Journal of Learning Theory and Methodology
Журнал теорії та методології навчання

ISSN 2708-7581 (Online)
ISSN-L 2708-7573

Original scientific article

# Effectiveness of Inclusive Physical Education Classes on the Ability to Perform Rhythmic Activities 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

DOI: 10.17309/jltm.2023.4.03

**Abstract**

**The purpose of the study** was to reveal the effectiveness of inclusive physical education classes on the ability to perform rhythmic activities and the state of health of students with disabilities in the process of implementing a differentiated physical education program.

**Materials and methods.** The experiment was attended by 30 students with disabilities. To determine the effectiveness of the differentiated program of physical education for students with disabilities, pedagogical testing has been used.

**Results.** According to the results of the experiment, it was established that the use of the developed differentiated program of physical education for students with disabilities made it possible to improve the level of ability to perform rhythmic activities during the period of the experiment. It was established that the implementation of the content of the test control provided by the differentiated program during the physical education of students with disabilities provides a positive effect (at the level of $p<0.05$) in solving the tasks, as evidenced by the test results. In conclusion, the average values with which the level of physical education correlates with health, of which corresponded to the "low" level, passed into the range of values that correspond to "below average" (72.4%), in others, indicators of physical health showed a tendency to improve.

**Conclusions.** It was determined that a special role in the context of solving the issue of inclusive education in institutions of higher education is assigned to physical education, which is aimed at eliminating existing negative trends in the physical development and health of students with disabilities. The analysis of the final data at the end of the experiment testifies to the benefit of the implemented development of pedagogical actions, which proves the need for the introduction of innovations, and fundamentally new approaches to the formation of programs of inclusive physical education based on a differentiated approach.

**Keywords:** inclusive, physical education, students with disabilities, health, ability to rhythmic activity, program.

## Introduction

Ensuring the opportunity for students with disabilities to obtain quality education following their characteristics, needs, and opportunities is one of the key priorities of modern Ukrainian social and educational policy (Bondar, 2019). This question is considered in the national context, as it concerns the category of citizens who in the future should form the basis of the productive forces of society. In any country based on humanistic and democratic principles, human health is the highest value, the most important asset of the state, it is an indisputable priority, a guarantee of the sustainability and progress of society (Ainscow, 2020). Today, when the number of students with disabilities is constantly growing due to the long-term hostilities on the territory of Ukraine, the problem of their inclusion in the educational space of a higher school is extremely urgent.

There is no doubt that the process of inclusion of students with disabilities is complex and dynamic (Baglieri & Bacon, 2020), 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 and improving health in learning conditions (Lidor & Hutzler, 2019). Inclusive PE, based on humanistic and democratic principles, positions the health of participants in the educational process as an indisputable priority (Overton, Wrench & Garrett, 2016).

In the literature, scientists are actively researching various aspects of the organization and functioning of inclusive PE. If the concept of inclusion is transferred to the field of PE, then inclusive PE is interpreted as providing additional support to students who, for one reason or another, cannot take an active and meaningful part in the educational process



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(Block & Obrusnikova, 2007). In scientific works, inclusive PE is considered a pedagogical process aimed at eliminating existing negative trends in the physical development and health of students with disabilities (Morley, Bailey, Tan & Cooke, 2005; Tant & Watelain, 2016).

According to the analysis, PE in higher education is positioned as the main means of creating an opportunity for students with disabilities to obtain a certain amount of knowledge and skills to apply in practice to counteract health disorders, aimed at improving social, mental, emotional, and physical measurements (Overton, Wrench & Garrett, 2016; Udych, 2018).

In scientific sources (Lidor & Hutzler, 2019; Smith, 2004; Tant & Watelain, 2016), attention is focused on the impact of PE classes on the motor and mental spheres of students with disabilities. The leading role of inclusive PE in the prevention of the progression of existing disorders in the state of health of students with disabilities, unsatisfactory state of health, as a consequence of adaptation to the learning process and subsequent appropriate correction of this process with adequate pedagogical means and methods has been proven (Barboza, Ramos, Abreu & Castro, 2019; Morley, Bailey, Tan & Cooke, 2005). In this context, the optimal organization of PE classes is relevant for solving the problem of health care in the process of studying in higher education (Fiorini & Manzini, 2018).

