



## INDIVIDUALIZATION OF THE EDUCATIONAL PROCESS OF INCLUSIVE PHYSICAL EDUCATION OF STUDENTS WITH DISABILITIES

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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### Abstract

**Background.** The relevance of the study is due to the objective need to increase the effectiveness of PE for students with disabilities during their studies in higher education.

**The study purpose was:** of the article is to identify the effectiveness of the implementation of classes on inclusive physical education for students with disabilities according to the individual program.

**Materials and methods.** The experiment was attended by 30 students of Lviv Polytechnic National University with disabilities (with diseases of the nervous system) during a three-year physical education course, with equal numbers of female and male students participating. To determine the effectiveness of the program of physical education for students with disabilities (with diseases of the nervous system), cardiovascular tests have been used.

**Results.** From the standpoint of the general objectives of the study, the results of the experimental study showed the effectiveness of the individual approach in the choice of correctional and developmental means of inclusive physical education for students with disabilities. After the course, we observe stabilization with a tendency to regression of autonomic disorders, and improvement of peripheral hemodynamics, against the background of reducing the clinical manifestations of diseases of the nervous system in students of the study sample.

**Conclusions.** It is proved that the main reason for the introduction of an individualized approach to inclusive physical education of students with disabilities is the provision that this process should focus on the individual health of each student and the ability to eliminate existing deviations by physical education, and thus achieve the highest results in such activities. Analysis of research and educational practice gives grounds to conclude that such an approach in physical education, namely taking into account the individual characteristics of a contingent of students with disabilities, identifies new prospects for inclusive physical education of students in higher education in general.

**Keywords:** inclusive education, students with disabilities, physical education, cardiovascular tests, individual program.

### Introduction

In the modern higher school of Ukraine, the institute of an inclusive environment is considered an important component of the educational process, which provides an opportunity to achieve the educational and professional goals of higher education seekers with disabilities. To implement the idea of “education accessible to all”, higher education must be a safe and functional environment for students with disabilities (Kedian & West-Burnham, 2017). Recognition of the rights of such students, their interests, needs, assistance in the process of socialization, and choice of professional activity is very important in the development of education (O'Rourke & Houghton, 2006).

The implementation of anti-discrimination aspirations in the issues of educational integration of students with disabilities determines the change of target priorities of educa-

tion in general. Today, the number of accumulated changes in higher education, especially in the creation of an inclusive environment, has increased significantly and is constantly undergoing purposeful transformation (Baglieri & Bacon, 2020). However, the priority is the need to build a quality educational process for students with disabilities following their real capabilities, based on the peculiarities of their personal development and educational needs (Campos, Ferreira, & Block, 2014; Tant & Watelain, 2016).

The effectiveness of inclusive education is determined not by the chaos of methods, but by systematic work in all areas. There is no doubt that the process of inclusion of students with disabilities is complex and dynamic (Lidor & Hutzler, 2019; Maxwell, Granlund, & Augustine, 2018), lasts throughout the study, and a prominent place in this process is given to physical education (PE) as a factor in realizing their physical development in health.

An inclusive environment in educational institutions in scientific intelligence is considered a key factor in the socialization of students with disabilities (Kedian, & West-Burnham, 2017; Smith, 2004). There is an active search for ways to organize and operate an inclusive educational environment in higher education (Campos, Ferreira, & Block, 2014), the features of inclusive education, analysis of European-oriented educational inclusion (Goodwin & Watkinson, 2000; Haycock & Smith, 2010) and opportunities for integration of such experiences (Bondar, 2019). The issues of developing new educational practices for students with disabilities are considered (Page, Anderson, & Charteris, 2021; Ruscitti, Thomas, & Bentley, 2017). Some works are designed to find ways to improve the process of inclusive learning (Block & Obrusnikova, 2007; Lidor & Hutzler, 2019).

According to the available ideas, the innovative methodology is based on the principles of student-centeredness, which involves identifying the talents of each individual with developmental problems, and creating conditions for their successful development and self-realization in higher education (Baglieri, Valle, Connor, & Gallagher, 2011).

PE has been identified as one of the leading factors in ensuring the effectiveness of inclusive education, and therefore physical activity with the use of physical exercises is of paramount importance for achieving the goal of this process (Bertills, Granlund, Dahlström, & Augustine, 2018b; Block & Obrusnikova, 2007; Morley, Bailey, Tan, & Cooke, 2005). Scientific sources study the impact of PE classes on the motor and mental spheres of students with disabilities (Briere & Siegle, 2008; Ma, Wang, Li, & Wang, 2020), which is positioned as one of the leading means of ensuring mental performance. Instead, it is proved that one of the main conditions for successful learning of students with disabilities is the implementation of an individual development program (Cavanaugh, 2017; Sönmezoglu, Tosun, & Yıldız, 2021). It is believed that such programs based on the individualization of correctional and developmental means of PE create an opportunity to fully organize the educational process in higher education (Haycock & Smith, 2010).

