

# Applied physical education students based on the assessment of stabilometric indicators

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**Abstract.** *Practice shows that in educational institutions of higher education, students with temporary or permanent disabilities require a significant reduction in physical activity, taking into account their working capacity and functional abilities. Many of them are not fully prepared for standard physical training. Education of such students has its own characteristics, which result in the need to improve the educational process in terms of physical training. An intra-individual analysis was carried out: the stabilometric indicators of the same students with disabilities were compared before and after special preparation. 39 people from the South Ural State University (experimental group) and 31 persons from the P.I. Tchaikovsky South Ural State University participated in the study. All participants are 17-22 years old. This circumstance is associated with the determination of ranges of normal values and a comparative analysis of the results.*

**Keywords -** *students, methodology, professional adaptation, limited abilities, pedagogical process, applied physical education, stabilometry.*

## I. INTRODUCTION

The profession imposes specific requirements on a person, including those connected with physical and mental qualities and applied skills. Therefore, there is a need for special physical education aimed at preparing young people for work that combines general physical training with professionally-applied physical training (PAPT). Studying comprises active adaptation to new social conditions, while ensuring the necessary level of physical and functional preparedness and developing professionally important qualities. This process of professional adaptation acts as a connecting link in maintaining the optimal ratio between changing external conditions and the relative stability of the functions performed. This provides a single, integrated process of establishing the relationships between personality and profession [1].

Professionally-applied physical training implies the optimal use of means, methods and forms of physical education for each of the components of professional adaptation. In the educational process, the concept of adaptation is constantly reassessed, leading to the formation of a more holistic view of physical education as a whole [2]. Taking these scientific points into account is of fundamental importance for the theory and practice of PAPT, in terms of focusing on both education and the leading abilities essential for a future career.

The study showed that the health status of students is characterized by the following features: a decrease in the percentage of healthy people (35-48%), an increase in somatic diseases (22-41%), a decrease in physical development indicators (59-63%), and an increase in the rate of aging (43-64 %). The frequency of chronic diseases in the student's environment varies widely: from 15.4% for respiratory diseases to 19.2% for cardiovascular disorders and 34.6% for the diseases of the musculoskeletal system. In girls, the incidence rate is on average 1.2 times higher. About 30.8% of students have two or more negative deviations [3]. It is worth noting that there is an indefinite number of students who have serious health restrictions, but they do not inform the educational institution about their health limitations.

In this regard, it became necessary to justify and develop methods of professionally applied physical training for students with disabilities, since traditional professional training does not always solve this problem effectively.

## II. MATERIALS AND METHODS

Scientists prove that professionally-applied physical training contributes to the development of professional skills and abilities (V. Kabachkov, S. Polievsky and others), but we

have not found any works on professionally-applied physical training in students with disabilities.

Applied physical education (APE) is the pedagogical process of professionally applied physical training, during which students with disabilities improve their adaptive abilities, acquire professionally important qualities, and, as a result, improve their professional adaptation. Therefore, APE is a crucial element of education in general.

The study involved students of the South Ural State University (n = 39) and students the P.I. Tchaikovsky South Ural State University (n = 31) aged 17-22 years. All students are engaged in physical education in the main medical group, but according to the medical certificate they belong to a preparatory medical group. Regardless of the specifics of the future profession, all students have deviations from reference values in terms of anthropometric, morphological and functional indicators, as well as physical development and physical fitness.

Practice shows that scientific and methodological support provided by means of applied physical training in students with health restrictions does not always give the desired effect: on the one hand, students are limited in their applied educational activities within the range of their health-related abilities. On the other hand, teachers do not sufficiently possess knowledge necessary for understanding the essence of pathological processes occurring in the body in various diseases, as a result they show unreasonable passivity and inertness in this important work, which significantly affects functional preparedness and, ultimately, students' adaptation to the changing life conditions.

In contrast to the traditional practice of professionally-applied physical education, within the framework of the author's approach, applied physical education is a pedagogical process aimed at students with health-related problems affecting their professionally important qualities. APE contributes to successful mastery of the profession, opens up innovative way of applying the conceptual model, pedagogical conditions, technologies for their implementation in the process of forming students' professional adaptation.

