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Effects of a Model of Supplementary Exercises for the Development of Motor Skills in Elementary School Students

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Abstract

The aim of this research was to evaulate the effects of supplementary exercise models on the development of motor skills in elementary school students. The study involved a sample of 120 students divided into experimental and control groups, with 60 students in each group. Students in the experimental group, in addition to the regular curriculum, implemented a supplementary exercise model aimed at developing motor skills, while students in the control group followed the regular physical education curriculum. The research variables included: segmental speed, repetitive strength, explosive power and sprint speed, evaluated through tests such as hand tapping (HTP), foot tapping (FTP), wall taps with feet (WTF), sit-ups on a Swedish bench (SSB), mixed pull-ups (MPU), squats (SQT), standing long jump (SLJ), standing triple jump (STJ), vertical jump "Sergeant" (VJS), 20-meter sprint (S20), 40-meter sprint (S40), and 60-meter sprint (S60). Based on the T-test results, the experimental group showed no statistically significant differences only in wall taps with feet (WTF) and standing long jump (SLJ), while all other tests indicated statistically significant differences in motor skills between initial and final measurements. In the control group, there were no statistically significant differences between initial and final measurements in motor skills.

Keywords: *model, supplementary exercises, motor skills, students, elementary school*

Introduction

The objectives of physical education, stemming from its goals, and operational tasks concerning gender and age of students, are categorized into three thematic areas. One of these areas is the development of physical abilities, where elementary school students, in all physical education classes and extracurricular activities, are provided with time necessary for optimal development of physical abilities: strength, speed, endurance, flexibility, and appropriate motor habits (Momčilović, 2020). However, it is important to note that changes in physical abilities during growth and development partly do not depend on children's physical activity (Malina & Katzmarzyk, 2006).

Elementary school represents a period of intensive growth and development during which significant changes occur in the students' bodies. It is a period when the body is more susceptible to external influences, although it follows the basic trends of natural developmental changes, and physical education plays a crucial role in the development of not only motor skills but also the overall psychosomatic status of elementary school students (Malacko, 2002; Horvat and Vuleta, 2002; Višnjić, 2006; Pržulj, 2006; Pržulj, 2007). Active participation in class and spending more time in physical exercise allows students to improve their motor skills (Corbin, Pangrazi, & Welk, 1994; Silverman, 2005; Pavlović, 2017; Šekeljić and Stamatović, 2014).

During the maturation process, motor skills are not acquired spontaneously but through physical exercise, where the precise load (volume and intensity) is determined individually for each person (Hardy et al., 2010). Properly dosed physical load enables optimal development of motor skills (Metvejev,

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2000; Željaskov, 2004; Pržulj, 2006; Milanović, 2014).

The development and maintenance of achieved levels of motor skills can be significantly influenced by physical exercise, and to better understand these transformations, it is necessary to continuously monitor and study the transformation processes of motor skills (Metcalfe & Clark, 2002). Developing and perfecting motor skills and monitoring physical development to achieve good physical health in children and adolescents are fundamental prerequisites (Mikkelsson et al., 2006).

Different models of transformational processes and the effects of specifically programmed educational processes, their positive influence on the development and enhancement of motor skills in elementary school children, are of great importance for improving physical education and are the subject of numerous studies (Kurelić et al., 1975; De Vris, 1976; Heimar and Medvedev, 1997; Metvejev, 2000; Branković, 2001; Višnjić, 2004; Markuš and Markuš, 2006; Duraković, 2007; Pržulj, 2009; Milanović, 2014).

Methods

The sample consisted of 120 elementary school students in Niš, aged 13 and 14 years (±6 months), enrolled in three regular physical education classes.

The entire sample was divided into two homogeneous subsamples. The first subsample, consisting of 60 participants, constituted the experimental group. These students were involved in the regular physical education classes where 60% of the class time was dedicated to implementing pre-planned program content, while the remaining 40% was reserved for supplementary exercises aimed at developing students' motor skills.

The second subsample, also comprising 60 participants, served as the control group. These students participated in regular physical education classes where 100% of the class time adhered strictly to the prescribed curriculum.