Scientists are united in the opinion (Bertills, Granlund, Dahlström & Augustine, 2018b; Ruscitti, Thomas & Bentley, 2017), that inclusive PE involves taking into account the maximum possible number of individual characteristics of students in the process of influencing their motor and mental spheres by means of PE to prevent the formation of inadequate adaptation in higher education institutions. The latter causes a decrease in the level of functioning of individual systems, the stress of regulatory mechanisms, and the loss of functional resources (Fiorini & Manzini, 2018). Accordingly, the result can be a deterioration in health, and therefore a general development different from the optimal one. It is also necessary to take into account the influence of several factors that caused students with disabilities to deviate from the norm by which specialists characterize health today, as a result of the introduction of quarantine security measures, and then martial law.

At the same time, the main priority of PE with students with special educational needs is the implementation of differentiated PE to individualize the process of PE (Blavt, 2022; Barboza, Ramos, Abreu & Castro, 2019; Iedynak et al., 2017). It is believed (Adilson et al., 2006; Gorla & Araujo, 2007), that the rational construction of the process of PE for ensuring the implementation of health improvement goals, requires systematic pedagogical and medical control over the physical development of students with disabilities, as well as the development of unified programs (Lidor & Hutzler, 2019; Smith, 2004) in the process of individual training, use of effective comprehensive assessment in accordance with the individual and gender characteristics of the body of students with disabilities (Ma, Wang & Wang, 2020).

At present, there is no comprehensive study of the indicators of PE influence on the correlation of disorders in the body of students with disabilities caused by the presence of a somatic disease, which greatly complicates the identification of regular trends and disease-related features of their changes.

The purpose of the study was to reveal the effectiveness of inclusive PE classes on the ability to perform rhythmic activities and the state of health of students with disabilities in the process of implementing a differentiated PE program.

## Material and methods

### *Study participants*

The research was conducted in the Department of PE of the National University "Lviv Polytechnic" during the one-year course of PE. 30 first-year students (an equal number of girls and boys) took part in the experiment. The study was conducted following the Helsinki Declaration of the World Medical Association (WMA-2013) WMA, Ethical Principles of Medical Research Involving Human Subjects.

PE of students with disabilities involves ethical issues and lengthy procedures. The sample size is determined by the number of enrolled students with disabilities. After they agreed to participate, consent was obtained from their classmates and PE teachers. The limited number of participants in this study suggests obtaining information about group patterns rather than significant values.

For the duration of the research, the research groups were formed on the principle of cluster analysis, with satisfaction of the requirements regarding the adequacy of the sample size at the probability level $p<0.05$. The number of students in the research groups is sufficient for the evidentiary evaluation of the results of the experiment.

### *Study organization*

Methods of obtaining empirical data: pedagogical experiment, pedagogical testing, mathematical methods of processing digital arrays. An differentiated program of inclusive PE was used to conduct the empirical study. The defining difference of this program is the individualization of corrective and developmental means used in the process of PE of students with disabilities. The experiment was implemented during two academic semesters.

To control the level of development of the ability to perform rhythmic activities, the following tests were chosen:

"Clap your hands in a given rhythm": the student is left to repeat the given test exercise while preserving the rhythmic pattern. Overall assessment of the task in points.

"Walk with clapping your hands in a given rhythm": the test consists of one series of rhythmic tasks. After showing the test, the student should reproduce the clapping of the hands while walking. Evaluation in points for the performance of four tasks.

"Rhythmic tapping of your hands": indicators of rhythmic ability were determined and evaluated based on the results of performing rhythmic movements of the upper and lower limbs. The student stood in the corner of the sports hall facing the wall so that with straightened arms and legs it was possible to reach each of the two walls. On command, student performed a rhythmic cycle of movements for 20 seconds. The number of correctly performed complete cycles of rhythmic movements was determined.

"Rhythmic movements of the upper and lower limbs": the student must repeat the hand movements shown by the teacher in rhythm. The number of completed cycles in 20 seconds is estimated.

