IMPACT OF PSYCHOMOTOR ABILITY ON SUCCESS IN LEARNING

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Abstract
In order to determine the influence of anthropological space of psychomotor and cognitive skills and their association with success in learning, research was conducted in part on a simple random sample of 200 female high school population of entities, described by seven sets of primary psychomotor indicators and a set of general indicators of success in learning. By the criterion of formal representation of kinesiology education classes in the curriculum, the sample was stratified on the subsamples with two or four hours a week. To determine the influence of predictor variables in the system of psychomotor criterion variable success in teaching applied regression analysis. According to the actual parameters in multiple linear regressions, it confirmed the initial assumption that the system of psychomotor variables and variables of the general student success in high school there is a statistically significant association. Then it was concluded that the results do not contradict current scientific knowledge and the actual connection psychomotor and cognitive dimensions of anthropological space. The data indicate the need for transition model curriculum of the treated population in favour of their biosocial integrity of its entities.

Key words: psychomotor skills, cognitive abilities, regression, female pattern, Middle School

Introduction
It is of the utmost importance for the anthropology to determine the level of connectedness and interaction among the phenomena and processes. Psychomotor abilities research on the relationship with other anthropological dimensions of space has resulted in numerous findings of their bivariate and/or multivariate structural, functional and performance connection. This paper examines the partial correlation in the space of anthropological psychomotor and cognitive dimensions at the level of success in learning the subjects in the population of high school students, in order to - in the final biologically and psychologically relatively stable stage of development students - determine the actual state of development and legality of underlying dimensions by formally unequal external factors limit. The main objective of this study was to determine and analyze the impact of psychomotor skills for success in teaching secondary school students, and all the formal criteria of unequal representation of kinesiology education classes in their assigned curriculum.

Methods
Sample of entities
As stated as the GR-AB, includes 200 students, divided into two subgroups, namely: (1) subsample of 100 students (GR-A), which was scheduled for two hours a week of regular classes of kinesiology education in the 2nd year of high school, and (2) subsample of 100 students (GR-B), which was scheduled for four hours per week of regular classes of kinesiology education in the 2nd year of high school was appointed as the GR-B. The initial classification was made solely on the basis of the planned number of weekly hours of regular physical education students who just completed the second year of high school.

Sample of variables
To assess the psychomotor status it is significant to estimates all the sizes that exist in a hypothetical psychomotor area, but due to objective features, the sample sizes for a hypothetical primary were selected, which was presumed to be of particular interest for planning of kinesiology education with regard to the characteristics of psychomotor female student status. For the assessment of these dimensions following instrument was applied: (1) Explosive power: standing long jump / MFESDM /, From the numerical values of the general success of students at the end of the second grade high school a variable was formed, which is assumed to be predominantly caused by partly cognitive anthropological dimensions of space responsible for the success in learning (SUCCESS).

Results
Table 1. Distribution testing

<table>
<thead>
<tr>
<th>T-01: MFESDM</th>
<th>Kolmogorov-Smirnov</th>
<th>Shapiro-Wilk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Statistic</td>
<td>df</td>
</tr>
<tr>
<td>GR-A</td>
<td>.055</td>
<td>100</td>
</tr>
<tr>
<td>GR-B</td>
<td>.051</td>
<td>100</td>
</tr>
<tr>
<td>GR-AB</td>
<td>.045</td>
<td>200</td>
</tr>
</tbody>
</table>

By accepting the assumption that the variable long jump comes from a normal distribution, the risk set of 5% may be, based on interval arithmetic mean, calculated by expanding the characteristic ± 3.2794 times the standard deviation, 99.73% claim that the distribution GR-A subsample of this variable is between 83 713 cm and 179 437 cm, and subsamples GR-B between 197 893 cm and 89 542 cm, and sample the GR-AB between 84 803 cm and 190 489 cm.
Comparison of distribution of subsamples A-GR and GR-B variables long jump shall be applied the Kolmogorov-Smirnov test, which calculates the maximum distance between the cumulative distributions of the subsamples. In this case, the maximum distance is $DM = 0.37$, two-sided large sample $KS = 2.6163$ and $p = 0.000$ approximately. Since the $p$-value is less than 0.050, meaning that, at the risk of 5.00%, there is a statistically significant difference between the distribution of subsamples A-GR and GR-B variables long jump. In accordance with the already mentioned in connection with the conditions of release, the variable SUCCESS is graphically represented, through the control chart "three sigma" box diagrams and histograms of frequency distribution of subsamples A-GR and GR-B. With graphical form control chart "3S": SUCCESS GR-AB is seen that the values in the sample GR-AB variable SUCCESS distributed within the range of three standard deviations, i.e. the arithmetic mean of the sample (mean: 3425) to lower (DL = 1,817) and upper (= GL 5033) limit. Box-diagram: SUCCESS GR-AB is a visualization of the relationship between the central values and dispersion of subsamples A-GR and GR-AB sample GR-AB variable success.