Motor skill variables in this study included: segmental speed, repetitive strength, explosive power, and sprint speed. Motor skill assessments utilized in this research were: hand tapping (HTP), foot tapping (FTP), and wall taps with feet (WTF) for segmental speed; sit-ups on a Swedish bench (SSB), mixed pull-ups (MPU), and squats (SQT) for repetitive strength; standing long jump (SLJ), standing triple jump (STJ), and vertical jump "Sergeant" (VJS) for explosive power; and 20m sprint (S20), 40m sprint (S40), and 60m sprint (S60) for sprint speed.

The motor skill variables were adopted from the research by Kurelić, Momirović, Stojanović, Šturm, and Viskić-Štalec (1975).

The experimental treatment lasted for three months with three classes per week, i.e., 36 instructional sessions in total. The experiment was conducted during regular physical education classes in elementary schools in Niš. The parents were informed about the testing, they confirmed that their children were healthy and gave their consent for them to participate in the tests. All procedures and tests were conducted according to the WMA Declaration of Helsinki.

During the experimental procedure, two measurements of motor skills were conducted: initial measurements at the beginning of the experiment and final measurements at the end of the experiment for all participants in both the experimental and control groups.

Results

The research results are the following:

Table 1. Basic statistical parameters for the assessment of motor skills of the control group during the initial measurement

Variables	N	Mean	Min.	Max.	Std.dev.	Skewn.	Kurtos.
HTP	60	31.10	26.00	38.00	15.62	0.025	1.015
FTP	60	22.84	18.00	29.00	11.14	0.152	-0.608
WTF	60	14.15	10.00	18.00	10.18	0.220	-1.507
SSB	60	11.22	8.00	16.00	15.51	0.204	-1.004
MPU	60	8.73	5.00	13.00	2.47	0.520	-1.108
SQT	60	11.35	9.00	17.00	11.24	0.207	-2.005
SLJ	60	179.68	168.0	230.00	8.82	0.100	0.105
STJ	60	498.32	425.00	595.00	7.02	0.024	-1.120
VJS	60	22.64	19.00	32.00	5.00	0.715	2.206
S20	60	4.42	3.84	4.88	2.02	0.129	0.100
S40	60	6.49	5.95	6.90	7.00	0.414	-0.104
S60	60	8.60	8.05	9.10	1.12	0.712	1.406

Notes: Arithmetic mean (Mean), minimum (Min), maximum (Max), standard deviation (Std. dev.), skewness (Skewn.), kurtosis (Kurtos.), hand tapping (HTP), foot tapping (FTP), wall taps with feet (WTF), sit-ups on a Swedish bench (SSB), mixed pull-ups (MPU), squats (SQT), standing long jump (SLJ), standing triple jump (STJ), vertical jump "Sergeant" (VJS), 20m sprint (S20), 40m sprint (S40), 60m sprint (S60).

Table 1. shows the results for the participants from the control group regarding their motor skills assessment during the initial measurement, and it indicates that there is no statistically significant deviation of the results from the normal distribution. The results of the tests that assess the participants' motor skills indicate that the distribution is positive. This is confirmed by the results of the distribution asymmetry (skewness) which does not exceed 1.00, which means that the tests are not difficult (up to +1.00) or easy (up to -1.00), but rather correspond to the surveyed participants and the value is below one. The homogeneity (kurtosis) indicates that there is a good sensitivity of the tests, because the obtained values are below 2.75. The results obtained regarding the motor skills do not deviate from the results of similar studies conducted in our country on this population of examinees, thus it is possible to apply the multivariate analysis methods in this research as well. Generalization of the results on the population from which the sample of these respondents was derived is thus possible.