Correlation analysis proved the existence of relationships between the accuracy indicators of the reproduction of individual rhythms (Golle & Rymarcewicz, 2021; Gorla & Araujo, 2007; Hirtz, 1985). According to the results of the analysis, there is a strong statistical relationship between almost all indicators of the ability to perform the rhythmic activity, and the selected test exercises form a homogeneous complex ($r_{tt}$ – 0.7–0.9).

The level of physical health (PHL) was determined by the sum of points proposed by H. L. Apanasenko: indicators of body weight, the vital capacity of the lungs (life Index), heart rate (ruffier index), blood pressure (index Robinson), hand dynamometry are used (strength index) (Hryban, 2008).

### *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). To determine the empirical reliability and validity coefficients of the tests, variance and correlation analysis were used. Quantitatively, the degree of reliability of the tests is expressed using the reliability coefficients, which are calculated using the intra-class correlation coefficient. The methods of mathematical statistics are used, it can be confirmed that the criteria of reliability adequately met.

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

We should note that in the proposed study of the implementation of a differentiated program, the key provisions were that regardless of the cause of the occurrence and development of the disease, the teacher's attention to students with disabilities during PE classes should be increased (Adilson et al., 2006; Fiorini & Manzini, 2018). First of all, this concerns the adequacy of the load parameters: they should be smaller for such students than for healthy ones, and also take into account the diagnosis (Lidor & Hutzler, 2019). Due to the fact that each student with disabilities has its dynamics and potential development opportunities, the implementation of the program's tasks depended on compliance with the set of PE tools used and the observance of hygienic principles in the organization of the educational process to the individual characteristics of the psychophysical development of students with disabilities. In the process of inclusive PE, we focused on the state of health of each specific student with a disability, taking into account the conclusions of medical examinations.

Our study took into account that one of the most important tasks of PE for students with disabilities is the development of motor function and the ability to control one's movements (Gorla & Araujo, 2007; Oliver et al., 2015). Therefore, it was considered appropriate to control the ability to perform rhythmic activities as a correlator of the development of coordination abilities of students with disabilities. It is also important that the sense of rhythm can be purposefully formed (Hirtz, 1985). In addition, the ability to perform rhythmic activities has a diagnostic ability: by monitoring their dynamics, it is possible to conclude the state of health of students to a certain extent (Gorla & Araujo, 2007). In addition, a high degree of development of the sense of rhythm determines the rapid mastery of new motor skills (Gorla, & Araujo, 2007).

The results of the 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 (Tab. 1, 2). The lack of gender dependence in the development of a sense of rhythm among students with disabilities was experimentally proven ($p>0.05$). The majority of students complete the tests with satisfactory grades: 63.5% among boys and 65.7% among girls. A significant proportion of the studied sample of students was unable to pass the tests 21.3% among boys and 25.1% among girls at the beginning of the study.

At the end of the study, a small number of students with disabilities passed the tests with an "excellent" rating: 1.1% of boys and 1.5% of girls ($p<0.05$). There were no students with disabilities who were unable to perform the given tests. This effect is caused by at least several reasons: one of them is the low initial level of development of the functional characteristic of the sense of rhythm, and the other is the involvement in the implementation of the content of PE of mechanisms and systems of the body that require the involvement of various functional characteristics []. In general, positive changes in the indicators of students with disabilities according to the studied parameter testify to the improvement of the condition of the neuromuscular apparatus.

**Table 1.** Results of monitoring the ability to perform rhythmic activities (male)

| Statistical parameters | Test tasks and measurement results | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Clap your hands in a given rhythm (points ) | | Walk with clapping your hands in a given rhythm (points) | | Rhythmic tapping of your hands ( number of cycles ) | | Rhythmic movements of the upper and lower limbs ( number of cycles ) | |
| Period of the experiment | at the beginning | after | at the beginning | after | at the beginning | after | at the beginning | after |
| M | 2.44 | 2.82 | 1.77 | 2.01 | 2.22 | 2.91 | 2.76 | 3.15 |
| S | 1.15 | 1.03 | 0.81 | 0.86 | 1.18 | 1.01 | 1.33 | 1.58 |
| V (%) | 44.5 | 46.8 | 52.3 | 49.4 | 37.5 | 48.4 | 58.1 | 41.2 |
| reliability | 0.899 | 0.913 | 0.723 | 0.789 | 0.811 | 0.867 | 0.766 | 0.818 |