In our work, we give the author's definition of the concept "applied physical education (APE)" - this is a pedagogical process that is sufficient in volume and adequate in terms of physical training, regardless of the factors and conditions of the chosen professional activity. APE is capable of forming professionally important qualities in students with health-related problems and contributes to successful functional readiness, reflecting an increase in the adaptive abilities of the body.

Traditionally, the greatest development of a physical quality occurs under the simultaneous effective development of other qualities, in a way similar to the quick mastery of new motor skills that largely depends on whether the students have a sufficient supply of skills previously developed through a variety of physical exercises.

For students with disabilities, applied physical education as a subsystem of vocational education includes the following stages, which reduce the period of adaptation to physical activity and increase physical fitness: the first stage – conceptual, which consists of general physical training and general education in the form of lectures, conversations,

problematic presentation of material, etc., the second stage - cognitive that implies actualization in the professionally-applied physical training of students taking into account their individual characteristics and knowledge that can be used in professional activities under the guidance of a teacher, the third stage - productive that comprises independent performance of activities in the selected form of physical exercises, which can be adjusted, refined, modified and even completely changed. The third stage is based on students' willingness and ability to solve practical situations with respect to their own values and desires.

Adjusting the stages of APE to university semesters is determined by the distribution of the educational material and educational activities, which in many respects assume the position of a student but do not predetermine it. This means that these external conditions do not set the student's position rigidly and are not the same for everyone. At the same time, they are true for most students, regardless of the factors of applied physical education. At each stage specific transformations take place in the students' physical qualities, at each stage physical education has a diversely oriented effect on the personality, which achieves the most complete results.

At each stage of the 1st, 3rd, and 5th semesters, the content included types of athletics of a cyclic and acyclic nature, since athletics is fundamental to human life, contributes to the versatile development of physical abilities and professionally important qualities. Appliedness is manifested, first of all, in improving the adaptive mechanisms of the body to physical activity of varying intensity and external environmental conditions.

The inclusion in the 2nd, 4th, and 6th semesters of physical exercises from various professionally applied sports, outdoor and sports games was determined by the diagnosis and health status. The main task is to improve physical performance while practicing a significant amount of physical activity.

Classes were held according to the phases of APE, regardless of the chosen field of study, which allows students with disabilities to shorten the period of adaptation to physical activity and, thus, increase physical fitness. The educational process included two lessons per week, which consisted of general physical preparation, professionally-applied physical training, and specialization in the chosen form of physical exercises (Table 1).

TABLE I. PLANNING AND PERIODIZATION OF APE IN STUDENTS WITH HEALTH LIMITATIONS

Semester	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year
	Stages and tasks of the educational process		
1, 3, 5	Adaptation to physical load	Recovery of physical performance	Development of special qualities
2, 4, 6	Development of applied skills	Mastering of applied skills	Enhancement of applied skills

Since professional adaptation is inextricably linked with physical education, it is impossible to find a criterion that could integrally measure this system. Physical exercise, as a means of APE, is formed according to the laws and methodology of physical education, while the labor motor

action is governed by the principles of the economics, production technology, and even legal laws.

Numerous studies have established that the introduction of PAPT in the practice of physical education of students and specialists of enterprises creates the prerequisites for reducing the time for professional adaptation, improving professional skills, achieving high working capacity and labor productivity. The work of persons systematically engaged in PAPT is more qualified, productive, and economical. These specialists are more resistant to diseases, less tired during work. Improving professionally important functions of the human body is only possible on the basis of general health promotion and the development of all body systems.

Therefore, it is advisable to use the method of stabilometry as a criterion, since body parameters are directly dependent on the health status of various organs and systems [5]. This method allows tracking the quality of the balance function, that reflects the dynamics of a person's mastering of new motor skills.

During the experiment, the following indicators of stabilometry were considered.

1. The velocity of the center of pressure (VCP) (V) is a value determined by the ratio of the length of the center of pressure path (the point located on the vertical projection of the support) to the time of study. The lower this indicator, the higher the balance function.

2. The area of the statokinesiogram (mm<sup>2</sup>) is an indicator describing the surface occupied by the statokinesiogram. A statokinesiogram can have a very complex path, but modern computer technology can easily cope with the calculation of the area of such surfaces. An increase in area indicates a deterioration in balance.

3. The indicator of the ratio of the length of the statokinesiogram to its area (LFS) shows how the length fits into the area, which reflects energy consumption for maintaining the posture and more accurately describes the APE process.

