RELATIONSHIP BETWEEN MORPHOLOGICAL CHARACTERISTICS AND THE SUCCESS IN PERFORMING HIGH JUMPS USING THE "SCISSORS" TECHNIQUE IN STUDENTS

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Abstract
The research aims to determine the relationship between morphological characteristics and the teaching topic "High jump" in Physical Education classes using the "scissors" technique with fifth-grade students in primary schools in Split, Republic of Croatia. Thus, on a sample of 304 students (152 female and 152 male), aged 11 years (± 6 months), a set of 16 anthropometric measures was applied to assess the morphological characteristics and the teaching topics of motor knowledge. The results of multiple regression analysis indicate a high degree of correlation between the predictor set of used morphological variables and the criterion variable High jump using the "scissors" technique in both samples of students (female R = 0.46; male R = 0.48). The sample of students showed that, of all the applied morphological variables, the variable Elbow diameter showed the statistically most significant partial contribution in defining the criteria values. Everything points to the importance of selecting the teaching content, i.e., kinesiological operators for effective programming in the teaching of Physical Education, and especially for the transformation of the students' certain anthropological characteristics to achieve the desired final states. The obtained results also show which morphological characteristics should be given priority in order for the students to achieve the best results in monitoring and evaluating when evaluating the teaching topic High jump using the "scissors" technique.

Key words: *kinesiology operators, morphology, motor learning, Physical Education, fifth-grade students.*

Introduction

The times we live in are accompanied by the expansion of scientific and technological discoveries, the spread of information and communication technologies, and accelerated globalization, and numerous positive and negative consequences. In such a situation, appropriate physical exercise is an integral and necessary part of the students' daily lives, especially for primary and secondary school-age students. At this age, the students' bodies are undergoing dynamic development, and the lack of appropriate physical activity has a significant adverse effect on their growth, development, and the normal functioning of all organs and their functions. Furthermore, adequate physical exercise contributes to the development of anthropological characteristics and, thus, to the improvement of their health (Findak, Prskalo, and Babin, 2011).

Early age is a favorable time to stimulate development, morphological characteristics, motor and functional abilities, and increase the optimal range of biotic motor knowledge. It is known that, in this period, missed opportunities to influence the development of the quality and quantity of all knowledge and skills cannot be compensated in later life no matter how much we intensify development incentives, both in the family as an autonomous educational environment, preschools, and schools and in all forms outside the family upbringing (Pejčić and Trajkovski, 2018).

The term motor information or motor knowledge refers to formed "command algorithms" located in the appropriate motor zones of CNS that enable the realization of purposeful motor structures of the movement. The "command algorithm" is responsible for activating and deactivating different muscle groups according to the order, intensity, and duration of work, which results in the performance of a certain motor operation (Findak, Metikoš, Mraković, Neljak and Prot, 2000; Gallahue and Donnely, 2003).

Kinesiological motor knowledge represents those motor structures of movement whose primary function is the development of certain dimensions of the students' anthropological status, primarily morphological and motor characteristics. Therefore, the primary value of this knowledge is the ability to change students' certain anthropological characteristics according to a predefined desired goal (Babin, Bavčević and Prskalo, 2010; Babin, 1996; Bavčević, Vlahović and Katić, 2008).

Motor knowledge in kinesiology education includes knowledge that could be of great use due to the possibility of forming rational procedures for planning, programming, monitoring, and evaluation in the teaching of Physical Education. It must be borne in mind that the quality of teaching Physical Education depends on many factors, and one of the crucial ones is the knowledge of the current state of the students' morphological characteristics and their effectiveness in mastering certain motor skills and teaching content, and consequently the transformation of the students' specific morphological characteristics. Thus, this is a prerequisite so that properly selected motor

knowledge would assume the function of an appropriate kinesiological stimulus in the development of the students' anthropological characteristics. By carefully examining Physical Education objectives, both general and specific, we come to realize that they can be achieved in several ways, but programming, monitoring, and evaluating play a vital role. According to Findak (2003), the quality of the kinesiology education process depends on many factors, one of the crucial factors being knowledge of the students' current condition, abilities, characteristics, knowledge, and transformational values of individual kinesiology operators and teaching content.