**Table 2.** Results of monitoring the ability to perform rhythmic activities (girls).

| Statistical parameters | Test tasks and measurement results | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Clap your hands in a given rhythm (points) | | Walk with clapping your hands in a given rhythm (points) | | Rhythmic tapping of your hands (number of cycles) | | Rhythmic movements of the upper and lower limbs (number of cycles) | |
| Period of the experiment | at the beginning | after | at the beginning | after | at the beginning | after | at the beginning | after |
| M | 2.81 | 3.01 | 1.93 | 2.15 | 2.11 | 2.77 | 2.55 | 2.98 |
| S | 1.33 | 1.41 | 0.99 | 1.02 | 1.02 | 0.95 | 1.40 | 1.69 |
| V (%) | 42.1 | 41.6 | 48.7 | 50.1 | 40.1 | 43.8 | 49.8 | 40.5 |
| reliability | 0.721 | 0.871 | 0.788 | 0.811 | 0.803 | 0.875 | 0.791 | 0.831 |

**Table 3.** Results of physical health monitoring of students research group

| Research stage /sex | Life Index | points | Strength Index | points | Index Robinson | points | Indicators of body weight | points | Ruffier Index | points | total PHL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| up to/ boys | 56.2±2.9 | 1 | 48.1±3.1 | 0 | 885.1±3.8 | 0 | 19.8±1.3 | -1 | 8.1±1.1 | 2 | 2 |
| after/boys | 59.1±1.9 | 1 | 57.7±3.5 | 1 | 93.2±3.1 | 0 | 21.6±1.5 | 0 | 6.7±0.0 | 2 | 4 |
| up to/ girls | 42.4±2.7 | 0 | 41.1±3.2 | 0 | 92.7±5.2 | 0 | 21.1±2.3 | 0 | 7.4±1.2 | 2 | 2 |
| after/ girls | 47.1±2.1 | 1 | 53.9±3.1 | 1 | 87.7±3.1 | 0 | 19.3±1.4 | 0 | 6.8±1.1 | 2 | 4 |

*Note: PHL – level of physical health. The differences in the results are significant ($p<0.05–0.001$)

The results of the study showed that deficiencies in the development of the motor sphere, which is a consequence of the low level of physical development of students with disabilities, negatively affect the perception and reproduction of the given rhythm of performing motor actions. However, the development of the ability to perform rhythmic activities is determined by those biological and mental functions that may be physiologically impaired in students with disabilities due to the presence of certain deviations in the state of health. These violations, in turn, led to the inconsistency of various body functions, primarily motor, and the activity of other body systems (vestibular and visual analyzers, joint-muscle proprioception and higher departments of the central nervous system, etc.), which ensure the proper development of the sense of rhythm (Hirtz, 1985). In addition, the development of a sense of rhythm in many cases is determined by the strength of muscles, accordingly, this is their sharply expressed characteristic feature. Therefore, the testing process is accompanied by the difficulty of controlling the motor apparatus during rhythmic movement.

The study of the level of physical health (Tab. 3) showed, that during the experiment, boys and girls research group improved 2 of all 5 indicators of physical health, the others showed a tendency to improve.

## Discussion

It was determined that the leading role of PE lies in the prevention of an unsatisfactory state of health of students, as a consequence of adaptation to the process of studying at universities (Koryahin et al., 2019). We support scientific approaches that PE as a powerful means of influencing the body, expands the range of opportunities, especially the motor area students with disabilities, affected by a persistent defect (Bertills et al., 2018b; Blavt et al., 2022).

Scientific data on the need to introduce special methods, pedagogical technologies, and differentiated programs into the process of inclusive PE have been expanded (Gorla & Araujo, 2007; Barboza et al., 2019). The research was based on the provisions (Serbetar, 2014; Zwierzchowska et al., 2004) about the dependence of the effectiveness of the PE process on taking into account the laws of rhythm, in a broad sense as the form of the course of certain processes in time, which is characterized by clearly defined temporal and spatial characteristics, and in a narrow sense as an integral characteristic of the technique of physical exercises (Schielke, 1989). It is a practically confirmed hypothesis that understanding and using in the process of PE psychological, biomechanical, physiological, and pedagogical regularities of the rhythm of exercises makes it possible to speed up the learning process.

