ORIGINAL ARTICLE

PHYSICAL DEVELOPMENT OF STUDENTS AS AN INDICATOR OF THE PHYSICAL EDUCATION SYSTEM FUNCTIONING IN THE EDUCATIONAL INSTITUTION

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ABSTRACT

The aim: To investigate the impact of organizational and methodological conditions of physical education system in higher educational institution on the students' physical development.

Materials and methods: The research involved 120 students of two higher educational institutions (30 men and 30 women each). Determination of physical development of students was carried out in the dynamics of learning from the first to the fourth instructional years in terms of 100 m run, 3000 m (boys) and 2000 m (girls) run, pull-ups on the crossbar (boys), push-ups (girls), 4 x 9 m shuttle run, standing long jump, lifting torso to the sitting position, torso leaning forward from the sitting position.

Results: The research determined organizational and methodological conditions of physical education system in two educational institutions, which differ in the duration of "Physical Education" academic subject depending on the instructional year, the number of academic hours provided for the subject mastery, approaches to the basic and elective components of the curriculum, organization of fitness and health recreation as well as sports events during extracurricular activities.

Conclusions: It was established that the level of students' physical development is better in the educational institutions where the physical education system functions more efficiently (compulsory physical education training sessions are held in the amount of 4 hours a week, more students are involved in educational and extracurricular physical education training sessions, where students' training motivation is higher).

KEY WORDS: physical education, organizational and methodological conditions, physical development, students

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INTRODUCTION

Student youth is a special social group, whose life-sustaining activities are characterized by high mental and emotional loads caused by intellectual work, which takes place in conditions of lack of time, nervous tension and stress [1, 2]. The analysis of the scientific literature shows that during the years of study at a higher educational institution (HEI) student youth tend not to increase health, but largely lose the reserve capacity of their body, which negatively affects active dispositive capacity and sharply reduces creative potential [3, 4]. To solve this problem, higher educational institutions need to make full use of the possibilities of physical education. Meanwhile, in the conditions of reforming higher education and granting autonomy to HEIs, the entire responsibility for the organization of physical education in HEIs rests with its administration. Unfortunately, according to the leading experts in the field of physical culture [5, 6], there is currently an underestimation of the importance of physical education for the preservation and strengthening of the health of student youth by representatives of HEI administrations. This leads to a decrease in the corresponding academic load, lack of quality control of students' physical condition. Currently, there is a reduction in the number of academic hours for the study of "Physical Education" academic subject in many HEIs of Ukraine [7, 8]. This situation has led to a decrease in motor activity and, as a consequence, deterioration of the indicators of physical development of students.

THE AIM

The aim is to investigate the impact of organizational and methodological conditions of physical education system in higher educational institution on the students' physical development.

MATERIALS AND METHODS

The research was conducted in 2017-2021 on the basis of the two higher educational institutions in Dnipro (Ukraine):

Oles Honchar Dnipro National University (DNU), Prydniprovska State Academy of Civil Engineering and Architecture (PSACEA). The research involved 120 students (30 men and 30 women each) of the main educational department.

The following tasks were identified to achieve the aim of the research: 1) to analyse the effectiveness of the physical education system in each HEI; 2) to study the attitude of students to the existing system of physical education in HEI; 3) to investigate the dynamics of indicators of physical development of students of each HEI.

To implement the first task, we analysed the content of the working educational documentation of the departments of physical education of the two HEIs. The attitude of students to the organization of physical education in HEI, their motivation for physical education training sessions were assessed by the authors' questionnaire. The questionnaire included 15 questions and was developed in compliance with all necessary requirements for sociological research and was approved by the Academic Council of the Dnieper State Academy of Physical Culture and Sports before its application. Determination of physical development of students was carried out in the dynamics of learning from the first to the fourth instructional years in terms of 100 m run, 3000 m (boys) and 2000 m (girls) run, pull-ups on the crossbar (boys), push-ups (girls), 4 x 9 m shuttle run, standing long jump, lifting torso to the sitting position for 1 minute, torso leaning forward from the sitting position.

Scientific methods: theoretical analysis and generalization of scientific and methodical literature, documentary method, questionnaires, testing, methods of mathematical statistics. Study results were processed using the "Data Analysis" package of Microsoft Excel spreadsheets. Descriptive statistics (mean and standard deviation) were determined. The reliability of the differences in average values was estimated by the Student's t-test; the difference was considered to be reliable at $p<0.05$

This research has been complied with all the relevant national regulations and institutional policies, and has followed the tenets of the World Medical Association Declaration of Helsinki – ethical principles for medical research involving human subjects. All participants agreed to participate in the research.