Morphological characteristics are traits responsible for growth and development, including bone structure, muscle mass, subcutaneous adipose tissue, and, above all, are the result of heredity and adaptation to the environment. With their tone, large muscle groups contribute to the proper body posture, and an appropriately dosed workload can significantly contribute to this. During growth and development, and especially at younger school age, the organism is most susceptible to various influences of kinesiological activities that directly cause changes in the students' morphological characteristics. In the primary school curriculum, Physical Education is the only area defined in terms of the possibilities to influence the students' overall anthropological characteristics and, thus, their morphological characteristics.

The teaching unit *Jumping* in the Physical Education Curriculum for fifth-grade primary-school students envisages the adoption of three teaching topics: *High jump using the "scissors" technique, Squat stance standing long jump, and Squat jump with springboard takeoff* (*Primary school curriculum*, 2006). For this research, the teaching topic High jump using the "scissors" technique was chosen as motor knowledge for monitoring, evaluation, planning, and programming for fifth-grade primary-school students.

Determining the connection between morphological characteristics and motor knowledge is still insufficiently researched. However, it is a very current theoretical and practical problem that is of great importance, primarily due to its possibility of forming rational procedures for planning, programming, monitoring, and evaluation in Physical Education, as well as for orientation and selection of young athletes, planning, programming, control of the training process, and efficient monitoring of the development of athletes' and students' relevant anthropological characteristics (Vlahović, 2012). Babin, B., Vlahović, and Babin, J. (2019) determined the connection between morphological characteristics and representative teaching topics *Bounce from Middle Position in Volleyball* from the teaching unit *Games* in the official Physical Education Curriculum for fifth-grade primary-school students. A set of 16 anthropometric measures was applied to assess the morphological characteristics, and the teaching topic *Bounce from Middle Position in Volleyball*. The results of multiple regression analyses showed a high degree of correlation between the predictor set of applied morphological variables, and the criterion variable bounce from the *Bounce from Middle Position in Volleyball* (R = 0.44). An analysis of the partial influence of individual morphological variables on the regression model's significance showed that a statistically significant contribution was shown by the following variables: back skin fold, medium thorax circumference, upper arm skin fold, forearm circumference, lower leg skin fold, and wrist diameter. This research indicates the importance of choosing the topic *Bounce from Middle Position in Volleyball* for programming in the teaching of Physical Education to transform certain morphological characteristics and achieve the students' desirable final states and achieve better results in assessing that teaching content. Trajkovski, Malacko, and Tomljenović (2011) applied a system of a total of 43 variables, of which 14 morphological and 29 motor variables on a sample of 393 participants (169 girls and 224 boys) of preschool age, ages 4, 5, and 6, from the Primorje-Gorski Kotar County (kindergartens Fužine, Kostrena, Delfin, Delnice, Zamet, Maestral, Krnjevo, and Galeb).

Their objective was to determine the univariate and multivariate statistical significance of differences in the arithmetic means of applied morphological and motor variables between preschool girls and boys in order to perform modeling, diagnosing, planning, programming, and controlling of the teaching process based on the obtained information in the most optimal, timely, and efficient way. The results showed that there is a multivariate statistical significance of differences between the sexes in the systems of applied variables at the level of p = 0.00. Based on the obtained univariate values, it can be concluded that boys – with statistically significant differences in arithmetic means of morphological variables with reduced subcutaneous adipose tissue and increased transverse skeletal dimensionality, as well as better values in height and bodyweight – achieve better results in explosive power motor variables, partial body coordination, flexibility in the lying position, and endurance (running for three minutes expressed in meters), as well as better heart rate before and after the performed activity. Girls with increased morphological values of soft tissue voluminosity achieve better values in the static arm and shoulder girdle strength, repetitive torso strength, hamstring flexibility, hip flexibility, and 3-minute polygon. Trajkovski Višić, Plavec, and Rastovski (2008) determined the connection between motor abilities with nine variables and morphological characteristics with 12