Table 2. Basic statistical parameters for the assessment of motor skills of the control group during the final measurement

Variables	N	Mean	Min.	Max.	Std.dev.	Skewn.	Kurtos.
HTP	60	31.70	28.00	40.00	1.24	0.445	-2.524
FTP	60	23.64	19.12	31.00	15.42	0.025	-2.112
WTF	60	15.30	12.00	20.00	5.31	0.169	0.302
SSB	60	12.18	9.00	17.00	12.14	0.024	2.025
MPU	60	9.00	6.00	15.00	13.14	0.502	0.236
SQT	60	12.26	10.00	18.00	11.55	0.200	0.300
SLJ	60	189.32	164.00	240.00	11.36	0.203	0.225
STJ	60	515.25	430.00	610.00	10.10	0.506	-2.436
VJS	60	24.10	20.00	32.00	15.52	0.042	1.562
S20	60	4.34	3.72	4.76	1.30	0.160	0.303
S40	60	6.35	5.84	6.75	11.10	0.014	2.016
S60	60	8.52	7.90	8.86	3.12	0.124	1.236

Notes: Arithmetic mean (Mean), minimum (Min), maximum (Max), standard deviation (Std. dev.), skewness (Skewn.), kurtosis (Kurtos.), hand tapping (HTP), foot tapping (FTP), wall taps with feet (WTF), sit-ups on a Swedish bench (SSB), mixed pull-ups (MPU), squats (SQT), standing long jump (SLJ), standing triple jump (STJ), vertical jump "Sergeant" (VJS), 20m sprint (S20), 40m sprint (S40), 60m sprint (S60).

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Table 3. Basic statistical parameters for the assessment of motor skills of the experimental group during the initial measurement

Variables	N	Mean	Min.	Max.	Std.dev.	Skewn.	Kurtos.
HTP	60	30.62	27.00	37.00	15.75	-0.317	-1.047
FTP	60	23.45	19.00	30.00	12.23	-0.338	1.104
WTF	60	13.73	9.00	17.00	11.34	-0.004	1.675
SSB	60	10.82	7.00	14.00	17.05	0.236	0.359
MPU	60	8.37	5.00	12.00	6.06	-0.173	2.611
SQT	60	11.56	8.00	15.00	15.22	-0.508	1.365
SLJ	60	182.18	162.00	240.00	7.05	0.281	-0.762
STJ	60	505.43	470.00	590.00	3.77	0.311	0.400
VJS	60	22.83	19.00	31.00	4.72	-0.119	0.403
S20	60	4.20	3.72	4.94	3.31	0.350	2.200
S40	60	6.54	5.86	6.93	3.50	0.340	0.320
S60	60	8.56	8.15	8.97	0.45	0.046	1.055

Notes: Arithmetic mean (Mean), minimum (Min), maximum (Max), standard deviation (Std. dev.), skewness (Skewn.), kurtosis (Kurtos.), hand tapping (HTP), foot tapping (FTP), wall taps with feet (WTF), sit-ups on a Swedish bench (SSB), mixed pull-ups (MPU), squats (SQT), standing long jump (SLJ), standing triple jump (STJ), vertical jump "Sergeant" (VJS), 20m sprint (S20), 40m sprint (S40), 60m sprint (S60).

Table 3. shows the results for the participants from the experimental group regarding their motor skills assessment, and it indicates that there is no statistically significant deviation of the results from the normal distribution. The results of the tests that assess the participants' motor skills indicate that the distribution is positive. This is confirmed by the results of the distribution asymmetry (skewness) which does not exceed 1.00, which means that the tests are not difficult (up to +1.00) or easy (up to -1.00), but correspond to the surveyed participants and the value is below one. The homogeneity (kurtosis) indicates that there is a good sensitivity of the tests, because the obtained values are below 2.75. The results obtained regarding the motor skills do not deviate from the results of similar studies conducted in our country on this population of examinees, thus it is possible to apply the multivariate analysis methods in this research as well. Generalization of the results on the

Table 4. Basic statistical parameters for the assessment of motor skills of the experimental group during the final measurement

Variables	N	Mean	Min.	Max.	Std.dev.	Skewn.	Kurtos.
HTP	60	36.82	28.00	41.00	12.22	-0.075	-2.300
FTP	60	28.43	21.00	32.00	11.83	0.223	-1.241
WTF	60	15.67	11.00	19.00	15.31	0.342	1.09
SSB	60	17.14	10.00	20.00	10.97	0.587	0.334
MPU	60	14.26	8.00	17.00	15.17	0.622	-0.245
SQT	60	16.72	11.00	19.00	3.68	0.100	2.049
SLJ	60	194.85	175.00	250.00	10.55	0.602	2.500
STJ	60	590.83	510.00	640.00	2.47	0.084	0.122
VJS	60	31.28	23.00	33.00	2.54	0.405	1.352
S20	60	3.86	3.50	4.76	10.45	0.270	1.079
S40	60	5.85	5.44	6.24	12.85	0.522	1.508
S60	60	7.90	7.63	8.56	17.35	0.800	-0.100

