ОРИГІНАЛЬНА НАУКОВА РОБОТА

DISCRIMINANT ANALYSIS: IMPACT OF THE NUMBER OF REPETITIONS ON THE EFFECTIVENESS OF TEACHING BOYS AGED 15 A CARTWHEEL

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Abstract

The purpose of the study was to determine the impact of the number of repetitions on the effectiveness of teaching boys aged 15 a cartwheel.

Materials and methods. The study participants were 20 boys aged 15. The children and their parents were fully informed about all the features of the study and gave their consent to participate in the experiment. To solve the tasks set, the study used: pedagogical experiment, discriminant analysis.

Results. The study found that 6 repetitions 1 time each with a rest interval of 60 s are more effective than 6 repetitions 2 times each with a rest interval of 60 s when teaching the ability to assess movement performance by time ($p < 0.001$). And with the first exercise mode, fewer repetitions are needed to master the entire cartwheel.

Conclusions. Based on the analysis of group centroids, it was found that 6 repetitions of the exercise (6 sets 1 time each with a rest interval of 60 s) significantly influence the cartwheel skill development in boys aged 15 during physical education classes. The results of group classification show that 95.0% of the original grouped observations were classified correctly.

Keywords: discriminant analysis, boys, acrobatic exercises, exercise mode, teaching.

Introduction

Motor skills development in schoolchildren is the main task of the modern school (Ivashchenko, 2020; Kapkan et al., 2019a,b). Studies focus on optimizing the teaching of basic movements (Herrmann et al., 2019; Morley et al., 2019; Samsudin et al., 2021). The modes of alternating exercises and rest intervals are considered as a factor that influences the effectiveness of teaching (Burstein et al., 2021; Ivashchenko et al., 2017; Ivashchenko et al., 2015). Therefore, it is relevant to study the impact of different exercise modes on the effectiveness of teaching schoolchildren aged 15 acrobatic exercises.

The purpose of the study was to determine the impact of the number of repetitions on the effectiveness of teaching boys aged 15 a cartwheel.

Material and methods

Study participants. The study participants were 20 boys aged 15. The children and their parents were fully informed about all the features of the study and gave their consent to participate in the experiment.

Organization of the study. To solve the tasks set, the following research methods were used: study and analysis of scientific and methodological literature; pedagogical observation, timing of training tasks; pedagogical experiment, methods of mathematical statistics, discriminant analysis.

The pedagogical experiment was conducted at the lyceum No. 107, Kharkiv, in the 2020-2021 academic years.

The pedagogical experiment examined the influence of 6 and 12 repetitions with a 60-second rest interval during a physical education class on the number of repetitions of training tasks to the 100% level of proficiency. In the first group (n = 10), the boys repeated the tasks 6 sets 1 time each with a rest interval of 60 s, in the second group (n = 10) – 6 sets 2 times each with a rest interval of 60 s.

During teaching, the method of algorithmic instructions was used. The next exercise started on condition of correct performance of the previous exercise on three consecutive attempts. The number of repetitions required for correct performance on three consecutive attempts was recorded. The level of proficiency in the exercises was determined by the alternative method: "performed" or "failed". A technically correct performance of the exercise gave the students "1" point; a failure to perform the exercise gave them "0" entered in the protocol.

Statistical analysis. The study materials were processed using the IBM SPSS 20 statistical analysis program. Discriminant analysis was conducted. For each canonical discriminant function, the study calculated the following: eigenvalue, variance percentage, canonical correlation, Wilks' lambda, Chi-square. For each step: prior probabilities, Fisher's function coefficients, unstandardized function coefficients, Wilks' lambda for each canonical function.

The study protocol was approved by the Ethical Committee of the University. In addition, the children and their parents or legal guardians were fully informed about all the features of the study, and a signed informed consent document was obtained from all the parents.

Results

The analysis of mean values shows that statistically significant differences in the number of repetitions are observed in the first and fourth series of training tasks. The 15-year-old boys who use the first mode need fewer repetitions to master the movements than the 15-year-old boys who use the second mode of training.

To determine the impact of different modes of exercises on the level of proficiency, discriminant analysis was conducted. The results of the Box's M test confirm the assumption about the homogeneity of variances and covariances used in the discriminant analysis.