variables in children aged four years. On a sample of 108 children (both sexes), a stepwise regression analysis determined the dependence of each motor test on the morphological characteristics and the child's sex. The obtained results indicate that there is an influence of morphological characteristics on the realization of most motor tasks and that the body height and leg length are the most dominant in the realization of the Standing long jump test. The authors conclude that the genetic factor is very influential at that age on the result in motor performance. The results of this research will contribute to the teachers' better understanding of Physical Education when choosing the teaching topic High jump using the "scissors" technique, both for the selected criteria and evaluation methods and for the morphological specification of this teaching topic in its importance for the effective planning and programming in Physical Education. This research was conducted to analyze the correlation size between the variables of morphological characteristics with the teaching topic High jump using the "scissors" technique, which was evaluated in fifth-grade primary-school students in the teaching of Physical Education.

Methods

Based on previous research (Mišigoj-Duraković, Matković, and Medved, 1995; Vlahović, 2012), measurements were performed by assessing four latent anthropometric dimensions, and each of the hypothetical morphological dimensions was estimated with four variables. Accordingly, and for the purposes of this research, a set of 16 anthropometric measures was formed, which were measured according to the following descriptions:

Longitudinal skeletal dimensionality
1. Body height (AVIS)
2. Leg length (AJN)
3. Arm length (ADR)
4. Foot length (AJS)

Transverse skeleton dimensionality
5. Knee diameter (ADKL)
6. Elbow diameter (ADLK)
7. Wrist diameter (ADRZ)
8. Pelvic width (AŠRZ)

Body volume and mass
9. Body mass (ATŽT)
10. Forearm circumference (AOPP)
11. Lower leg circumference (AOPT)
12. Medium thorax circumference (AOGK)

Subcutaneous fat tissue
13. Upper arm skin fold (AKNN)
14. Back skin fold (AKNL)
15. Abdomen skin fold (AKNT)
16. Lower leg skin fold (AKNP)

The teaching topic High jump with the "scissors" technique represents motor knowledge for fifth-grade primary-school students and is constructed as a representative teaching topic according to Vlahović (2012) from the teaching unit Jumping (Primary School Curriculum, 2006). Seven independent competent assessors evaluated the success of performing this motor task by direct observation of the students' performance. Prior to conducting the research, the evaluators attended seminars in order to educate themselves and agree on the set criteria in making an assessment of this motor knowledge. The teaching topic was evaluated according to the following description:

High jump using the "scissors" technique

Aids: Two stands for the high jump, elastic band or bar 5 meters long, jumping pit or mat, picture of the task.

Location: school hall for Physical Education (mats) or school playground (jumping pit).

Task: The task is to perform a high jump using the "scissors" technique from a straight run over an elastic band/bar placed at the height of 50 cm, taking off with the stronger leg.

Description and correct execution of the teaching topic: The examinee is at an arbitrary distance from the stand with an elastic band/bar and then makes a run-up in a straight line comprising 5-7 steps at an angle of about 30-40^0 in relation to the elastic band/bar. In the last two steps, he prepares for takeoff by extending the penultimate and shortening the ultimate step, lowering the center of gravity of the body, overtaking the shoulders with the hips, and placing the outstretched take-off leg on the ground. He takes off with the leg further away from the elastic band/bar (take-off leg) and moves upwards with the free (swing), outstretched leg.

The work of the swing leg and arm begins simultaneously as the last step before the takeoff, and its top speed is in its first half. The swing arm ends at shoulder height, and the swing leg at face height. In the upward movement and above the elastic band, the swing leg is followed by the slightly bent take-off leg. The participant's body does not yet rotate about the vertical axis. As it crosses the elastic band/bar almost in a vertical position, the swing leg is lowered down-back with an energetic movement, followed by the take-off leg with the knee outstretched. The examinee lands softly on the swing leg and then on the take-off leg, after which he stops moving.