Shown is the normal distribution curve. Tests for normal distribution, the Kolmogorov-Smirnov and Shapiro-Wilk, showed no statistically significant difference between, the distribution results of subsamples GR and GR-A and-B sample GR-AB variable SUCCESS, and the given parameters of a Gaussian normal distribution curve.

With all three figures, there are also differences between the subsamples GR-GR-A and B in sample GR-AB in the mean, range and dispersion success variables, defined in the numerical part of descriptive statistics, which is preceded by a graphical representation of the basic statistical characteristics of the studied parameters. This displays the comparative frequency histogram of variables and the general SUCCESS of psychomotor factor / GMF /, with the intention to present a general picture of their relationships. This is possible if the variables are reduced to the same, namely z-measure.

The visual impression is that the sample SUCCESS variable has a unimodal distribution, while the pattern variable of general psychomotor factor / GMF / has a bimodal distribution. This means that in the psychomotor variable there are more widespread results and pronounced results heterogeneity, with a tendency to divide the sample into two approximately equal parts. Since the criterion for the formation of subsamples of respondents required a varied representation of kinesiology education in their intended curriculum, it is likely that this fact influenced the outcome.
The results of testing the significance of multiple correlation (R<sub>0</sub>)

Regression procedure based on correlations in Table 2 refers to the results of testing hypotheses about the statistical significance of multiple correlation (R<sub>0</sub>) between the dependent variable SUCCESS-AB and independent manifest / MGR AB /, primary / Science AB /, secondary / SMF-AB /, tertiary / TMF-AB / motor variables, as well as general psychomotor factor / GPMF-AB /, respectively: (1) MGR AB, (2) Science AB, (3) SMF-AB, (4) AB-TMF, (5) GPMF-AB. The table shows the R<sub>0</sub>, R<sub>0</sub>2, and standard error estimates. R<sub>0</sub> is the coefficient of multiple correlations and it expresses the optimum relationship between the variables because it takes into account the relative contribution of each independent variable in the overall relationship with the dependent variable. The range is 0 to 1; higher value means a stronger bond. Kvadtat coefficient of multiple correlation (R<sub>0</sub>2), in this case, is a common measure of variability of motor and cognitive dimensions of anthropological space. It can be argued that it determines the proportion of common variance of the dependent and independent variables, subject to the regression model. The value of R<sub>0</sub>2 is ranked from 0 to 1. Statistics changes include changes in R<sub>0</sub>2, and the likelihood of changes in F, p, and F. Changes in R<sub>0</sub>2 are produced by adding or subtracting one independent variable, and in this specific case of all motor variables simultaneously. If R<sub>0</sub>2 is associated with a block GR-AB, a large, this means that the GR-AB is a good predictor of the dependent variable. Degrees of freedom are associated with the likelihood of changes in the F calculation, where the df1 is a numerator and df2 is a denominator. Durbin-Watson test is testing a serial correlation (autocorrelation) of the residuals. One of the assumptions of regression analysis is that in the variety of observations residuals are not correlated. If this is true, the expected value of the Durbin-Watson statistic is 2, while lower values suggest a positive and significant negative autocorrelation. The fact that D-W value is greater than 1.4 means that there are certainly not any serious autocorrelations in the residuals. Inspection of the table 2: From the results of testing the significance of R<sub>0</sub> can be concluded that the R<sub>0</sub> for each of the five suppositions at p ≤ 0050 is statistically significant with p = 0.000. So there is no reason for the statistically significant association of SUCCESS-AB with: (1) MGR AB, (2) Science AB, (3) SMF-AB, (4) TMF-AB, (5) GPMF-AB MGR-SUCCESS-AB and AB to not be accepted. Similarly, with probability greater than 95% it can be concluded that such a correlation will be also achieved in the respective populations. Achieved for R<sub>0</sub>2 = 0434 (1) MGR-AB and AB-SUCCESS means that 43.4% of variance exhibited in the SUCCESS-AB with MGR-AB. The SUCCESS-AB and: (2) Science AB R<sub>0</sub>2 = 0302, (3) SMF-R02 AB = 0289, (4) TMF- R<sub>0</sub>2 AB = 0.273, (5) GPMF- R<sub>0</sub>2 AB = 0228. Custom R02 sample tends to statistically optimally estimate how well the model fits the population.

