented at defining contents, load and methods required for development of anthropological characteristics and motor knowledge in line with Elementary School Curriculum. For that purpose, exercises were selected and dosed, and classroom activities were harmonized with aims and tasks of regular PE classes.

3. RESULTS AND DISCUSSION

Table 2. Significance of differences between arithmetic means of participants in the experimental group – motor abilities

Testovi	Mean(i)	Mean(f)	T-value	p
MDTK	5.14	7.36	3.74	**.007**
MMZG	7.26	9.52	3.54	**.006**
MSKL	3.53	6.24	3.65	**.005**
MSDM	132.64	144.75	1.43	.210
MSAR	26.63	32.17	1.51	.110
MTRS	390.73	513.58	1.56	.210
MTAP	29.64	33.24	4.36	**.006**
MTAN	22.18	25.62	4.26	**.005**

MTAZ	17.42	19.45	3.17	**.004**
M10V	3.15	2.82	1.71	.195
M20V	4.36	4.05	1.22	.166
M30V	5.93	5.32	1.15	.176

*Legend***:** arithmetic mean initially (Mean (i), arithmetic mean finally (Mean (f), T-test value (T-value) and significance level (p)

Table 2 contains T-test values for motor abilities between initial and final measurements of the experimental group. Upon performed analysis of the results obtained (p) the conclusion is that there is statistically significant difference in sit ups (MDTK .007), mixed pull ups (MMZG .006), push ups (MSKL .005), hand tapping (MTAP .006), foot tapping (MTAN .005) and oot tapping against the wall (MTAZ .004).

Table 3. Significance of differences between arithmetic means of participants in the control group – motor abilities

Testovi	Mean(i)	Mean(f)	T-value	p
MDTK	5.05	5.72	1.43	.254
MMZG	5.90	6.63	1.47	.189
MSKL	3.14	3.85	-1.25	.284
MSDM	126.95	132.54	-1.58	.287
MSAR	26.48	26.73	-1.27	.255
MTRS	380.64	425.72	-1.77	.296
MTAP	29.24	32.76	0.79	.474
MTAN	23.52	24.10	1.63	.249
MTAZ	18.28	19.85	-1.54	.223
M10V	3.25	3.22	-1.73	.103
M20V	4.40	4.35	1.55	.178
M30V	6.05	5.96	-1.12	.155

*Legend***:** arithmetic mean initially (Mean (i), arithmetic mean finally (Mean (f), T-test value (T-value) and significance level (p)

Table 3 contains T-test values for program activities in regular PE classes between initial and finale measurements of participants in the control group. Upon the performed analysis the conclusion is that there is no statistically significant difference in tests of motor abilities of the participants in the control group.

Table 4. Multi-variant analysis of motor abilities variance between experimental and control group at final measurement

Wilks' Lambda	Rao's R	Q
.197	8.99	**.000**

*Legend***:** Bartlett's test values (Wilks' Lambda), Rao's F-approximation (Rao's R) and significance level (Q)

Upon the analysis of Table 4 showing results of significance tests for motor skills in final measurement between experimental and control group statistically significant difference was observed. Wilks' Lambda is .197, which using Rao's approximation of 8.99 provides significance of Q= .000. therefore, in the applied system of motor abilities, statistically significant differences were observed.

Table 5. Uni-variant analysis of motor abilities variance between experimental and control group at final measuring.

Testovi	Means (E)	Means (K)	F-odnos	Q
MDTK	7.36	5.72	2.88	**.008**
MMZG	9.52	6.63	3.54	**.007**
MSKL	6.24	3.85	3.04	**.003**
MSDM	144.75	132.54	1.44	.091
MSAR	32.17	26.73	1.56	.143
MTRS	513.58	425.72	1.44	.103
MTAP	33.24	32.76	6.34	**.000**
MTAN	25.62	24.10	4.65	**.000**
MTAZ	19.45	19.85	5.02	**.000**
M10V	2.82	3.22	1.62	.129
M20V	4.05	4.35	1.52	.225
M30V	5.32	5.96	1.42	.134

Legend: arithmetic mean of experimental group (Mean (e)), arithmetic mean of control group (Mean (k)), F-test value (F-ratio) and significance level (Q)

In Table 3 is presented uni-variant analysis of variance of tests for motor abilities by comparing the results of arithmetic means of experimental and control group at final measurement. On the basis of coefficient of F-ratio and its significance (Q) it is possible to draw a conclusion that there was statistically significant difference at levels of motor abilities between experimental and control group in the following motor tests: sit ups (MDTK .008), mixed pull ups (MMZG .007), push ups (MSKL .003), hand tapping (MTAP .000), foot tapping (MTAN .000) and foot tapping against the wall (MTAZ .000).