Grading: Each examinee performs one jump, and a grade 1-5 is entered.

Table 1 shows the criteria for evaluating the teaching topic *High jump using the "scissors" technique* for both samples of participants.

Table 1. Evaluation criteria for the teaching topic *High jump using the "scissors" technique.*

GRADE	DESCRIPTION OF EVALUATION CRITERIA
5 (excellent)	The examinee performs the high jump with the "scissors" technique without errors
4 (very good)	- stops at an angled run-up due to poor estimation of the run-up length - does not overtake the shoulders with the hips just before the takeoff
3 (good)	- poorly assesses the run-up length and loses running rhythm - does not extend the penultimate step to enter the takeoff - does not overtake the shoulders with the hips just before the takeoff - does not perform a synchronized leg and arm swing before and after the takeoff
2 (sufficient)	- has an insecure run and lacks rhythm - lacks proper entry into the penultimate and ultimate step before the takeoff - is insecure in his takeoff leg - performs a premature or delayed single-leg takeoff - has a bent swing leg - does not perform an arm swing but rather touches the elastic band/bar with his arms - performs an almost double-leg landing
1 (insufficient)	- has an insecure run-up because he is insecure in his take-off leg - takes off with the wrong (closer) foot - does not perform an arm swing but rather grabs the elastic band/bar - in the flight phase, he is positioned in a forward bend and curled up - lands with both feet

The total result of each measurement of individual morphological variables and the score of seven motor knowledge assessors was calculated using Burt's simple summation method (participants' average score in items, according to Dizdar, 2006) and as such was used in further analyses. The results of all measurements were subjected to the descriptive indicators analysis, and the following were calculated: arithmetic mean (AS), minimum score (Min), maximum score (Max), standard deviation (SD), distribution asymmetry (Skew), distribution elongation (Kurt), and the Kolmogorov-Smirnov normality test (Max D). To obtain information on the correlation size between the predictor set of variables of morphological characteristics and the criterion variable of motor knowledge in the performance of the teaching topic *High jump using the "scissors" technique*, a multiple regression analysis was applied in the manifest morphological space to determine the multiple correlation coefficient (R), the coefficient of determination (R^2), standard forecast error (σ_e), F-test value (F), standardized regression coefficient (β), the correlation coefficient of the linear predictor variable (r), t-test value (t), and level of significance (p) were applied. Data processing was performed using the software package Statistica for Windows 13.0. at the Faculty of Humanities and Social Sciences, University of Split.

Results

Table 2 presents the parameters of descriptive statistics and the Kolmogorov-Smirnov normality test for the assessment of morphological characteristics on a sample of female students (Babin et al., 2019).

Table 2. Parameters of descriptive statistics and the Kolmogorov-Smirnov test of morphological variables on a sample of female students (AS – arithmetic mean; SD – standard deviation; Min – minimum result, Max – maximum result; Skew – asymmetry; Kurt – elongation; Max D – Kolmogorov-Smirnov test).