4. The quality of the balance function (BFQ,%) is the most reliable indicator characterizing the individual genetic property of a person to maintain balance. For some people it is low, for others it is high, which indicates the professional suitability of people for the profession. This indicator evaluates how minimal the VCP is under the student's timely compensation for deviations of the body from the vertical. As a result, the higher the BFQ value, the better the person maintains balance.

It should be noted that the information obtained allows comparing the quantitative characteristics of the motor responses formed in APE targeted training, and therefore, to obtain objective, practically significant data that reflect the physical abilities of students with health limitations. All of these indicators determine the stability of physiological systems and the whole organism during the period of time that is necessary for the effective performance of professional activities.

### III. RESULTS AND DISCUSSION

It was shown that under the influence of systematic physical activity, the level of adaptation to vestibular loads increases, less pronounced responses to vestibular irritation

develop [4]. Therefore, the APE process is the physiological basis for the growth of fitness, the speed of which is determined by the nature of physical activity. It is shown that a comparative assessment of the average values in both groups in the 2015-16 academic year revealed significant differences ( $p > 0.05$ ) for all indicators of stabilometry (Table 2). The exception is the BFQ indicator, which confirms the existence of a stable norm, regardless of the standard used for this research. Comparing and analyzing the obtained indicators of CG before and after the experiment, we did not reveal any significant differences ( $p > 0.05$ ), while significant differences were recorded between EG before and after the experiment.

TABLE I I. DYNAMICS OF STABILOMETRY INDICATORS

Parameter	Group	Period		
		2015-16 academic year	2016-17 academic year	2017-18 academic year
VCP, V (mm/s)	EG	24,7±2,7	18,3 ±2,1	17,8 ±1,9
	CG	17,4±1,8	16,1±0,3	16,3±0,4
Area of statokinesiogram, S90 (mm <sup>2</sup> )	EG	234,1±51,4	206,2 ±39,8	173,6 ±32,7
	CG	248,3 ±42,2	229,4 ±39,01	232,31 ±40,9
The ratio of the length of the statokinesiogram to its area, LFS90 (1/mm)	EG	3,1±0,45	2,55 ±0,4	2,03 ±0,32
	CG	2,91±0,14	2,57 ±0,19	2,2 ±0,22
BFQ	EG	64,36 ±5,2	76,77 ±4,7	85,10 ±4,02
	CG	65,52±2,44	69,36±4,35	73,12±3,27

VCP analysis also indicates a pronounced positive dynamic in students from the EG. The decrease in the values of this indicator to the 3rd course reflects improved stability.

The area of the statokinesiogram is a part of the plane limited by the curve of the statokinesiogram. This parameter depends on many factors. A significant decrease in this indicator in the EG by 26% from 234.1 to 173.6 indicates the effectiveness of the APE. While the CG this indicator decreased only by 15.7%.

The total energy spent on maintaining or changing the posture during the study (LFS) characterizes the energy intensity of the posture. This indicator also has a pronounced physical meaning, which allows us to more accurately associate its value with APE. Efficiency in this case means minimizing energy costs. In students with health limitations from the EG, by the end of the 3rd year, the results obtained reflect cost-effectiveness due to the pronounced dynamics from 3.1 (1 year) to 2.55 (2 year) and 2.03 (3 year).

The stability index (BFQ), integratively reflecting the balance function, has no significant differences either before or after the experiment, which confirms the existence of a stable norm for all students. However, in students of the EG this parameter is characterized by a decrease in the spread of fluctuations.

## IV. CONCLUSION

Based on the analysis of real practice, it was found that applied physical education is a pedagogical system that does not simply combine ready samples of applied pedagogical practices necessary in labor activity, but creates new universal knowledge that opens up an innovative way of applying pedagogical conditions and technologies for their implementation in professional adaptation of future specialists with limitations to professional activities.

APE is not opposed to physical education, while serving as a means of comprehensive physical training. It should go parallel to general physical education throughout the entire training period.

Stabilometric monitoring in students with health limitations allows timely and efficient identification adaptive abilities of the body to physical activity. The use of computer stabilometry significantly simplifies the procedure for assessing the functional status of the body, and it seems possible to use the data obtained to assess the impact of APE regardless of the factors and conditions of the chosen professional activity.

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