Research results suggested that the participants in the experimental group, in comparison to the control group, in duration of experimental period achieved significantly better results in all assessment tests for motor abilities, whereas they had statistically significant contribution in repetitive strength and segmentary speed assessment tests (Tables 3–8). Experimental group had two classes of PE a week, and three additional classes with programmed activities in gymnastics –acrobatics a week, and we may conclude that statistically significant results in tests of repetitive strength and segmentary speed were a consequence of adequate methodical shaping of training activities in training, in planning and programming process, dosage, distribution and control of applied loads and increase in intensification of activities for individual needs of participants. Additionally, dynamics of exchange of periods of load in duration of training with periods of rest certainly contributed changes of motor abilities and eventually on average higher results of the participants of the experimental group in final measuring.

In tests for assessment of sprint speed and explosive strength, which proved to be relevant for the program but not statistically significant for changes in motor abilities in favor of experimental group was due to their great coefficient of inheritance.

On the other hand, the indicators we obtained for control group and their lower degree of progress at measured tests could be caused by low intensity of classes performed, i.e. that the students exercise at lower intensity level at regular classes. This is a consequence of effective time at disposal at education process, in comparison to the training process. In previous research performed it was concluded that effective exercising time at PE classes was 15 minutes [2, 30, 36], and in one of recent papers, with application of SOFIT instruments (system for observing fitness instruction time), average active time of students' exercising was 17.6 minutes [39].

4. CONCLUSION

Final experimental research results suggested that by application of motor exercises in acrobatics in duration of 36 classes statistically significant changes in motor abilities can be achieved.

Statistically significant changes were observed in variables for assessment of repetitive strength and segmentary speed. Results which do not represent statistical significance (explosive strength and sprint speed) occurred due to probably short duration of experiment and hereditary factor of motor abilities observed for the purpose of experiment. Although there was no statistically significant differences between two measurements, changes are evident, which proves positive effects of acrobatic exercises.

Teachers and trainers have the ability to develop their own models of exercising for better quality of acrobatics training in line with their individual abilities and qualities.

It was established that application of adequate intensity, duration and frequency of the acrobatics model may ensure efficient manner of improving motor abilities. The results obtained provide additional information on development of motor abilities in children and possibility of obtaining new information on modelling additional classes of Physical Education which was confirmed by other authors who dealt with similar or same topic [1, 14, 47]. In line with the above mentioned, the results obtained may be a contribution to realization of regular and additional activities at PE classes for the purpose of optimal planning, programming and control of activities. That would add to more efficient validation of harmonization of their motor learning and possible more adequate and purposeful projections of further desired development.

5. LITERATURE

1. Adashevskiy, V.M., Iermakov, S.S., Korzh, N.V., Muszkieta, R., Prusik, K., & Cieslicka, M. (2014). Biomechanical study athletes'movement techniques in the hurdles (on example of phase of flight). Physical education of students, 4, 3-12. doi:10.6084/m9.figshare.996012.
2. Arunović, D., Novaković, M., & Tomić, Z. (1979). *Opterećenost i angažovanost učenika na času fizičkog vaspitanja*. Beograd: Fizička kultura, 5, 372-379.
3. Balas, J., & Bunc, V. (2007). *Short-term influence of climbing activities on strength, endurance and balance within school physical education*. Int. J. Fit. 3(2):33-42.
4. Baltsevych,V. K., & Zaporozhanov, V .A. (1987). *Physical functioning of man.* Kiev.
5. Cieslicka, M., & Słowiński M. (2012). *Training loads of female canoeing youth national team in sprint competitions*. Pedagogics, psychology, medical-biological problems of physical training and sports. 12: 149-157.
6. Cieślicka, M., Napierała, M., & Zukow, W. (2012). *State building somatic and motor abilities in kids practicing tennis on prebasic training.* In: Health - the proper functioning of man in all spheres of life. Bydgoszcz: Bydgoszcz school higher.
7. Dorita, du Toit, Anita, E. Pienaar, & Leani, Truter. (2011.) *Relationship between physical fitness and academic performance in South African children*. SAJR SPER, 33(3), 23-35.
8. Fjortoft, I., Pedersen, A. V., Sigmundson, H., & Vereijken, B. (2011). *Measuring physical fitness in children who are 5 to 12 years old with a test battery that is functional and easy to administer.* Phys. Ther. 91(7):1087-1095.
9. Fujinaga, H. (2008). *Static standing balance as a component of motor fitness among the 5-year- old children*. Int. J. Fit. 4(2):67-74.