Variable	AS	SD	Min	Max	Skew	Kurt	Max D
AVIS	154.44	7.83	137.40	178.90	0.45	-0.00	0.06
ADŽN	83.34	4.86	79.43	105.00	0.47	0.13	0.06
ADŽR	66.43	3.80	57.56	78.23	0.41	-0.05	0.09
ADŽS	23.95	1.26	20.56	27.56	0.33	0.05	0.07
ADKL	8.72	0.54	7.66	10.36	0.52	-0.15	0.08
ADLK	5.81	0.35	5.10	6.70	0.24	-0.41	0.08
ADRZ	4.87	0.29	4.06	5.60	-0.11	-0.08	0.06
AŠRZ	24.50	2.07	20.46	30.43	0.39	-0.11	0.07
ATŽT	46.06	10.71	30.00	80.50	0.95	0.53	0.10
AOPP	20.48	1.87	16.40	25.63	0.35	-0.34	0.07
AOPT	31.85	3.16	25.06	39.50	0.52	-0.24	0.12
AOGK	75.78	7.78	62.06	100.46	0.81	0.52	0.07
AKNN	15.22	5.26	6.20	31.73	0.71	0.19	0.08
AKNL	11.29	6.17	4.46	34.40	1.72	2.97	0.17
AKNT	19.11	8.54	4.13	44.73	0.47	-0.29	0.06
AKNP	18.31	7.00	8.33	38.20	0.88	0.14	0.10

Critical value of the KS-test = 0.13; p = 0.01
Legend: AVIS – body height; ADŽN – leg length; ADŽR – arm length; ADŽS – foot length; ADKL – knee diameter; ADLK – elbow diameter; ADRZ – wrist diameter; AŠRZ – pelvic width; ATŽT – body mass; AOPP – forearm circumference; AOPT – lower leg circumference; AOGK – medium thorax circumference; AKNN – upper arm skin fold; AKNL – back skin fold; AKNT – abdomen skin fold; AKNP – lower leg skin fold.

Analyzing the obtained descriptive parameter values of the variables for assessing the students' morphological characteristics, it is evident that most variables show mainly the expected parameters in forming the distribution of results when measuring morphological variables. Thus, for data distribution, it can be stated, with an error rate of 0.01 (KS-test – 0.13), that the measurement results do not deviate significantly from the normal Gaussian distribution, except for the variable Back skin fold (AKNL; Max D = 0.17).

Table 3 shows the parameters of descriptive statistics and the Kolmogorov-Smirnov normality test of the distribution of variables for the assessment of morphological characteristics on a sample of male students (Vlahović and Babin, 2018).

Table 3. Parameters of descriptive statistics and the Kolmogorov-Smirnov test of morphological variables on a sample of male students (AS – arithmetic mean; SD – standard deviation; Min – minimum result, Max – maximum result; Skew – asymmetry; Kurt – elongation; Max D – Kolmogorov-Smirnov test).

Variable	AS	SD	Min	Max	Skew	Kurt	Max D
AVIS	154.48	7.73	132.60	175.06	-0.02	0.01	0.05
ADŽN	89.79	5.46	73.90	103.33	-0.04	0.14	0.04
ADŽR	66.89	4.05	57.30	78.86	0.12	0.05	0.04
ADŽS	24.68	1.54	21.26	28.66	0.21	-	0.03
ADKL	9.29	0.61	7.96	10.86	0.38	-	0.08
ADLK	6.12	0.45	5.23	7.23	0.27	-	0.04
ADRZ	5.01	0.33	4.33	5.73	0.04	-	0.06
AŠRZ	24.45	2.19	20.30	30.86	0.70	-	0.10
ATŽT	47.37	11.68	28.00	82.00	0.64	-	0.10
AOPP	21.04	2.05	16.46	26.63	0.26	-	0.05
AOPT	32.17	3.64	24.30	42.03	0.25	-	0.06
AOGK	75.98	8.00	59.73	98.36	0.61	-	0.09
AKNN	15.06	7.01	5.80	33.13	0.77	-	0.11
AKNL	11.88	7.89	3.93	33.63	1.47	1.16	0.22
AKNT	19.75	11.27	4.93	51.13	0.72	-	0.10
AKNP	17.75	8.09	5.46	40.46	0.56	-	0.09

Critical value of the KS-test = 0.13; p = 0.01

Legend: AVIS – body height; ADŽN – leg length; ADŽR – arm length; ADŽS – foot length; ADKL – knee diameter; ADLK – elbow diameter; ADRZ – wrist diameter; AŠRZ – pelvic width; ATŽT – body mass; AOPP – forearm circumference; AOPT – lower leg circumference; AOGK – medium thorax circumference; AKNN – upper arm skin fold; AKNL – back skin fold; AKNT – abdomen skin fold; AKNP – lower leg skin fold.