However, the study of the organization and implementation of individualization of inclusive PE remains insufficiently studied and requires detailed research. Elaboration of the literature on the research problem allows us to conclude that the key areas of this cooperation are mostly the search for the formation and implementation of best educational practices in higher education to ensure positive results. In addition, only the fragmentation of the development of certain motor and mental functions, and changes in morphofunctional indicators of students with disabilities with various forms of disorders are under the influence of PE.

*The study purpose* was to identify the effectiveness of the implementation of classes on inclusive PE for students with disabilities in the implementation of the individual program.

## Material and methods

### Participants

The experiment was attended by 30 students of Lviv Polytechnic National University with disabilities (with diseases of the nervous system) during a three-year PE course, with

equal numbers of female and male students participating. The research was conducted in compliance with the WMA Declaration of Helsinki, – Ethical Principles for Medical Research Involving Human Subjects, 2013. The study protocol was approved by the Ethical Committee of Lviv Polytechnic National University.

For the duration of the research, the research groups was formed of the students having a common feature (nosological characteristic), were formed on the principle of cluster analysis, with satisfaction of the requirements regarding the adequacy of the sample size at the probability level  $p < 0.05$ .

### Study organization

For empirical research, a program of PE adapted for students with diseases in the state of the nervous system was used. The decisive difference of such a program from the current is the ratio of PE methods, which were obtained taking into account the recommendations on the effect of physical activity on the body in the presence of violations in the state of the nervous system. The program has been tested during an academic course of PE in university. The research was conducted annually in the defined curriculum terms, following the same order of organization.

To determine the effectiveness of the program of PE for students with disabilities (with diseases of the nervous system), cardiovascular tests have been used (Mathias & Sir Bannister, 2013). Solving the tasks of the study required the use of a research method that would allow relatively small changes in vegetative activity to be recorded using a simple, fast-acting test without any effect on the very activity of the student's body. Using simple objective non-invasive, reliable and accurate diagnostic methods – cardiovascular tests, it was possible to estimate the degree of violation of the pathological process on the autonomic nervous system. Specialists recommend that they be used to assess the process of urgent adaptation of the cardiovascular system to different types of load and to determine the functional state of the nervous system of persons with a wide range of diseases in this system. Interpretation of indicators of cardiovascular tests is based on representations about regulatory influences on the autonomic nervous system, and higher levels of management of physiological functions.

The research uses the following indicators:

1. Determination of the difference between the maximum and minimum values of cardiointerval RR during continuous recording of heart rate for research groups during deep slow breathing (6 for 1 min) and deduction of RR ( $KR-R = (R-R_{max})/(R-R_{min})$ ). that tachycardia in rest and reducing the spread of RR intervals indicate a deterioration of the parasympathetic function of the autonomic nervous system.

2. Assessment of the change in heart rate during ascension with the calculation of the ratio of R-R intervals at the 30<sup>th</sup> and 15<sup>th</sup> blows from the onset of ascent (K30:15) (Parati, DiRienzo, & Mancia, 2000).

3. Valsalvi test: the student breathes into the mouthpiece, connected to the pressure gauge, and maintains pressure in the spirometer at 40 mm Hg. Art. within 10-15 seconds. Register the ECG before, during and after the test. Calculate the Valsalvi coefficient (KValsalvi): the ratio of the extended R-R

interval in the first 20 s after the test to the shortened R-R interval during the sampling (Levin, 1966).

4. Orthostatic test, minus the difference for systolic blood pressure (SAT) in the position of lying and at the 3rd minute in standing position (DAT).

5. Isometric test: Student compresses the dynamometer for 30 minutes from the maximum for 3 minutes. Determine the change in diastolic blood pressure (D DAT) to the test and at the 3rd minute. Compression of the dynamometer.

This test characterizes the ability of the peripheral vessels to reduce, that is, the sympathetic function. Thus, the first three tests are aimed at the study of parasympathetic vegetative paths, the next two – on the study of sympathetic paths (Mathias & Sir Bannister, 2013).