Notes: Arithmetic mean (Mean), minimum (Min), maximum (Max), standard deviation (Std. dev.), skewness (Skewn.), kurtosis (Kurtos.), hand tapping (HTP), foot tapping (FTP), wall taps with feet (WTF), sit-ups on a Swedish bench (SSB), mixed pull-ups (MPU), squats (SQT), standing long jump (SLJ), standing triple jump (STJ), vertical jump "Sergeant" (VJS), 20m sprint (S20), 40m sprint (S40), 60m sprint (S60).

population from which the sample of these respondents was derived is thus possible.

Table 4. shows the results for the participants from the experimental group regarding their motor skills assessment during the final measurement, and it indicates that there is no statistically significant deviation of the results from the normal distribution. The results of the tests that assess the participants' motor skills indicate that the distribution is positive. This is confirmed by the results of the distribution asymmetry (skewness) which does not exceed 1.00, which means that the tests are not difficult (up to +1.00) or easy (up to -1.00), but rather correspond to the surveyed participants and the value is below one. The homogeneity (kurtosis) indicates that there is a good sensitivity of the tests, because the obtained values are below 2.75. The results obtained regarding the motor skills do not deviate from the results of similar studies conducted in our country on this population of examinees, thus it is possible to apply the multivariate analysis methods in this research as well. Generalization of the results on the population from which the sample of these respondents was derived is thus possible.

Table 5. Significance of differences between means of the control group

Tests	Mean(i)	Mean(f)	T-value	p
HTP	31.10	31.70	-1.25	0.218
FTP	22.84	23.64	-1.24	0.205
WTF	14.15	15.30	-1.21	0.200
SSB	11.22	12.18	1.75	0.405
MPU	8.73	9.00	1.24	0.205
SQT	11.35	12.26	-1.15	0.262
SLJ	179.68	189.32	-1.77	0.158
STJ	498.32	515.25	1.52	0.378
VJS	22.64	24.10	-1.17	0.354
S20	4.42	4.34	-1.23	0.263
S40	6.49	6.35	1.52	0.234
S60	8.60	8.52	-1.56	0.206

Notes: initial mean (Mean (i)), final mean (Mean (f)), T-test value (T-value), and significance level (p), hand tapping (HTP), foot tapping (FTP), wall taps with feet (WTF), sit-ups on a Swedish bench (SSB), mixed pull-ups (MPU), squats (SQT), standing long jump (SLJ), standing triple jump (STJ), vertical jump "Sergeant" (VJS), 20m sprint (S20), 40m sprint (S40), 60m sprint (S60).

Table 5. presents the results of the T-test for motor skills between initial and final measurements of the control group. After analyzing the obtained results, it is concluded that there is no statistically significant difference in motor skill tests.

Table 6. presents the results of the T-test for motor skills between initial and final measurements of the experimental group. After analyzing the obtained results, it is concluded that there is a statistically significant difference in hand tapping (HTP $p<0.001$), foot tapping (FTP $p<0.001$), sit-ups on a Swedish bench (SSB $p=0.006$), mixed pull-ups (MPU $p= 0.005$), squats (SQT $p=0.003$), standing triple jump (STJ $p<0.001$), Sergeant jump (VJS $p=0.001$), 20-meter sprint (S20 $p<0.001$), 40-meter sprint (S40 $p<0.001$), and 60-meter sprint (S60 $p<0.001$).