The results of the coefficients of descriptive parameter variables for assessing morphological characteristics on a sample of male students show, as in the sample of female students, with an error rate of 0.01 (KS-test = 0.13), that all morphological variables, except the variable Back skin fold (AKNL; Max D = 0.22), have a data distribution that does not show a significant deviation from the normal distribution.

Table 4 contains the parameters of descriptive statistics and the Kolmogorov-Smirnov normality test of the distribution of the motor knowledge variable.

Table 4. Parameters of descriptive statistics and the Kolmogorov-Smirnov test of the motor knowledge variables for *High jump using the "scissors" technique* on a sample of both sexes (AS – arithmetic mean; SD – standard deviation; Min – minimum result, Max – maximum result; Skew – asymmetry; Kurt – elongation; Max D – Kolmogorov-Smirnov test)

Sex	AS	SD	Min	Max	Skew	Kurt	Max
Female	2.47	0.93	1.00	4.71	0.30	-	0.07
Male	2.52	0.87	1.00	5.00	0.18	-	0.05

Critical value of the KS-test = 0.13; p = 0.01

The obtained results of descriptive parameters of the motor knowledge variable by performing the teaching topic *High jump with the "scissors" technique* on a sample of male and female students do not show values that would have maximum deviations from empirical values

concerning the theoretical relative cumulative frequencies Max D (0.07 – female students; 0.05 – male students). Furthermore, since they do not exceed the KS-test's critical value (0.13), it is clear that there is no significant deviation of the results from the normal distribution.

Table 5 shows the multiple regression analysis results of the criterion variable *High jump using the "scissors" technique* and a predictor set of morphological characteristics on a sample of female students (Vlahović, 2012).

Table 5. Multiple regression analysis; criterion variable *High jump with the "scissors" technique*; predictor set *morphological variables* – female students (R – multiple correlation coefficient; R2 – determination coefficient; σ_e – standard prediction error; F – F-test value; β – standard regression coefficient; r – linear correlation coefficient of the predictor variable; t – t-test value; p – significance level).

R = 0.46	R^2 =	σ_e =	F =	p =
Variable	**β**	**r**	**t**	**p**
AVIS	0.30	0.09	1.09	0.28
ADŽN	-	-	-	0.70
ADŽR	-	-	-	0.74
ADŽS	-	-	-	0.13
ADKL	0.06	0.03	0.35	0.73
ADLK	0.22	0.14	1.65	0.10
ADRZ	0.01	0.00	0.04	0.97
AŠRZ	0.07	0.04	0.41	0.68
ATŽT	-	-	-	0.12
AOPP	0.19	0.06	0.74	0.46
AOPT	-	-	-	0.38
AOGK	0.44	0.16	1.84	0.07
AKNN	0.14	0.06	0.66	0.51
AKNL	-	-	-	0.94
AKNT	-	-	-	0.08
AKNP	0.02	0.01	0.09	0.93

Legend: AVIS – body height; ADŽN – leg length; ADŽR – arm length; ADŽS – foot length; ADKL – knee diameter; ADLK – elbow diameter; ADRZ – wrist diameter; AŠRZ – pelvic width; ATŽT – body mass; AOPP – forearm circumference; AOPT – lower leg circumference; AOGK – medium thorax circumference; AKNN – upper arm skin fold; AKNL – back skin fold; AKNT – abdomen skin fold; AKNP – lower leg skin fold.