### Statistical analysis

To characterize the results obtained, the indicators of descriptive statistics were used. The statistical significance of the results was determined using the methods of inductive statistics (Student's t-criterion). All statistical analyzes were performed using SPSS Version 21. Results of descriptive statistics in this study were presented as percentages. The 0.05, 0.01 and 0.001 levels of probability were used to indicate statistical significance.

### Results

The experimental study was based on the fact that the leading role of inclusive PE is to prevent poor health of students as a result of adaptation to the university learning process and further appropriate correction of this process by adequate pedagogical tools and methods (Lidor & Hutzler, 2019). Accordingly, an inclusive PE program should meet the individual needs of each student, not be determined by nosology or diagnosis (Goodwin & Watkinson, 2000). At the same time, the implementation of the program is directed in two directions: the formation of motor knowledge, skills, abilities, and socialization (socially acceptable behavior and communication appropriate to the context). Each of these areas is determined individually for specific students with disabilities. Thus, the principle of individualization of PE is realized. The effectiveness of managing the psychophysical condition of students with disabilities takes into account the motor capabilities due to the form of the disease, sexual and age characteristics of morphofunctional maturation, and compliance with the conditions of adaptation.

The key goal of the program is to provide each student with disabilities, despite the existing physical, intellectual, social, emotional, linguistic, and other features, the possibility of inclusion in a common, unified, holistic process of PE, development and socialization to reduce its risks segregation and isolation, with the prospect of full self-realization in the personal and educational life of higher education institutions. This goal setting is a sign of the development of the higher education system of every civilized country in the world.

To ensure the objectivity of the expert opinions on the experimental study, the initial statistical analysis of the obtained primary data of qualitative characteristics of the studied parameters of the students of the studied sample at the

beginning of the experiment. In the context of inclusive education, this is extremely important because it makes it possible to find out how different PE programs affect the elimination of existing negative trends in the physical development, and health of students with disabilities by stimulating physical activity, psychophysiological characteristics, functional capabilities, and motor skills.

The experiment involved the constant collection and analysis of data on the formation and implementation of the program related to the implementation of full-fledged physical activity. Believe (Ivashchenko & Khudolii, 2016), that this will contribute to a better understanding of the factors that have a positive or negative impact, the identification of problems, achievements, and best practices in this area, and purposeful planning of this process. We emphasize the need to adapt the content, forms, methods, and technologies of PE for students with disabilities.

It is established that the implementation of the content of PE for students with disabilities provided by experimental research provides a positive effect (at the level of  $p < 0.05$ ) in solving the tasks, as evidenced by the results of the control (Table 1). The results of testing conducted at the beginning of scientific research did not differ significantly, which is statistically confirmed ( $p > 0.05$ ) and indicates the homogeneity of the contingent of the studied sample of students. The majority of the studied students (75.6%) found disorders in the functional state of the nervous system, which manifested themselves in the processes of disintegration between the nervous and humoral channels of regulation, mainly in the form of hyper-sympathetic reactions.

Given that functional disorders of the autonomic systems are not only risk factors for somatic pathology and a predictor of cardiovascular disease, but also factors affecting the physical and mental development of students, such reactions are justified from the standpoint of learning and the presence of functional disorders in the state of health of students. In addition, during the study period, age-related physiological changes in the youth of students of research groups coincide with social changes (Maxwell, Granlund, & Augustine, 2018). Given that the vegetative effect is one of the important factors in ensuring the proper level of adaptation processes and maintaining internal homeostasis, especially in the presence of disorders of the nervous system, studied indicators of autonomic regulation, which generally students at the beginning of the study had no significant differences ( $p < 0.05$ ).

A series of cardiovascular tests were performed to assess the process of urgent adaptation of the cardiovascular system to different types of stress and to determine the functional state of the nervous system (Mathias & Sir Bannister, 2013). The results of these tests before the experiment generally showed a low functional reserve of the autonomic nervous system in the students of the study sample and allowed to determine the directions of possible correction for different types of deviations.

Thus, during the implementation of individual programs of inclusive PE, almost all surveyed students had increased heart rate during cardiovascular tests, these results were significant ( $p < 0.05$ ) in both groups of male and female. Despite lower heart rates in male compared to female, these differences are not significant ( $p > 0.05$ ).