RESULTS

The analysis of the working educational documentation of the departments of physical education of DNU and PSACEA shows that the organizational and methodological conditions for building a system of physical education of students in these HEIs have significant differences regarding the duration of "Physical Education" academic subject depending on the instructional year, the number of academic hours provided for the subject mastery, approaches to the basic and elective components of the curriculum, sports as well as fitness and health recreation systems presented in the curriculum, organization of fitness and health recreation as well as sports events with students during extracurricular activities (Table I).

The most important fundamental peculiarity of the system of physical education in DNU is that the study of "Physical Education" academic subject is carried out during the entire years of attendance, except for the final semesters, for 4 hours a week. In PSACEA compulsory training sessions are held during four semesters in the first and second instructional years for 4 hours a week.

We conducted a survey of graduate students of both HEIs (the fourth instructional year) to study the opinions of students on the effectiveness of the existing system of physical education in HEIs, to determine their attitude and motivation to physical education training sessions within academic and extracurricular hours. It was found that the vast majority of students (53.3 % of DNU students and 40 % of PSACEA students) indicated the lack of

Table I. Comparative analysis of the effectiveness of the physical education system in different HEIs

Researched indicators	HEI	
	DNU	PSACEA
Duration of "Physical Education" academic subject by semesters	7 semesters according to the level of education "Bachelor"	4 semesters according to the level of education "Bachelor"
Number of hours of training sessions a week	4 hours	4 hours
Sports as well as fitness and health recreation systems in the basic component of the curriculum	Track-and-field athletics, gymnastics, game-oriented sports (basketball, volleyball, football, badminton), swimming	Track-and-field athletics, gymnastics, game-oriented sports, swimming
Conditions for the implementation of the elective component of the curriculum	During extracurricular activities	During training sessions
Peculiarities of the implementation of theoretical and methodological training	During each training session	2 hours of training sessions and 4 hours of independent training in each module
Type of final academic assessment	Pass / fail exam	Pass / fail exam
Conditions for physical education training sessions during extracurricular activities	27 sections, free training sessions for students, 2 times a week	12 subscription sections, preferential terms of payment for training sessions, 2 times a week

Table II. Dynamics of indicators of physical development of male students during their study in the HEI (n = 60)

Instructional year	DNU (n=30)			PSACEA (n=30)			Significance of the difference	
	X	σ	m	X	σ	m	t	p
100 m run, s								
1st	14.4	1.41	0.13	14.6	1.27	0.15	1.01	>0.05
2nd	14.2	1.35	0.14	14.4	1.32	0.17	0.91	>0.05
3rd	14,0	1.29	0,12	14,5	1.29	0,14	2.71	<0.05
4th	14,0*	1.17	0,15	14,7	1.31	0,16	3.19	<0.01
3000 m run, min, s								
1st	14.14	0.59	0.21	14.15	1.03	0.27	0.03	>0.05
2nd	14.01	1.08	0.24	14.06	1.07	0.29	0.13	>0.05
3rd	13.46	1.05	0.31	14.11	1.12	0.21	1.74	>0.05
4th	13.38*	0.57	0.28	14.15	1.09	0.23	2.12	<0.05
4 x 9 m shuttle run, s								
1st	9.35	0.51	0.11	9.65	0.42	0.12	1.84	>0.05
2nd	9.20	0.48	0.09	9.56	0.58	0.14	2.14	<0.05
3rd	9.26	0.52	0.15	9.67	0.54	0.11	2.20	<0.05
4th	9.18	0.56	0.13	9.69	0.56	0.13	2.77	<0.05
Standing long jump, cm								
1st	218.5	19.84	2.17	220.5	19.21	2.15	0.66	>0.05
2nd	223.7	18.93	2.09	224.9	18.76	2.19	0.39	>0.05
3rd	228.2	19.16	1.98	223.5	18.39	2.08	1.62	>0.05
4th	231.3***	18.91	1.79	219.8	19.91	1.96	4.30	<0.001
Pull-ups on the crossbar, number of times								
1st	11.8	3.41	0.96	11.5	2.81	0.89	0.23	>0.05
2nd	12.5	3.48	1.07	12.7	4.43	0.83	0.15	>0.05
3rd	12.8	4.01	1.13	12.5	3.91	0.75	0.22	>0.05
4th	13.6	3.85	1.32	11.9	4.14	0.67	1.15	>0.05
Lifting torso to the sitting position for 1 minute, number of times								
1st	43.2	5.78	1.47	43.7	6.72	1.89	0.21	>0.05
2nd	45.6	6.37	1.48	46.0	6.29	2.01	0.16	>0.05
3rd	47.8	7.09	1.82	45.3	5.83	1.73	1.00	>0.05
4th	49.7**	6.96	1.67	44.2	6.08	1.86	2.20	<0.05
Torso leaning forward from the sitting position, cm								
1st	13.3	5.21	0.91	12.4	4.84	0.98	0.67	>0.05
2nd	14.2	5.67	1.30	12.6	4.91	1.32	0.86	>0.05
3rd	15.5	6.03	1.22	12.3	5.07	1.43	1.70	>0.05
4th	16.2*	5.85	1.09	11.9	4.95	1.51	2.31	<0.05