Table 6. Significance of differences between means of the experimental group

Tests	Mean(i)	Mean(f)	T-value	p
HTP	30.62	36.82	6.53	<0.001
FTP	23.45	28.43	5.55	0.000
WTF	13.73	15.67	1.52	0.120
SSB	10.82	17.14	1.36	0.006
MPU	8.37	14.26	1.26	0.005
SQT	11.56	16.72	1.17	0.003
SLJ	182.18	194.85	1.82	0.090
STJ	505.43	590.83	11.29	<0.001
VJS	22.83	31.28	3.12	0.001
S20	4.20	3.86	10.47	<0.001
S40	6.54	5.85	10.84	<0.001
S60	8.56	7.90	5.15	<0.001

Notes: initial mean (Mean (i)), final mean (Mean (f)), T-test value (T-value), and significance level (p), hand tapping (HTP), foot tapping (FTP), wall taps with feet (WTF), sit-ups on a Swedish bench (SSB), mixed pull-ups (MPU), squats (SQT), standing long jump (SLJ), standing triple jump (STJ), vertical jump "Sergeant" (VJS), 20m sprint (S20), 40m sprint (S40), 60m sprint (S60).

Discussion

The paper presents basic statistical parameters and the results of the T-test for motor skills between initial and final measurements of the experimental and control groups.

The results of the T-test for motor skills between initial and final measurements of the control group indicate that there is no statistically significant difference in motor skill tests: hand tapping (HTP p=0.218), foot tapping (FTP p=0.205), wall taps with feet (WTF p=0.200), sit-ups on a Swedish bench (SSB p=0.405), mixed pull-ups (MPU p=0.205), squats (SQT p=0.262), standing long jump (SLJ p=0.158), standing triple jump (STJ p=0.378), Sergeant jump (VJS p=0.354), 20-meter sprint (S20 p=0.263), 40-meter sprint (S40 p=234), and 60-meter sprint (S60 p=0.206).

Based on this, questions about the current lesson plan and program and the adequate selection of contents, methods and forms of work in regular physical education arise. Then, questions about the intensity and the scope of the student activities during the physical education classes, as well as, those about the better quality of the teachers' training. Also, there is the question of the student motivation during the regular physical education classes. Programmed classes and the implementation of various exercising models carry a more fun and more interesting content which is welcomed by students with greater motivation and stronger engagement which leads to heightened intensity and work scope and thus to development of motor skills. We believe that the improvement of the material conditions and provision of more diverse apparatuses, sports requisites and better equipment in school gyms and fitness rooms can bring about better effects in regular physical education classes. (Popović, 2004; Milanovic, 2007; Milanović, 2016; Momčilović, V., Momčilović, Z., 2017, 2024; Momčilović, V., Zdravković, V., 2020; Momčilović Z., Momčilović V., 2024).

The results of the T-test for motor skills between initial and final measurements of the experimental group indicate that there is a statistically significant difference in the following tests: hand tapping (HTP p<0.001), foot tapping (FTP p<0.001), sit-ups on a Swedish bench (SSB p=0.006), mixed pull-ups (MPU p=0.005), squats (SQT p=0.003), standing triple jump (STJ p<0.001), Sergeant jump (VJS p=0.001), 20-meter sprint (S20 p<0.001), 40-meter sprint (S40 p<0.001), and 60-meter sprint (S60 p<0.001). There were no statistically significant differences found in wall taps with feet (WTF p=0.120) and standing long jump (SLJ p=0.090).

The results of this study are one in a series indicating that experimental programs and supplementary exercise models for developing motor skills in elementary school children yield excellent results (Milenković, 2002; Dragić, 2003; Stamatović & Šekeljić, 2006; Pržulj, 2009; Bakhtjari, S., Shafinja, P., Ziaee, V., 2011; Korjenić et al., 2012; Milanović, S., 2016; Momčilović, V., Momčilović, Z., 2017, 2024; Momčilović, V., Momčilović, Z., & Cenić, S., 2018; Momčilović, V., Zdravković, V., 2020; Mekić, R., et all., 2023; Momčilović Z., Momčilović V., 2024).