Customized to R<sub>0</sub><sup>2</sup> is R<sub>0</sub><sup>2</sup> correction in the sense that it more closely reflects the adaptation of the model population, so that in 95% and more cases in a population 36.7% change SUCCESS-AB could explain MGR-AB. Custom R<sub>0</sub><sup>2</sup> SUCCESS-AB individually with: (2) Science AB R<sub>0</sub>2 = 0.277, (3) SMF- R<sub>0</sub>2 AB = 0.275 (4) the TMF- R<sub>0</sub>2 AB = 0266, (5) GPMF- R<sub>0</sub>2 AB = 0224. The last implies that general psychomotor ability accounted for 22.4% of the results of proficiency in the population of high school students. Of course, this is a statistical measure, but not contradictory to actual connection between psychomotor (which is often treated as intellectual) and cognitive dimensions of anthropological space. In addition, a share of affective factors is likely present in the results, which are to a large extent relevant part of the anthropological premises. Furthermore, the result of general success in physical education also contains a part of the motor results.

The regression coefficients

Table T-03: Regression Coefficients MGR-AB with the SUCCESS-AB shows: constant (a), not standardized b - coefficients (NstKf) and their standard error (SG), standardized β - coefficients (StKf), t-test results and their significance, 95% level of confidence in the β (95% CI (β), zero (R0), partial (Rp) and partial correlation (pR), and test results of collinearity (VIF). β - coefficients are standardized values, which are interpretable as they are in the same units of measurement. If the analyzed data is previously transformed into z-values, then β - coefficients are not standardized. They are tested with T-statistics, in other words, the relative importance of each variable in the model is being tested. Statistical significance is expressed by the probability (p) for each of the variables treated. Inspecting Table 3: It can be concluded that the connection of motor and cognitive anthropological space was realized through the mechanism for the regulation of movement, and almost with equal participation of the mechanism for the synergistic regulation and control of tone and structure of the mechanism of movement. Among other things, the solution is real likely because with the concerned age of the patients exercise can achieve significant progress in not only maintaining but also increasing levels of interaction capabilities that depend on the relation of these mechanisms and psychological processes. Whether through the optimization of control of movement (stimulating cognitive and affective processes) and / or energy regulation (homeostatic stimulating the adaptation process), in each case there is motor contribution to the physiological and psychological aspects of success in learning. The following analysis will surely present more information about the strong influence. Anthropological relations latent motor skills with proficiency in studies among the subjects in the population of high school students have made positive regression effects on the secondary, tertiary and general level. Fitness index (CI) is the square root relationship of eigenvalue, larger with each successive eigenvalue.
Value greater than 15 indicates possible problems and if greater than 30 it indicates serious correlation problems, which in this model is not the case. According to the results achieved, success-AB was significantly associated with the mechanism for the synergistic regulation and the regulation of tone duration ($\beta = 0.0187$, $T = 2.163$, $p = 0.036$), as well as the mechanism for the structure of movement ($\beta = 0.0520$, $T = 5.636$, $p = 0.000$). The results of success in learning are significantly related to general psycho-motor ability, which is expressed in the statistics parameters: $\beta = 0.0478$, $T = 7.555$, $p = 0.000$. It should be noted that this outcome does not mean lack of influence SMF1-AB and SMF2-AB, or TMF1-AB on the SUCCESS-AB, because their effects are statistically significant in the hypothesized model, in simple linear regression. In addition, subsamples of these meetings were statistically significantly associated with their respective subsamples of the SUCCESS variable. According to the actual parameters in multiple linear regression, it might be concluded that in defining the psychomotor effects on cognitive performance in middle school students, a multipotent role have: the mechanisms responsible for the bilateral integration movement, the formation of ideomotor structure, the control process of afferentation and reafferentation, as well as mechanisms for the regulation of tone individual muscle groups and when performing relaxation of antagonists of cyclic motion. On the other hand, if one takes into account the low average level of all results, while there were significant differences in the framework of such mediocrity, it is possible to estimate the influence of problem to be burdened with the level of these differences, or - problems in the realization of individual subjects psychomotor content, more than is supported by indications of the actual level of reciprocal changes. Of course, it is important to consider the fact that the subjects in a population partially explored are in biologically stable phase of their development, while their stability in the psychological sense is significantly relativized by psychosocial factors of environment in which they live and are educated. These factors in the continuity, together with the economic factor, have produced, and also systematized low average results, of which no human ability is immune. The conclusion is that the motor system, in the continuity, together with the economy, has produced, and also systematized low average results, of which no human ability is immune.