Notes: X – arithmetic mean, σ – mean-square deviation, m – error of the mean-square deviation, t – value of the Student's test, p – significance of the difference between the indicators of students of different HEIs, * – significance of the difference betweenthe indicators of the 1st and the 4th instructional years at $p < 0.05$, ** – at $p < 0.01$, *** – at $p < 0.001$

opportunities to engage in the chosen sport as the factor that causes dissatisfaction with the content of physical education training sessions. 43.3 % of DNU students and 56.6 % of PSACEA students are satisfied with the quality of organization of fitness and health recreation as well as sports events during extracurricular activities. According to the results of the survey, 43.3 % of DNU students and 33.3 % of PSACEA students regularly engage in physical

Table III. Dynamics of indicators of physical development of female students during their study in the HEI (n = 60)

Instructional year	DNU (n=30)			PSACEA (n=30)			Significance of the difference	
	X	σ	m	X	σ	m	t	p
100 m run, s								
1st	17.3	1.17	0.25	17.4	1.16	0.19	0.32	>0.05
2nd	17.1	1.21	0.31	17.1	1.13	0.21	0.01	>0.05
3rd	16.9	1.19	0.24	17.1	1.18	0.23	0.60	>0.05
4th	16.8	1.22	0.22	17.2	1.14	0.18	1.41	>0.05
2000 m run, min, s								
1st	11.55	0.59	0.35	11.57	1.01	0.26	0.05	>0.05
2nd	11.46	0.57	0.29	11.49	0.58	0.24	0.08	>0.05
3rd	11.32	0.54	0.27	11.55	1.04	0.27	0.60	>0.05
4th	11.24	0.56	0.28	11.59	1.02	0.31	0.84	>0.05
4 x 9 m shuttle run, s								
1st	11.1	0.53	0.13	11.0	0.48	0.11	0.59	>0.05
2nd	11.1	0.48	0.12	10.8	0.53	0.14	1.63	>0.05
3rd	11.0	0.46	0.16	11.1	0.58	0.15	0.41	>0.05
4th	10.8	0.51	0.14	11.2	0.61	0.13	2.09	<0.05
Standing long jump, cm								
1st	165.5	13.89	1.87	165.8	13.48	1.79	0.12	>0.05
2nd	169.8	14.01	1.93	170.7	13.76	1.86	0.34	>0.05
3rd	171.9	14.17	1.91	168.3	13.84	1.91	1.33	>0.05
4th	172.2*	14.28	1.89	166.1	13.65	1.94	2.25	<0.05
Push-ups, number of times								
1st	14.8	3.41	0.69	14.6	2.82	0.56	0.23	>0.05
2nd	15.6	5.54	1.01	15.3	4.39	0.81	0.24	>0.05
3rd	17.6	4.49	1.02	15.1	4.56	0.90	1.84	>0.05
4th	18.1*	5.38	1.10	14.2	4.18	0.89	2.76	<0.05
Lifting torso to the sitting position for 1 minute, number of times								
1st	35.7	6.59	1.76	37.8	6.97	1.69	0.86	>0.05
2nd	39.1	6.73	1.82	40.9	7.02	1.76	0.71	>0.05
3rd	44.7	6.91	1.78	40.3	6.89	1.74	1.77	>0.05
4th	48.8***	7.11	1.91	38.8	7.12	1.77	3.84	<0.01
Torso leaning forward from the sitting position, cm								
1st	14.3	5.13	0.93	14.2	4.67	0.81	0.08	>0.05
2nd	15.8	5.19	0.96	14.9	6.02	1.12	0.61	>0.05
3rd	17.3	6.11	0.91	14.9	5.97	1.08	1.70	>0.05
4th	18.9**	5.76	0.89	14.6	5.89	1.11	3.02	<0.01