The results of determination of the effects of the explosive strenght experimental model on motor and functional skills transformation during the regular physical education classes in elementray school students have shown that, under the experimental program influence, the experimental group of students achieved better results in motor and functional abilities measurements. Also, the results have shown that there are statistically significant effects on the final testing. (Momčilović, V., Momčilović, Z., & Cenić, S., 2018). The multivariate analysis of covariance in the field of motor skills indicates that there is statistically significant difference at the multivariate level between participants of experimental and control group. Existing difference occurs under the impact of experimental treatment which had an effect on the development of the motor skills of the experimental group. Furthermore, s statistically significant effect was determined at the reliability level of 99%, for acrobatic agility, 20m running with flying start, 50m running with standing start, pushups, standing long jump and standing triple jump. Only for one of the tests, i.e., squats, was the difference not statistically significant.

In the research about the effects of the combined physical education and sports gymnastics classes on the antropological status of elementary school students (Mekić, R., et all., 2023), in addition to the positive effects on morphological characteristics, the obtained results clearly show the positive effects of the gymnastics program on the students' motor skills in most of the tested anthropological and teoanthropological views on physical activity variables. Statistically significant changes at the final measurement in relation to the initial measurement were observed in the following variables: hand tapping, standing long jump, polygon backwards, trunk lifting, while in the

case of the variables deep bend various, stand up with a pull-up and running for 3 minutes, although there have been changes compared to the initial measurement, these changes are not at a statistically significant level.

The results of the research (Milanović, S., 2016) point to the fact that additional exercise treatment led to significant changes in motor skills of the examinees. The statistically significant differences in the levels of motor skills were observed between the experimental and the control groups in the following motor skills tests: arial agility , bat coordination, ground agility, standing long jump, standing triple jump, standing medicine ball throw, trunk lifts on the decline bench, mixed grip pull-ups, squats, 20-meter sprint from a high start, 40-meter sprint from a high start, 60-meter sprint from a high start, hand tapping, leg tapping and wall leg tapping.

Determining the impact of the selected excercises on the motor skills of the girls in the third grade od elementary schools has shown that selected excercises can be used to improve motor skills in the third grade elementary school students. (Bakhtjari, S., Shafinja, P., Ziaee, V., 2011). The results have shown statistically significant differences between the experimantal and the control groups in locomotor skills, manipulative skills and overall motor skills. In fact, the selected excercises impacted the motor skill development in examinees and led to the improvement in their motor skills development.

Conclusion

Based on the results of this research, we can conclude that the effects of supplementary exercise models on the development of motor skills in elementary school students have been identified, with statistically significant differences in motor skills observed in the experimental group after the experimental treatment.

Through the work on this study and previous research, it is evident that various supplementary exercise models, experimental programs, alternative curricula, and different teaching concepts contribute to positive transformative processes in the motor skills of elementary school students.

Starting from one of the primary objectives of physical education, which is the systematic monitoring of physical development and abilities of elementary school children, we can assert that the findings from this and similar studies are valuable for healthcare professionals, physical education teachers, sports professionals, and all other experts in the field of child education and development. These findings hold exceptional societal significance.

For systematic monitoring of physical development and abilities in children, longitudinal studies are of greater importance. With appropriate methodology and measurement techniques, these studies can contribute to transforming and modifying educational curricula effectively.

The limitation of this research is that the scope could have been larger and the research instrument could have included a greater number of variables in motor, morphological and functional space with the aim to better observe the anthropological dimensions of the students and to determine the impact of the programmed physical education classes more precisely. In addition, more detailed and complex statistical procedures and analyses could be used which would present the research results more precisely and completely.

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References

Bakhtjari, S., Shafinja, P., Ziaee, V. (2011). Effects of Selected Exercises on Elementary School Third Grade Girl Students' Motor Development. Asian J. Sports Med. 2(1):51–56.

Branković, N. (2001). Razvojne karakteristike motoričkih sposobnosti učenica na kraju šestomesečnog izvoĐenja nastave fizičkog vaspitanja. U S. Vučković (Ur.). Zbornik radova "Fis-komunikacije" (str. 205-207). Niš: Fakultet fizičke kulture.

Clark, J. E., & Metcalfe, J. S. (2002). The Mountain of Motor Development: A Metaphor. In J. E. Clark, & J. Humphrey (Eds.), Motor Development: Research and Reviews (pp. 163-190). Reston, VA: NASPE Publications.