Since $p (a) = 0.000$ is less than 0.010, means that in more than 99% of cases there is a statistically significant difference between the value of a sequence on the Y-axis for levels A and B. Also, $P (B) = 0.033$, means that in more than 95% of cases there are significant differences between the values of the slope levels A and B. This further means that the impacts of GPMF-A on SUCCESS-A and GPMF-B on the SUCCESS-AB are significantly different in their level and direction.
Overall differences in the effects of GPMF-AB on the SUCCESS-AB are statistically significant at $p = 0.000$. The conclusion is that the initial assumption is rejected, which means that the representation of kinesiology education in the curriculum of high school significantly affects the level and direction of correlation between the psychomotor and cognitive dimensions of subjects from a population of high school students. Of course, in favor of those with more planned time for physical education and, on that basis, better results of GPMF and SUCCESS, to optimize these effects. By controlling the movements in a specific order, cognitive processes significantly affect the time of execution of complex motor activity, while, on the other hand, complex motor tasks stimulate the flow of information and the cognitive level, which is reflected in a greater connection between motor and cognitive variables. Kinesiology education classes, under the proclamation of versatility and harmonious development, is predominantly forcing a informatics component of the content of work, without enough exercise, which is the basic requirement for any changes in quantitative and qualitative dimensions of kinesiology, and anthropological status. As Kinesiology education is insufficiently represented in the curriculum, this approach generally results in low energy, including affective component, which is uncontested issue in physical education state among female subjects. With some differences, cognitive and psychomotor skills are mostly of dispositional character. It is evident that the psychomotor activity generally carries considerable cognitive load. The part of the variability that can be attributed to not inherited factors, the influence of psychomotor on cognitive functioning, could be attributed to positive biochemical changes that occur in the central nervous system under the influence of psychomotor activity, and work content (information) complexity of psychomotor tasks on the activation process of intellectual. Psychomotor performance and cognitive interaction is a rather complex way associated with emotional and motivational functions and structure of personality as a whole, to enable the adaptation to environmental conditions and better psychomotor performance.

**Conclusion**

On a representative sample of 200 middle school students the parameters are estimated on mutual influences in the anthropological area of psychomotor and cognitive dimensions at the level of success in learning, and in terms of representation of kinesiology education in the curriculum of secondary school. The regression analysis was applied to determine the influence of the predictor system of psychomotor variable on criterion variable of success in teaching. According to the actual parameters in multiple linear regression, the initial assumption was confirmed, that the system of psychomotor variables and variables of the general student success in high school there is a statistically significant correlation.

It is concluded that, in the anthropological space, there is a positive correlation between psychomotor ability and success in learning. Also, such a correlation exists between the number of hours allocated to kinesiology education curriculum: a higher number of hours of kinesiology training will have a greater transfer on psychomotor skills, and thus to a better success in learning. Hence, the results of this study indicate the need for transition of the model of teaching curriculum of treated population, in favor of the biosocial integrity of its entities.

**References**


UTICAJ PSIHOMOTORIČKIH SPOSOBNOSTI NA USPJEH U UČENJU

Sažetak
Radi utvrđivanja uticaja u antropološkom prostoru psihomotoričkih i kognitivnih sposobnosti te njihove povezanosti sa uspjehom u učenju, provedeno je djelomično istraživanje na jednostavnom slučajnom uzorku od 200 entiteta ženske srednjoškolske populacije, opisanih sa 7 setova primarnih psihomotoričkih indikatora te setom indikatora općeg uspjeha u učenju. Po kriteriju formalne zastupljenosti nastave kineziološke edukacije u nastavnom planu, uzorak je stratificiran na subuzorke sa po dva i sa po četiri sata sedmično. Za utvrđivanje uticaja prediktorskog sistema psihomotoričkih varijabli na kriterijsku varijablu uspjeha u učenju primijenjena je regresiona analiza. Prema ostvarenim parametrima u multiploj linearnoj regresiji, potvrđena je početna pretpostavka da između sistema psihomotoričkih varijabli i varijable općeg uspjeha učenica u srednjoj školi postoje statistički značajna povezanost, potom je zaključeno da rezultati ne proturječene dosadašnjim naučnim saznanjima i stvarnom povezanosti psihomotoričkih i kognitivnih dimenzija antropološkog prostora. Podaci indiciraju potrebu tranzicije modela nastavnog plana i programa tretirane populacije u korist biopsihosocijalnog integriteta entiteta.

Ključne riječi: psihomotoričke sposobnosti, kognitivne sposobnosti, regresija, žene, srednje škole

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