**Table 1** Results of cardiovascular tests of students of research groups

Investigated parameters		Period of the experiment								%	Reliability of discrepancies (p)	
		at the beginning				after						
		X	S	As	Me	V	X	S	As			Me
Heart rate beats/min	m	12.18	1.99	0.36	6.11	36.8	14.18	1.99	0.32	0.34	16.41	<0.05
	f	13.75	1.73	0.58	6.44	37.5	15.71	1.73	0.52	6.09	14.26	<0.05
$K_{R-R}$	m	1.167	0.028	0.70	2.13	37.4	1.236	0.052	0.68	4.98	13.52	<0.05
	f	1.041	0.016	0.46	2.13	36.2	1.187	0.034	0.54	5.88	14.02	<0.05
$K_{30:15}$	m	1.015	0.006	0.53	0.43	34.7	1.192	0.026	0.30	6.43	17.43	<0.05
	f	1.012	0.003	0.54	0.32	34.5	1.177	0.012	0.47	69.3	16.30	<0.05
$K_{Valsalvi}$	m	1.211	0.009	0.34	6.00	39.0	1.413	0.033	0.60	73.2	16.68	<0.05
	f	1.193	0.009	0.22	4.78	40.4	1.388	0.021	0.45	1300	16.34	<0.05
D SAT, mm Hg	m	12.24	1.075	0.62	5.66	36.2	9.96	1.013	0.56	1401	18.46	<0.01
	f	13.06	1.302	0.52	6.66	34.7	10.04	1.882	0.35	38.32	15.48	<0.05
D DAT, mm Hg	m	13.54	0.885	0.20	69.9	34.5	10.66	0.717	0.52	40.92	21.27	<0.01
	f	13.95	0.660	0.79	73.1	37.5	11.04	0.539	0.38	42.43	20.08	<0.01

\* Note: hereinafter:  $K_{30:15}$  – coefficient of change of heart rate;  $K_{R-R}$  – coefficient of respiratory test,  $K_{Valsalvi}$  – coefficient of Valsalva; m – male; f – female.

The nature of the response to stimulation of the parasympathetic autonomic nervous system by the value of the coefficient of Valsalva, which is within the limits of pathological values ( $p < 0.001$ ), showed the presence of dysfunction of sympathetic and parasympathetic mechanisms of baroreflex reflexes. Indicator  $K_{30:15}$  was in the area of pathological values, indicating the presence of autonomic dystonia, lack of general effects, and low reactivity of the parasympathetic nervous system. In general, these indicators do not have gender and intergroup differences ( $p > 0.01$ ). Nice function according to the results of tests at the limit of limit values.

Studies of autonomic functions, namely the assessment and analysis of the initial autonomic tone, autonomic reactivity, and autonomic status, have shown an imbalance in the nervous system – a phenomenon of systemic autonomic degeneration. And since the results of functional tests are determined by the state of the central nervous system and autonomic endocrine system (Mathias & Sir Bannister, 2013), respectively, the quantitative results of an integrative assessment of cardiovascular reflexes were extremely pathological in the study sample of students.

In general, 70.1% of students had one or another form or two forms of violation of autonomic homeostasis. Given that it has a decisive role in shaping the state of health (Levin, 1966), it is obvious that this factor has decisively led to a low level of somatic health in students in the study sample.

In the course of the study, we note the activation of extracardiac factors under the influence of the implemented program of inclusive PE, which allowed to level pathogenic processes in the nervous system and optimize the processes of sanogenesis.

## Discussion

Modern research focuses on the need to significantly improve the quality of research and make drastic changes in the organization of the educational process for students with disabilities in terms of higher education (Bondar, 2019; Goodwin & Watkinson, 2000). This involves searching for and processing information to properly substantiate the

principles of inclusive PE of students with disabilities, determining effective conditions for its implementation based on understanding and objective assessment of domestic science and practice and world experience in this field.

We support scientific approaches (Koryahin et al., 2019; Tant & Watelain, 2016; Briere & Siegle, 2008), which require permanent special monitoring and evaluation studies of the effectiveness of inclusive PE for students with disabilities. We believe that without such research it is impossible to assess the impact of PE on their physical development, learning, education, and socialization. Thus, it is possible to ensure the effectiveness of planning and management functions in the course of inclusive PE, which is a factor in its effectiveness (Smith, 2004).

In the process of research, a program of inclusive PE for students with disabilities was developed and implemented, which included a set of measures aimed at individualizing this process. The obtained results can be used as a basis for developing a curriculum for students with disabilities based on the developed strategies, methods, technologies, and techniques of inclusive PE. We believe that through the introduction of such programs in the educational process of higher education, students with disabilities can gain real experience of physical activity, develop new skills and expand their range.