Corbin, C. B., Pangrazi, R. P., & Welk, G. J. (1994). Toward an understanding of appropriate physical activity levels for youth. Physical Activity and Fitness Research Digest, 1(8), 1–8.

Dragić, B. (2003). Efekti alternativnog nastavnog plana i programa fizičkog vaspitanja na morfološke karakteristike, motoričke sposobnosti i socijalne karakteristike učenika VI razreda osnovne škole. Doktorska disertacija, Niš: Fakultet fizičke kulture.

Duraković, M. (2008). *Kinatropologija*, *Biološki aspekti tjelesnog vježbanja*. Zagreb: Kineziološki fakultet Sveučilišta.

Hardy, L. L., King, L., Farrell, L., Macniven, R., & Howlett, S. (2010). Fundamental movement skills among Australian preschool children. Journal of Science and Medicine in Sport, 13(5), 503-508.

Heimar, S. i Medved, R. (1997). *Funkcionalna dijagnostika treniranosti sportaša, Međunarodno savetovanje,* Zbornika radova (23-44). Zagreb: Fakultet za fizičku kulturu Sveučilišta u Zagrebu.

Horvat, T. i Vuleta, D. (2002). Razlike u nekim motoričkim sposobnostima između učenika 5–8. razreda O.Š. „Josipa Račića" i učenika 5–8 razreda u OŠ u Hrvatskoj. U V. Findak (ur.). Zbornik radova 11. ljetne škole kineziologa Republike Hrvatske Programiranje rada u području edukacije, sporta, sportske rekreacije i kineziterapije. Zagreb: Hrvatski kineziološki savez.

Korjenić, A. , Jeličić, M. , Basinac, I., & Begović, D. (2012). Efekti programirane nastave odbojke na nivo motoričkih sposobnosti i usvojenost elemenata odbojkaške igre. Sportske nauke i zadravlje, 2 (2), 93-99. doi:10.7251/ssh1202093k

Kurelić, N., Momirović, K., Stojanović, M., Šturm, J., Radojević, Đ., Viskić-Štalec, N. (1975) Struktura i razvoj morfoloških i motoričkih dimenzija omladine. Beograd: Fakultet za fizičku kulturu / FFK - Institut za naučna istraživanja

Malacko, J. (2002). Sportski trening. Novi Sad: Fakultet fizičke kulture.

Malina, R.M., katzmarzyk, P.T. (2006). Physical activity and fitness in international growth standard for preadolescent and adolescent children. Food and Nutrition Bulletin. Vol 27, 4. 295-313.

Markuš, D. & Markuš, J. (2006). Uticaj posebno programiranog treninga na promene nekih motoričkih sposobnosti članova gimnastičke sekcije. U V. Findak (Ur). 15. letnja škola kineziologa republike hrvatske (str. 168-173.). Rovinj: Hrvatski kineziološki savez.

Mekić R, Bjelica B, Murić B, Kahrović I, Radenković O, Petković E, Aksović N. (2023). Influence of combined teaching of physical education and sports gymnastics on the anthroplological status of elementary school students. 10th INTERNATIONAL SCIENTIFIC CONFERENCE "ANTHROPOLOGICAL AND TEO-ANTHROPOLOGICAL VIEWS ON PHYSICAL ACTIVITY", BOOK OF PROCEDEEINGS pp. 56-62, Kopaonik, Serbia.

Mikkelsson, L., Kaprio, J., Kautianinen, H., Kujala, U., Mikkelsson, M., Nupponen, H. (2006). School fitness tests as predictors of adult healtrelated fitness. Am J Hum Biol, 18, 342-349.

Milanović R. S.. (2016). Efekti dopunskog metodičkog oblika rada na razvoj antropoloških obeležja školske dece. Uzdanica, XIII/2, str. 149–160.

Milanović, I. (2007). Efekti programirane nastave fizičkog vaspitanja u mlađem školskom uzrastu. Fizička kultura, 61(1–2), 43–70.