10. Gallahue, D. L., & Ozmun, J. C. (2006). *Understanding Motor Development. Infants, adolescents, adults*. (6th ed.) USA: McGraw-Hill publication pp.69-88.
11. Gert-Jan, de Bruijn, & Benjamin, Gardner. (2011). *Active Commuting and Habit Strength: An Interactive and Discriminant Analyses Approach.* American Journal of Health Promotion, 25(3), 27-36. http://dx.doi.org/10.4278/ajhp.090521-QUAN-170
12. Granacher, U., Muehlbauer, T., Doerflinger, B., Strohmeier, R., & Gollhofer, A. (2011). *Promoting Strength and Balance in Adolescents During Physical Education: Effects of a Short-Term Resistance Training.* J. Strength Cond. Res. 25(4):940-949
13. Haga, M. (2008). *The relationship between physical fitness and motor competence in children*. Child: care, health, and development. (5):329-334.
14. Iermakov, S.S. (2010). *Biomekhanichni modeli udarnikh rukhiv u sportivnikh igrakh u konteksti vdoskonalennia tekhnichnoi pidgotovki sportsmeniv* [Bio-mechanical models of strike movements in context of perfection of sportsmen technical fitness]. Teoria ta metodika fizichnogo vikhovannia, 4, 11–18.
15. Ivashchenko, O. V. (1988). *Normativnye pokazateli trenirovochnykh nagruzok na nachal'nom etape podgotovki iunykh gimnastok 6—8 let.* Cand. Diss. [Normative indicators of training loads at initial stage of junior, 6-8 yrs., girlgymnasts], Moscow; (in Russian)
16. Ivashchenko, O. V., & Pelepenko, O. V. (2011). *Osoblivosti rozvitku rukhovikh zdibnostej u divchat serednikh klasiv* [Specific features of secondary school girls' motor skills' training]. Teoriia ta metodika fizichnogo vikhovannia,10:3-9. http://dx.doi.org/10.17309/tmfv.2011.10.743
17. Ivashchenko, O. V., & Dudnik, Z. M. (2011). *Vikovi osoblivosti rozvitku rukhovikh zdibnostej divchat starshikh klasiv* [Age specificities of senior school girls' motor skills' training]. Teoriia ta metodika fizichnogo vikhovannia, 8:3-5. http://dx.doi.org/10.17309/tmfv.2011.8.727.
18. Ivashchenko, O. V. (2014). *Osoblivosti funkcional'noi, koordinacijnoi j silovoi pidgotovlenosti iunakiv 9-11 klasiv* [Specific features of functional, coordination and power fitness of 9-11 forms' boys]. Teoriia ta metodika fizichnogo vikhovannia,1:2433.http://dx.doi.org/10.17309/tmfv.2014.1.102.
19. Ivashchenko, O. V., Khudolii, O. M., Yermakova, T. S., Pilewska, W., Muszkieta, R., & Stankiewicz, B. (2015). *Simulation as method of classification of 7-9th form boy pupils' motor fitness*. Journal of Physical Education and Sport,15(1):142–147. http://dx.doi.org/10.7752/jpes.2015.01023.
20. Ivashchenko, O. V., Yermakova, T. S., Cieslicka, M., & Zukowska, H. (2015). *Discriminant analysis in classification of motor fitness of 9-11 forms' juniors.* Journal of Physical Education and Sport. 15(2),238–244. http://dx.doi.org/10.7752/jpes.2015.02037
21. Ivashchenko, O. V., Yermakova, T. S., Cieślicka, M., & Muszkieta, R. (2015). *Discriminant analysis as method of pedagogic control of 9-11 forms girls' functional and motor fitness*. Journal of Physical Education and Sport.15(3):576 – 581. http://dx.doi.org/10.7752/jpes. 2015.03086
22. Ivashchenko, O. V. , Kapkan, O., Khudolii, O., & Yermakova, T. (2017). *Informative indicators of 14–15 years' age boys' motor fitness.* Teoria ta metodika fizicnogo vihovanna [Theory and Methods of the Physical Education], 17(2), 86–97. doi: 10.17309/tmfv.2017.2.1193
23. Janković, I. (2008). *Adaptivne promene nekih antropoloških obeležja u toku šestomesečnog izvođenja nastave fizičkog vaspitanja kod učenika osnovnih škola*, Doktorska disertacija. Istočno Sarajevo: Fakultet fizičkog vaspitanja i sporta.
24. Khudolii, O.M., & Shlemin, A.M. (1988). *Methods of preparing young gymnasts.* Kharkov, KHPY, HHPY. (in Russian)