The idea is expanded (Haycock & Smith, 2010; Lidor & Hutzler, 2019), that the implementation of constructive approaches to the development of inclusive PE in higher education will help eliminate the contradiction between the declared equality in our country in receiving educational services and the actual limitation of opportunities for socially vulnerable groups. We are impressed by the opinion (Koryahin et al., 2019), that in higher education institutions PE should primarily provide a high level of interactivity, which necessitates an individual approach to students with disabilities.

In connection with the last, urgent task in the context of increasing the impact of PE classes on the motor and mental spheres of students with disabilities, is to increase their motivation for physical self-improvement, based on awareness of the importance of PE physical, social, and cognitive development as a result of physical training.

We agree (Block, 2007; Morley, Bailey, Tan, & Cooke, 2005), that the implementation of these tasks is possible under the conditions of individualization of the pedagogical process of PE of students with disabilities, aimed at eliminating existing negative trends in their physical development and health using physical culture on the body through stimulating physical activity taking into account the peculiarities of the formation of motor function, mental development with different directions of influence on motor skills and functional capabilities of body systems.

## Conclusions

Modern higher education requires the need to change the current paradigm of traditional didactic inclusive PE, focused on the student, his special academic needs, previous experience, and his vision of the future path in the labor market. It was found that a promising way to improve the pedagogical process of PE of students with disabilities is the individualization of the curriculum. The latter should be based on the psychophysiological condition of students with disabilities and their physical and psychological characteristics.

The developed program, taking into account the shortcomings of the current organization and content of PE of students with disabilities determines the directions of its improvement, guided by the principle of individualization, and in the formation of content for disabilities.

The use of inclusive PE for students with disabilities based on individualization of the educational process is experimentally substantiated. Thus, at the end of the formative stage of the experiment recorded significantly better ( $p < 0.05-0.001$ ) functional state of the central nervous system and autonomic and endocrine system of students with disabilities, in groups that implemented an inclusive PE program with individual focus. Thus, the experiment confirmed the feasibility of the measures taken in the organization of the educational process of PE of students with disabilities.

## Conflict of interest

The authors state no conflict of interest.

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## ІНДИВІДУАЛІЗАЦІЯ НАВЧАЛЬНОГО ПРОЦЕСУ ІНКЛЮЗИВНОГО ФІЗИЧНОГО ВИХОВАННЯ СТУДЕНТІВ З ОСОБЛИВИМИ ОСВІТНИМИ ПРОБЛЕМАМИ

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; Е – збір коштів  
Реферат. Стаття: 7 с., 1 табл., 26 джерел.

**Базова проблематика.** Актуальність дослідження обумовлена об'єктивною необхідністю підвищення ефективності фізичного виховання студентів з особливими освітніми потребами у термін їхнього навчання у закладах вищої освіти.

**Мета статті** – виявити ефективність реалізації занять із інклюзивного фізичного виховання студентів з особливими освітніми потребами згідно індивідуальної програми.

**Матеріали та методи.** У експерименті взяли участь 30 студентів Національного університету «Львівська політехніка» з особливими освітніми потребами (із захворюваннями нервової системи) протягом трирічного курсу фізичного виховання, у рівній кількості дівчат та хлопців. Для визначення ефективності програми фізичного виховання для студентів з особливими освітніми потребами (із захворюваннями нервової системи) використано кардіоваскулярні тести.

**Результати.** З позицій загальних завдань дослідження, результати експериментального дослідження засвідчили дієвість реалізації індивідуального підходу у виборі корекційно-розвивальних засобів інклюзивного фізичного виховання студентів з особливими освітніми потребами. Після проведеного курсу занять спостерігаємо стабілізацію з тенденцією до регресування вегетативних порушень, покращення периферичної гемодинаміки, на фоні зменшення клінічних проявів захворювань нервової системи у студентів досліджуваної вибірки.

**Висновки.** Доведено, що головною підставою впровадження індивідуалізованого підходу у інклюзивне фізичне виховання студентів з особливими освітніми потребами є положення про те, що цей процес повинен орієнтуватися на індивідуальні особливості стану здоров'я кожного студента та можливості усунення наявних відхилень засобами фізичного виховання, а, відтак, досягнення найвищих результатів у такій діяльності. Аналіз досліджень і освітньої практики дає підстави для висновку, що такий підхід у фізичному вихованні, а саме урахування індивідуальних характеристик певного контингенту студентів з особливими освітніми потребами, визначає нові перспективи інклюзивного фізичного виховання студентів закладів вищої освіти в цілому.

**Ключові слова:** інклюзивна освіта, студенти з особливими освітніми потребами, фізичне виховання, кардіоваскулярні тести, індивідуальна програма.

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