The first canonical function explains 100% of the results variation, which indicates its high informativity ($r = 0.915$). The materials of the canonical function analysis show its statistical significance ($\lambda = 0.163$; $p = 0.001$). The first function has a high discriminative ability and value in interpretation of the general population.

The standardized canonical discriminant function coefficients make it possible to determine the ratio of the contribution of variables to the function result. The results of the first and fourth series of training tasks make the largest contribution to the first canonical function. The above indicates that the exercises of the first and fourth series of training tasks are the most sensitive to the number of repetitions in boys aged 15.

The structure canonical discriminant function coefficients are the coefficients of correlation between the variables and the function. Thus, the function is most closely connected with the number of repetitions of exercises of the first and fourth series of training tasks.

The coordinates of centroids for two groups make it possible to interpret the canonical function in relation to the role in classification. At the positive pole is a centroid for the exercise mode of 12 repetitions, at the negative — a centroid for the exercise mode of 6 repetitions. This indicates a significant difference in the impact of exercise repetition modes on the number of repetitions required for motor skills development in boys aged 15 during physical education classes. The results of group classification show that 95.0% of the original grouped observations were classified correctly.

Thus, the assumption was made about a significant influence of the modes of alternating exercise repetitions and the rest interval on the effectiveness of motor skills development in boys aged 15. The study found that 6 sets 1 time each with a rest interval of 60 s are more effective than 6 sets 2 times each with a rest interval of 60 s when teaching the ability to assess movement performance by time ($p < 0.001$). And with the first exercise mode, fewer repetitions are needed to master the entire cartwheel. This is due to the fact that differentiation of time characteristics requires immediate information about the movement performance after each repetition. The results presented confirm the data of Iermakov et al. (2021), Ivashchenko et al. (2015), Kapkan et al. (2019b) about the influence of exercise modes on the effectiveness of motor skills development in schoolchildren.

Conclusions

Discriminant analysis made it possible to determine the impact of the number of repetitions on the effectiveness of developing the cartwheel skill in boys aged 15, answer the question as to how significantly the modes of repetition differ by the effectiveness of motor skills development, what class the object belongs to based on the values of discriminant variables.

Based on the analysis of group centroids, it was found that 6 repetitions of the exercise (6 sets 1 time each with a rest interval of 60 s) significantly influence the cartwheel skill development in boys aged 15 during physical education classes. The results of group classification show that 95.0 % of the original grouped observations were classified correctly.

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ДИСКРИМІНАНТНИЙ АНАЛІЗ: ВПЛИВ КІЛЬКОСТІ ПОВТОРЕНЬ НА ЕФЕКТИВНІСТЬ ПРОЦЕСУ НАВЧАННЯ ПЕРЕВОРОТУ УБІК ХЛОПЦІВ 15 РОКІВ

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Мета дослідження – визначити вплив кількості повторень на ефективність процесу навчання перевороту убік хлопців 15 років.

Матеріали і методи. У дослідженні прийняли 20 хлопців 15 років. Діти та їхні батьки були інформовані про всі особливості дослідження і дали згоду на участь в експерименті. Для вирішення поставлених завдань були використані: педагогічний експеримент, дискримінантний аналіз.

Результати. Встановлено що 6 повторень по 1 разу з інтервалом відпочинку 60 с має більшу ефективність ніж 6 повторень по 2 рази з інтервалом відпочинку 60 с у процесі навчання умінню оцінювати виконання рухів за часом ($p < 0,001$). Менша кількість повторень при першому режимі виконання вправ необхідна і для оволодіння перевороту убік в цілому.

Висновки. На основі аналізу центроїдів груп визначено, що 6 повторень вправи (6 підходів по 1 разу з інтервалом відпочинку 60 с) має суттєвий вплив на процес формування навички виконання перевороту у бік хлопців 15 років на уроках фізичної культури. Результати класифікації груп показують, що 95,0 % вихідних згрупованих спостережень класифіковано вірно.

Ключові слова: дискримінантний аналіз, хлопці, акробатичні вправи, режим виконання вправ, навчання.

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