25. Khudolii, O.M. (2008). *Metodika planuvannia navchal'noi roboti z gimnastiki v shkoli* [Methodic of planning of gymnastic training work in school]. Teoriia ta metodika fizichnogo vikhovannia;9:19-35.http://dx.doi.org/10.17309/tmfv.2008.9.454 (in Ukrainian)
26. Khudolii, O.M., & Ivashchenko, O.V. (2013). *Informacijne zabezpechennia procesu navchannia i rozvitku rukhovikh zdibnostej ditej i pidlitkiv (na prikladi sportivnoi gimnastiki)* [Informational provisioning of training process and development of children's and adolescents, motor skills (on example of calisthenics)]. Teoriia ta metodika fizichnogo vikhovannia. 4:3–18. http://dx.doi.org/10.17309/tmfv.2013.4.1031 (in Ukrainian)
27. Khudolii, O.M., & Ivashchenko, O.V. (2014). *Osnovi naukovodoslidnoi roboti u fizichnomu vikhovanni i sporti* [Principles of scientific research work in physical education and sports], Kharkiv, „OVS".
28. Khudolii, O.M., Iermakov, S.S., & Prusik, K. (2015). Classification of motor fitness of 7-9 years old boys. Journal of Physical Education and Sport. 15(2:245-253. http://dx.doi.org/10.7752/jpes.2015.02038.
29. Khudolii, O.M., Iermakov, S.S., & Ananchenko, K.V. (2015). *Factorial model of motor fitness of junior forms' boys. Journal of Physical Education and Sport*. 15(3):585 - 591. http://dx.doi.org/10.7752/jpes.2015.03088.
30. Krsmanović, B. (1992). *Aktivnost i angažovanost učenika na času fizičkog vaspitanja*. Zbornik radova Fakulteta za fizičku kulturu u Novom Sadu, 6, 25-31.
31. Krutsevych, T.Y., & Bezverkhnya, G.V. (2010). *Rekreaciia v oblasti fizicheskogo vospitaniia razlichnykh grupp naseleniia* [Recreation in physical education of different population groups]. Kiev: Olympic Literature.
32. Kurelić, N., Momirović, K., Stojanović, M., Radojević, Ž., & Viskić-Štalec, N. (1975*). Struktura i razvoj morfoloških i motoričkih dimenzija omladine.* Beograd: Institut za naučna istraživanja, Fakultet za fizičku kulturu.
33. Linec, M.M. (1997). *Principles of methodic of motor skills' development.* Lviv: Stabar.
34. Lopes, V.P., Rodrigues, L.P., Maia, J.A.R., & Malina, R.M. (2011). *Motor coordination as predictor of physical activity in childhood.* Scand. J. Med. Sci. Sports 21(5):663-669.
35. Lucertini, F., Spazzafumo, L., Lillo, F., Centonze, D., Valentini, M., & Federici, A. (2012). *Effectiveness of professionally guided physical education on fitness outcomes of primary school children.* Eur. J. Sport Sci. 11(6):1-9.
36. Lučić, V. (1975). *Klasičan čas u fizičkom vaspitanju ne obezbeđuje racionalno korišćenje vremena*. Beograd: Fizička kultura, 4, 28-30.
37. Madić, D. (2000). *Povezanost antropoloških dimenzija studenata fizičke kulture sa njihovom uspešnošću vežbanja na spravama.* Doktorska disertacija, Novi Sad: Fakultet fizičke kulture.
38. Malina, R.M., Bouchard, C., & Bar-Or, O. (2004). *Growth, maturation, and physical activity.* (2nd ed.) USA: Human Kinetics Publication pp.47-53.
39. Marković, M., Bokan, B., Rakić, S., & Tanović, N. (2012). *Primena instrumenta SOFIT za procenu aktivnosti učenika i nastavnika na časovima fizičkog vaspitanja u beogradskim osnovnim i srednjim školama.* U: Dopsaj, M. & Juhas, I. (Ur.) *Efekti primene fizičke aktivnosti na antropološki status dece, omladine i odraslih.* Beograd: Fakultet sporta i fizičkog vaspitanja.
40. Mironović, R. (1977). *Povezanost nekih psihomotornih varijabli s uspjehom u savlađivanju bazičnih gibanja u sportskoj gimnastici*. Magistarski rad: Zagreb: Fakultet za fizičku kulturu.