Notes: X – arithmetic mean, σ – mean-square deviation, m – error of the mean-square deviation, t – value of the Student's test, p – significance of the difference between the indicators of students of different HEIs, * – significance of the difference betweenthe indicators of the 1st and the 4th instructional years at $p < 0.05$, ** – at $p < 0.01$, *** – at $p < 0.001$

exercises and sports during extracurricular activities. At the same time, the majority of students of DNU and PSACEA prefer independent physical exercises (50 % and 43.3 %, respectively), and only a small part of students prefer to engage in physical exercises during training sessions and on the basis of their HEI during extracurricular activities. These results indicate the need on the one hand to improve the system of fitness and health recreation as well as sporting and mass participation events during extracurricular activities, and on the other – to pay more attention to the issues of rational planning of independent physical exercises during extracurricular activities. The most important

reasons that motivate students of both HEIs to exercise include strengthening health, improving appearance and knowledge of the benefits of training sessions. However, the number of DNU students who indicated that they were motivated to exercise by knowledge about their benefits significantly exceeds the number of PSACEA students (63.3 % compared to 43.3 %). This fact indicates that DNU gives more attention to the formation of knowledge about the benefits of exercise. The need to take a pass / fail exam in physical education also stimulates students of DNU to a greater extent than students of PSACEA (66.6 % and 38.3 %), which indicates higher requirements for students.

The results of the comparative analysis of indicators of physical development of students of both HEIs for the period of their study are given in Table II (men) and Table III (women).

The analysis of indicators shows that there were no statistically significant differences in physical development indicators for all tests ($p > 0.05$) during the first instructional year of male students of DNU and PSACEA. At the beginning of the research, the development of strength, agility and flexibility of students in both HEIs corresponded to the average level, and endurance and speed – low. During the period of study, there were some changes in the indicators of physical development of students of both HEIs, but the nature of these changes differs significantly depending on the organizational and methodological conditions of building a system of physical education in each of the HEIs. Thus, DNU students showed a significant ($p < 0.05$-0.001) improvement in most of the studied indicators in the learning process, and PSACEA students found no statistically significant changes in test results during their study period ($p > 0.05$), and even from the third instructional year there is a tendency to deterioration of the results of all tests that were determined during the study. The analysis of the results of the 100 m run showed that the students of DNU showed a significant improvement in the results of the 100 m run by 0.4 s ($p < 0.05$) during the period of their study. At the same time, the level of speed qualities of DNU students was significantly better than in the students of PSACEA by 0.5 ($p < 0.05$) and 0.7 ($p < 0.01$) seconds during the third and the fourth instructional years. The results of the 3000 m run for DNU students significantly improved from the first to the fourth instructional year by 36 seconds ($p < 0.05$). There was also a significantly better level of endurance during the fourth instructional year in DNU students compared to PSACEA students by 37 seconds ($p < 0.05$). The level of agility, which was assessed by "4 x 9 m shuttle run" test, was also significantly better in DNU students at the end of the research than in PSACEA students by 0.51 seconds ($p < 0.05$). The difference between the indicators of the development of speed and strength qualities of the students of the two HEIs, which were tested by standing long jumps, results in 11.5 cm in favour of DNU students and is significant ($p < 0.001$). No significant difference was found ($p > 0.05$) in the pull-ups on the crossbar during any of the instructional years. The results of lifting torso to the sitting position for 1 minute during the fourth instructional year showed that the level of development of the strength of the abdominal muscles was significantly better in DNU students than in the students of PSACEA, by times ($p < 0.05$). According to the indicators of flexibility tested by "Torso leaning forward from the sitting position" exercise, the students of DNU showed significantly better indicators than the students of PSACEA during the fourth instructional year, by 4.3 cm ($p < 0.05$).

Similar trends were observed in the indicators of physical fitness of female students (Table III). As in men, the groups of female students of different HEIs did not have statistically significant differences in the indicators of physical development ($p > 0.05$) during the first instructional year. According to the obtained data, there were no statistically significant changes in the indicators of development of speed, endurance and agility in the girls of both HEIs from the first to the fourth instructional years ($p > 0.05$). An increase in performance was determined in DNU female students according to such tests as "Standing long jump", "Push-ups", "Lifting torso to the sitting position for 1 minute" and "Torso leaning forward from the sitting position", which turned out to be significantly better during the fourth instructional year than the first one ($p < 0.05$-0.001). PSACEA students did not show statistically significant differences in the studied indicators ($p > 0.05$) during the entire study period, with some tendency to deteriorate in all tests used in our research.