Milanović, S. (2014). Efekti dopunskog metodičkog oblika rada na razvoj antropoloških obeležja školske dece. *Međunarodna interdisiplinarna naučno-stručna onferencija"Vaspitno-obrazovni i sportski horizonti"*. Subotica: Visoka škola strukovnih studija za obrazovanje vaspitača i trenera.

Milenković, V. (2002). Efekti primene eksperimentalnog programa sa akcentom na sportsku gimnastiku na neke motoričke sposobnosti učenika sedmog razreda osnovne škole. U R. Popović (Ur.) Zbornik radova "Fis-komunikacije", (str. 291-300), Niš: Fakultet fizičke kulture.

Momčilović Z., Momčilović V. (2024) Intercorrelations of motor abilities of young school-age students. *11th International Scientific Conference "ANTHROPOLOGICAL AND TEO-ANTHROPOLOGICAL VIEW ON PHYSICAL ACTIVITY"*, Book of Proceedings pp. 62-68, Kopaonik, Serbia, March, 21 – 22, 2024.

Momčilović, V. (2020). Motoričke sposobnosti učenika IV razreda osnovne škole gradske i seoske sredine u Vranju. Vranje: Pedagoški fakultet u Vranju.

Momčilović, V., Momčilović, Z. (2017). Efekti dodatnog programa vežbi koordinacije u redovnoj nastavi fizičkog vaspitanja na neke motoričke sposobnosti, Zbornik radova VII međunarodne konferencije „Sportske nauke i zdravlje", Panevropski univerzitet „APERION", Banja Luka, 186-191.

Momčilović, V., Momčilović, Z. (2024). Transformation processes in the motor skills of young schoolchildren. 14th International Conference on "Sports Science and Health", Book of Proceedings pp. 63-71, Banja Luka, 14-15. 3. 2024.

Momčilović, V., Momčilović, Z., & Cenić, S. (2018). Effect of experimental model of explosive strength in regular physical education classes. Facta Universitatis Series: Physical Education and Sport, 16(3), 569-576.

Momčilović, V., Zdravković, V. (2020). The influence of integration of physical and music education on class teaching students motor skills development, Facta Universitatis Series: Teaching, Learning and Teacher Education Vol. 4, No 1, 35 – 45.

Pavlović, S. (2017). Prediktori fizičke aktivnosti učenika na času fizičkog vaspitanja (Predictors of physical activity of student in physical education class). Unpublished Doctoral dissertation, Novi Sad: Faculty of Sport and Physical Education. In Serbian.

Popović, S. (2003–2004). Efikasnost nastave fizičkog vaspitanja u zavisnosti od organizacione forme rada u nastavnom procesu. Fizička kultura, 57 58(1-4), 26–40.

Pržulj, D. (2006):. *Osnovi antropomotorike*, Udžbenik. Pale: Fakultet fizičke kulture.

Pržulj, D. (2007): *Kondiciona priprema sportista*, Udžbenik. Pale: Fakultet fizičke kulture.

Pržulj, D. (2009). Razvoj motoričkih sposobnosti u funkciji pliometrijskog metoda treninga kod sportista. *Sport i zdravlje*, 4 (1), 58-62.

Šekeljić, G., & Stamatović, M. (2014). Teorija i metodika fizičkog vaspitanja (Theory and methodic of physical education). Užice: Faculty of Pedagogy. In Serbian.

Silverman, S. (2005). Thinking long term: physical education's role in movement and mobility. Quest, 57(1), 138-147.

Stamatović, M., & Šekeljić, G. (2006). Uticaj različitih koncepcija nastave fizičkog vaspitanja na motorički status učenika mlađeg školskog uzrasta. U G. Bala (Ur.) Antropološki status i fizička aktivnost dece i omladine, Zbornik radova, (str. 301-310), Novi Sad: Fakultet sporta i fizičkog vaspitanja.

Višnjić, D. (2006). *Nastava fizičkog vaspitanja*: od V do VIII razreda osnovne škole: priručnik za studente, nastavnike i profesore. Beograd: Zavod za udžbenike i nastavna sredstva.

Željaskov, C (2004). *Kondicioni tzrening frhunskioh sportista (teorija, metodika i praksa),* Udžbenik. Beograd: Sportska akademija.