Assessment of students' coordination abilities for mastering complex spatiotemporal skills

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Abstract

Objective of the study is to assess the coordination abilities of students of managerial specialties for mastering complex spatiotemporal skills using standardized testing tools.

Methods and structure of the study. The study participants (83 first- and second-year students of managerial specialties) performed standardized tests of spatial coordination. The standard deviation, the reliability level of the tests, and the factor loadings were calculated.

Results and conclusions. The factor structure of students' coordination abilities was revealed; it includes the ability to orient in space and lateral agility, which explain 75.4% of the coordination abilities of students of managerial specialties.

Keywords: *students, coordination abilities, spatial orientation, lateral agility.*

Introduction. Human coordination abilities are closely related to other physical qualities that determine the success of learning technical actions and the realization of motor skills under variable conditions of physical culture and sports activity. Coordination abilities, most successfully developed at a young age, determine the comprehensive physical development of the personality [4].

It is expected that specialists in the selection and training of personnel will be able to form certain coordination-motor skills of employees, relying on their own motor experience [2]. Therefore, studying the ability of students of managerial specialties to master complex coordination structures contributes to the selection of content and the expansion of opportunities for improving the physical condition of the trainees themselves and the subjects of their future professional activity [1].

Considering that diagnostic procedures in the field of movement coordination are quite complex, conducting research with the aim of diagnosing students' coordination abilities will serve as a basis for introducing the technology of mass personalization of physical education at a higher educational institution [3].

Diagnostic procedures for studying students' coordination abilities should be feasible without complex and expensive equipment in the conditions of practical physical education classes [5].

Objective of the study is to assess the coordination abilities of students of managerial specialties for mastering complex spatiotemporal skills using standardized testing tools.

Methods and structure of the study. The sample of study participants consisted of 83 first- and second-year students of managerial specialties aged 19.5±0.8 years.

The study was conducted by performing a set of standardized tests of spatial coordination, manifested in the ability to change modes and direction of movement (running with changes in body positions and directions of movement); to change the speed of movement in a non-standard way (passing the perimeter of a polygon backwards); and to quickly change lateral movements (performing side steps). The subjects

participated most actively in the exercise of moving with side steps and passing the perimeter of the polygon.

The analysis of the test results was carried out in order to determine their informativeness in assessing the coordination abilities of first-year students.

The test results were processed in the Statistica 12.0 package. The main statistical parameters and the coefficient of internal consistency (reliability) of the tests – Cronbach's (α) – were calculated.

The factor structure of the tests was determined. The factor loadings were normalized according to the Varimax criterion.

Results of the study and discussion. Testing of the normality of distribution showed a significant deviation from the normal distribution only in the third exercise – passing the perimeter of the polygon backwards. A significant improvement in the average results during the third attempt caused a substantial deviation of a number of data from the normal distribution with a shift of the kurtosis values to the right (Table 1).

As the number of attempts to perform the exercises increased, the results improved. Although the exercises performed were quite well mastered by the students, the improvement in results probably occurred not as a result of the immediate improvement of the coordination structure, but as a result of pedagogical stimulation on the part of the teacher. The influence of the participants' determination to achieve high personal results should also be taken into account.

The high reliability of the tests is confirmed by the value of Cronbach's alpha coefficient (α) as an indicator of internal reliability. The reliability coefficients are quite high (>0.80), which is considered a satisfactory confidence interval.

The values of the average correlation between the results of performing the exercises are also satisfactory, with a high correlation of the results of the attempts in running with changes in body positions and directions of movement (0.91), passing the perimeter of the polygon backwards (0.86), and the test of performing side steps (0.78).

The factor analysis revealed two key factors that explain approximately 75.4% of the variance of the correlation matrix of the data. The principal component method made it possible to identify commonalities of objects, indicating the existence of at least two factors forming the structure of students' coordination abilities.

The factor structure revealed on the basis of the principal component criterion clearly demonstrates that the integration of the results of performing all three tests into one principal component (a single factor) did not occur. As a result of the factor analysis, two factors were identified.

The first factor included the exercises in running with changes in body positions and directions of movement. This factor presupposes mastering the ability to move and control body movements in space, therefore it can be identified as the factor of the ability to orient in space.

The exercise of performing lateral movements describes the second factor of coordination, which presupposes a rapid lateral change in the direction of movement, which classifies it as the factor of lateral agility. During lateral displacements, the abilities to maintain body balance in unstable positions and to create force at various angles are in demand.

Considering the specificity of the diagnostic tests, the representativeness of the revealed factors is determined by the latent structure of coordination abilities.

Table 1. Results of performing the exercises, standard deviation, the reliability level of the tests, factor loadings

Exercise	N	x ± sd	α	F-1	F-2
Running with changes in body positions and directions of movement, s	1	21.37±2.56	0.91	0.73	0.16
	2	20.88±1.45			
	3	20.43±2.26			
Passing the perimeter of the polygon backwards, s	1	15.45±3.14	0.86	0.71	0.23
	2	13.41±2.36			
	3	13.06±2.70			
Performing side steps, s	1	11.83±1.39	0.78	0.25	0.94
	2	11.41±1.27			
	3	11.13±1.35			

Note: N – attempt number; α – Cronbach's alpha coefficient; F-1 – first factor; F-2 – second factor.

Since the exercises used in the study showed high reliability and validity, they can be considered standardized tests for assessing the coordination abilities of students of managerial specialties.

Conclusions. The coordination ability tests used are characterized by sufficient validity and are suitable for practical use in the process of physical education of students of managerial specialties. The factor model of spatial coordination includes the ability to orient in space and lateral agility, which explain 75.4% of the coordination abilities of students of managerial specialties. The structuring of two factors determines the directions for improving the coordination abilities of students of managerial specialties – the ability to move and control body movements in space and lateral agility.

References

1. Kiryanova L.A., Ponimasov O.E., Kolesnikov N.V., Vinogradova O.P. Polifunktsionalnaya fitness-tekhnologiya fizicheskogo vospitaniya studentov upravlencheskikh spetsialnostey. Teoriya i praktika fizicheskoy kultury. 2023. No. 7. Pp. 74-76.
2. Mironov A.O., Ponimasov O.E., Spiridonov E.A., Khutin S.A. Formirovanie menedzhment kompetentsiy studentov upravlencheskikh spetsialnostey sredstvami fizicheskogo vospitaniya. Teoriya i praktika fizicheskoy kultury. 2024. No. 12. Pp. 111-113.
3. Ponimasov O.E., Belyakova M.Yu., Sayganova E.G., Mironov A.O. Povedencheskie proektsii opyta zanyatiy sportom na dvigatelnuyu aktivnost studentov v period obucheniya v vuze. Teoriya i praktika fizicheskoy kultury. 2025. No. 7. Pp. 77-79.
4. Spiridonov E.A., Mironov A.O., Ponimasov O.E., Sayganova E.G. Sportivnaya deyatelnost kak sredstvo formirovaniya antistressovoy ustoychivosti studentov v obrazovatelnoy srede. Teoriya i praktika fizicheskoy kultury. 2024. No. 7. Pp. 70-72.
5. Frunze V.V., Kolesnikov N.V., Ponimasov O.E. Effektivnoe ispolzovanie upravlencheskikh resursov v realizatsii proekta «Sport – norma zhizni». Teoriya i praktika fizicheskoy kultury. 2024. No. 6. Pp. 37-39.