The comparative analysis of the indicators of physical development of students of the studied HEIs shows that the results in the 100 m and 2000 m run during the fourth year of DNU students were better compared to the results of PSACEA students by 0.4 seconds and 25 seconds, respectively, but no significant difference was found ($p > 0.05$). The indicators of development of agility ("4 x 9 m shuttle run") and speed and strength qualities ("Standing long jump") of the students of DNU during the fourth instructional year turned out to be significantly better than in the students of PSACEA, by 0.4 seconds and 6.1 centimetres, respectively. $p < 0.05$). DNU students of the fourth instructional year also showed significantly better results than PSACEAstudents according to the strength exercises ("Push-ups" and "Lifting torso to the sitting position for 1 minute"), by 3.9 times ($p < 0.05$) and 10 times ($p < 0.01$), respectively. DNU students also showed better results compared to the students of PSACEAat the end of their study in terms of the indicators of flexibility ("Torso leaning forward from the sitting position"): the difference is 4.3 cm and is significant ($p < 0.01$).

DISCUSSION

The main task of the system of physical education in the HEI is the formation of students' motivational and value attitude to physical culture, the need for regular exercise and sports. Health is the priority of physical education training sessions with students [9, 10]. However, many studies have shown a significant deterioration in the health, physical development

and physical fitness of Ukrainian students [11, 12]. In addition, many scientists [13, 14] point to a direct relationship between an increase in the number of students with a low level of physical fitness (physical development) and a deterioration in their physical health, especially in endurance tests. Thus, according to scientists, 100 % of students who have a low level of physical development, such motor skills as general endurance, speed, agility, strength endurance and flexibility are outside the safe level of physical health, which indicates a direct relationship between the state of health and the level of physical development and fitness of students [15].

During the period of students' study the HEI should be one of the systems of purposeful influence on solving the problem of reducing diseases and ensuring a high level of health and physical development of student youth. Therefore, it is necessary to create and maintain such an environment, such organizational and methodological conditions in the HEI that will promote the formation of goals, values, principles of healthy lifestyles and control over the factors that determine or affect the student's health as well as his / her physical development and fitness.

Our analysis of the dynamics of the indicators of physical development of students of the two HEIs, which organizational and methodological conditions for building a system of physical education have some differences, showed that the students of DNU (both men and women), where physical education training sessions are held throughout the entire period of study, revealed better indicators of physical development at the end of their study (during the fourth instructional year) than the students of PSACEA, according to all tests. At the same time, the dynamics of all studied indicators of DNU students is positive during their study in the HEI (from the first to the fourth instructional year), and the indicators of PSACEA students improve up to the second instructional year, and deteriorate from the third to the fourth instructional year occasionally even to the ones of first instructional year. All this testifies to the significant influence of organizational and methodological conditions of the functioning of the system of physical education in the HEI on the indicators of physical development of students in the learning process. Our research confirms the scientific achievements of many scientists [16-18] and expands them.

CONCLUSIONS

1. The efficiency of the functioning of the system of physical education in each of the two HEIs was analysed and it was found out that the organizational and methodological conditions of each of them differ in the duration of "Physical Education" academic subject depending on the instructional year, the number of academic hours provided for the subject mastery; approaches to the basic and elective components of the curriculum; sports as well as fitness and health recreation systems presented in the curriculum; organization of fitness and health recreation as well as sports events during extracurricular activities.
2. The attitude of students to the existing system of physical education in the HEI was studied and the level of their motivation to engage in physical exercises and sports within academic and extracurricular hours was determined. It was found that among the factors that motivate students to exercise, the most important for students of both HEIs are: strengthening health, improving appearance and knowledge of the benefits of training sessions. The opportunity to engage in the chosen sport was among the factors that cause dissatisfaction with the content of physical education training sessions. 43.3 % of DNU students and 33.3 % of PSACEA students regularly engage in physical exercises and sports during extracurricular activities. The need to take a pass / fail exam in physical education also stimulates students of DNU to a greater extent than the students of PSACEA (66.6 % and 38.3 %), which indicates higher requirements for students.
3. The dynamics of the indicators of physical development of students of the two HEIs was studied and it was established that the level of physical development of students (both men and women) is better in the HEI where "Physical Education" academic subject is studied during the entire instructional period (DNU), unlike PSACEA where training sessions are held only during the first and the second instructional years. According to the majority of the studied indicators, the indicators of DNU students were significantly ($p < 0.05$-0.001) better than those of PSACEA students at the end of the research.

Prospects for further research are to study the health indicators of HEIs students with different organizational conditions for the functioning of the physical education system.

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