The multiple regression analysis results on a sample of female students indicate the importance of the level of association of the predictor set of morphological variables with the criterion variable High jump using the "scissors" technique (MZSUŠ). The multiple correlation coefficient (R = 0.46) indicates that a significant part of the variability of the criterion variable can be attributed to the influence of the predictor set of variables. The regression model's statistical significance is confirmed by the values of the F-test (F = 2.28; p = 0.00) so that the mentioned model can be considered predictively valid. The value of the determination coefficient (R2 = 0.21), albeit lower, indicates a statistically significant amount of the predictor common variance and the criterion variable. The value of the standard prediction error (σ_e = 0.88), as an indicator of the standard deviation of the dispersion of the measured results around the regression direction, indicates a high and unsatisfactory degree of representativeness of the regression model.

The analysis of the partial influence of individual variables did not indicate a statistically significant contribution of any predictor of a morphological variable in defining the regression model's significance.

The obtained values of standardized regression coefficients are not significant (β: [-0.01. -0.73]), and the values of linear correlation coefficients of individual predictor variables and criteria are in the correlation values (r: [0.00. 0.16]). The obtained findings are also confirmed by t-test values (t: [0.04. -1.74]; p: [0.07. 0.97]).

Table 6 shows the results of the multiple regression analysis of the criterion variable High jump with the "scissors" technique and the predictor set of morphological characteristics on a sample of male students (Vlahović, 2012).

Table 6. Multiple regression analysis; criterion variable *High jump with the "scissors" technique*; predictor set *morphological variable* – male students (R – multiple correlation coefficient; R2 – determination coefficient; σ_e – standard prediction error; F – F-test value; β – standard regression coefficient; r – linear correlation coefficient of the predictor variable; t – t-test value; p – significance level).

R = 0.48	R^2 =	σ_e =	F =	p =
Variable	**β**	**r**	**t**	**p**
AVIS	0.15	0.05	0.54	0.59
ADŽN	-	-	-	0.88
ADŽR	-	-	-	0.11
ADŽS	-	-	-	0.88
ADKL	0.00	0.00	0.02	0.99
ADLK	0.40	0.21	2.49	0.01
ADRZ	-	-	-	0.17
AŠRZ	-	-	-	0.57
ATŽT	-	-	-	0.93
AOPP	0.01	0.00	0.04	0.97
AOPT	0.02	0.01	0.07	0.95
AOGK	0.28	0.10	1.22	0.23
AKNN	0.31	0.11	1.23	0.22
AKNL	-	-	-	0.22
AKNT	-	-	-	0.19
AKNP	-	-	-	0.10

Legend: AVIS – body height; ADŽN – leg length; ADŽR – arm length; ADŽS – foot length; ADKL – knee diameter; ADLK – elbow diameter; ADRZ – wrist diameter; AŠRZ – pelvic width; ATŽT – body mass; AOPP – forearm circumference; AOPT – lower leg circumference; AOGK – medium thorax circumference; AKNN – upper arm skin fold; AKNL – back skin fold; AKNT – abdomen skin fold; AKNP – lower leg skin fold.

The results of the multiple regression analysis on a sample of male students indicate a significant correlation between the predictor set of variables and the criterion variable High jump using the "scissors" technique (MZSUŠ). The multiple correlation coefficient (R = 0.48) shows that a significant amount of the variance of the criterion variable can be attributed to the influence of the predictor set of morphological variables. The statistical significance of the regression model was confirmed by applying the F-test (F = 2.56; p = 0.00), which suggests that the defined predictor set allows a valid prediction of criterion variable results. The value of the determination coefficient (R2 = 0.23) indicates a statistically significant value of the predictor set's common variance and the criterion variable. The obtained value of the standard prediction error (σ_e = 0.81), as a measure of the dispersion of the measured values in relation to the regression function, indicates a relatively high and unsatisfactory degree of representativeness of the defined regression model.

The analysis of the partial influence of individual variables of the predictor set indicates a statistically significant contribution of the variable Elbow diameter (ADLK) in defining the validity of the regression model. The value of the standardized regression coefficient (β = 0.40) indicates a significant influence of the mentioned morphological variable in defining the criteria values. The mentioned variable shows the correlation coefficient with the criterion variable of 0.21 (r = 0.21). Statistical significance was confirmed after t-test application (t = 2.49; p = 0.01).