41. NASPE (National Association for Sport and Physical Education) (2005). *Physical Education for Lifelong Fitness*. (2nd ed) USA: Human Kinetics Publication pp.39-105.
42. Pajek, M. B., Cuk, I., Kovac, M., & Jakse, B. (2010). *Implementation of the gymnastics curriculum in the third cycle of basic school in Slovenia*. Sci. Gym. J. 2(3):15-27.
43. Pehkonen, M. (2004). *Qualty of the teaching process as an explanatory variable in learning gymnastics skills in school physical education.* M. Qual. Teach. Proc. 2(2):29-40.
44. Piek, J.P., Baynam, G.B., & Barett, N.C. (2006). *The relationship between fine and gross motor ability, self-perception and self-worth in children and adolescent.* Hum. Mov. Sci. 25: 65-75.
45. Pop, C. L. (2016). *Physical and health education facing the technology challenge.* Physical Education of Students, 20(2), 45-49. doi:10.15561/20755279.2016.0207.
46. Pržulj, D. (2009). *Razvoj motoričkih sposobnosti u funkciji pliometrijskog metoda treninga kod sportista*. Sport i zdravlje, 4 (1), 58-62.
47. Vlasov, A., Demichkovskij, A., Ivashchenko, O., Lopatiev,A., Pitin, M., Pianylo, I., & Khudolii, O. (2016). *Sistemnijpidkhid i matematichne modeliuvannia biologichnikh ta prirodnikh ob'iektiv i procesiv* [Systemic approach and mathematical modeling of biological and natural objects and processes]. Fiziko-matematichne modeliuvannia ta informacijni tekhnologii, 23, 17–28.
48. Živčić, K., Čavar, I., & Sporiš, G. (2011). *Changes in gymnasts motor abilities during the nine month training process of female gymnasts 5-6 years of age*. Science of Gymnastics Journal, 2 (4); 45-54.
49. Werner, P.H., Williams, L.H., & Hall, T.J. (2012). *Teaching Children Gymnastics*. 3th ed. Human Kinetics Pub. pp.23-38.

Received: April 23. 2018
Revision received: June 15. 2018
Accepted: September 24. 2018

Correspondence
Dr Dušan Mićović
ŠOSO „Kosovski Božur – Special school" Kosovska Mitrovica
38220 Kosovska Mitrovica , Republic of Serbia
E-mail: d.micovic@hotmail.com.

Prof. dr Dalibor Fulurija
Faculty of Physical Education and Sport, University of East Sarajevo
71420 Pale, BiH-RS
E-mail: dalibor.fulurija@yahoo.com.

Prof. dr Tatjana Ćeremidžić
Faculty of Physical Education and Sport, University of East Sarajevo
71420 Pale, BiH-RS
E-mail: dorapet@teol.net.