Discussion and conclusion

The results of the data distribution indicators of the set of morphological variables indicate that only the measuring instrument Back skin fold (AKNL) shows a significant deviation from the normal distribution in both samples of participants, and the said measuring instrument is denied maximum confidence. In the case of all other measuring instruments, the indicators point to normal data distribution, and it is possible to state that the system of anthropometric measures in this research proved to be valid (Babin et al., 2019). However, it is certainly important information that the measuring instrument's insensitivity is not a criterion for excluding it from further analyses. In the case of insensitivity, the most justified is the application of non-parametric data processing methods. The simplest method of assessing the normality of results distribution using the Kolmogorov-Smirnov test is not the most accurate. The parameters of asymmetry and elongation are of great importance for the most accurate determination of distribution problems (Božanić, 2011).

Comparing the results of this research with some results of orientation values of eleven-year-old students in the Republic of Croatia (Findak, Metikoš, Mraković, and Neljak, 1996), it can be stated that, in terms of the body weight to body height ratio, female students showed above average and male students excellent values. The results of the forearm circumference measurements show that both samples have above-average values. The subcutaneous fat tissue values in the upper arm skin fold (AKNN) show below-average results in female students and poor results in male students.

The values of the descriptive parameters of evaluating the teaching topic *High jump using the "scissors" technique,* in both samples of participants, show that the measuring instrument for assessing this motor knowledge is very well constructed and that the measurement procedure was well developed and standardized. For this reason, valid confidence could be given in processing and analyzing the results of this research.

The multiple regression analysis coefficient values on a sample of female students show a significant linear relationship between the system of variables of morphological characteristics as a predictor and the criterion variable of motor knowledge in the performance of the teaching topic High jump with the "scissors" technique. The analysis of partial contributions of individual morphological variables in the regression of the analyzed motor knowledge variable does not show a statistically significant partial contribution of any variable of morphological characteristics.

The multiple regression analysis coefficient values on a sample of male students show a significant linear relationship between the system of predictor variables of morphological characteristics and the criterion variable of motor knowledge in the performance of the teaching topic *High jump with the "scissors" technique*. The analysis of partial contributions in defining the criterion variable showed that the variable *Elbow diameter* (ADLK) was the only one to show the significance of the regression coefficient and partial correlation in the prognosis of the success of performing the high jump technique. The analyses indicate that the larger elbow diameter in male students positively affects the arm swing's efficiency as the active swinging extremities when performing the high jump using the "scissors" technique. As one of the basic patterns of human movement, the vertical jump has a great connection with the arm swing, which in this motor task has the task of maintaining balance and enabling efficient movement performance. Therefore, when performing a jump, bent arm swings play a significant role in the quality of performing a vertical jump.

Knowledge of the arm swing mechanism, kinetic, and kinematic parameters that determine the swing's success is necessary for the process of learning and improving sports techniques. This provides a better insight into the swing's issue, and coaches of those sports in which swings are an integral part of the technique provide information that will allow them to design the training process better. In the practical part, this information should provide coaches with guidelines for planning and programming the development of technical components of the arm swing's accurate performance in kinesiological activities in which the vertical jump is one of the predictors of achieving top results (Rađenović, O., 2014).

Based on this research results, it is possible to state that the morphological characteristics are important for the effective performance of the teaching topic *High jump with the "scissors" technique* in eleven-year-old students. The results indicate an essential segment in selecting this teaching topic in the process of programming the teaching of Physical Education for the transformation of certain morphological characteristics, all to achieve the students' desired final states.

So, the results obtained in this research are directly applicable in the teaching of Physical Education as a foundation for understanding the specification models of individual kinesiological structures, and then as a significant factor in optimizing planning and programming, and implementation and evaluation of kinesiological education (Vlahović, Babin, B and Babin, J., 2016).

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