The ability to perform rhythmic activity gradually changes with age, but to a greater extent depends on purposeful influence (Ivashchenko & Khudolii, 2016; Serbetar, 2014). In addition, under the age of 18, this ability can be purposefully influenced and developed (Hirtz, 1985). Therefore, we support the opinion of scientists that the control of this ability should take its proper place in the inclusive PE of students with disabilities (Gorla & Araujo, 2007; Dietz, 2002).

The sense of rhythm is quite specific (Winnick & Porretta, 2017), and its development is determined by the functional state of the nervous system, and its individual properties, at the same time it has a motor nature and depends on the sense of space, the sense of time, the sense of the accuracy of muscle efforts (Bertills et al., 2018b). The physiological basis of the development of the sense of rhythm is the individual features of the structure of the cerebral cortex, the level of development of sensory systems, the productivity of mental processes, and the ability to regulate the emotional state (Oliver et al., 2015; Serbetar, 2014). It is confirmed that the development of this ability in the process of inclusive PE

of students with disabilities is of considerable importance for improving their physical health.

Taking the above into account when forming and implementing the content of inclusive PE for students with disabilities will ensure an increase in its effectiveness in solving both the main and secondary, but also important tasks of improving health (Gorla & Araujo, 2007; Ruscitti et al., 2017). Information about changes in the functional characteristics of students with disabilities or those who exercise is important for PE teachers, as it allows them to adjust the content of this process to achieve the best positive result (Blavt, 2022; Iedynak et al., 2017; Morley et al., 2005).

The practical value of the obtained results lies in the fact that they indicate directions for improving the organization, and the content of PE of students with disabilities to increase their functional characteristics and improve the general state of health.

## Conclusions

PE of students with disabilities due to a certain disease, at the current stage in higher education, is primarily considered inclusive – a social phenomenon, the main goal of which is to eliminate existing negative trends in the physical development and health of students with disabilities.

The importance of scientific developments in the field of inclusive PE is proven by information from literary sources and practical experience. The importance of developing and improving a sense of rhythm in the PE of students with disabilities is that they are a necessary prerequisite for the successful mastery of motor skills, which affect the pace, type and method of their acquisition, as well as further stabilization and situationally adequate diverse application.

Experimental verification of the differentiated program of inclusive PE proved its effectiveness. The practical implementation of the program ensured a positive effect of planned pedagogical corrective influences in the course of inclusive PE. The analysis of the final data at the end of the experiment testifies to the benefit of the implemented development of pedagogical actions since the studied indicators of the ability to perform rhythmic activities in students with disabilities are characterized by positive dynamics.

The results of the conducted research provide grounds for a conclusion regarding the possibility of purposeful correction by means of inclusive PE on the state of the ability to perform rhythmic activities of students with disabilities.

## Conflicts of interest

No conflicts of interest exist.

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# Ефективність інклюзивного фізичного виховання у розвитку здібності до ритмічної діяльності студентів з особливими освітніми проблемами

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 7 с., 3 табл., 31 джерело.

Проблема організації інклюзивного фізичного виховання у закладах вищої освіти передбачає необхідність комплексного вивчення показників впливу фізичного виховання на кореляцію порушень в організмі, зумовлених наявністю соматичного захворювання.

**Мета статті** – виявити ефективність впливу занять інклюзивного фізичного виховання на здібність до ритмічної діяльності та стан здоров'я студентів з особливими освітніми проблемами у процесі реалізації диференційованої програми ФВ.

**Матеріали та методи.** У експерименті взяли участь 30 студентів Національного університету «Львівська політехніка» з особливими освітніми потребами, у рівній кількості хлопців та дівчат. Для визначення ефективності диференційованої програми інклюзивного фізичного виховання студентів з обмеженими можливостями використано педагогічне тестування.

**Результати.** Підсумками експерименту установлено, що застосування розробленої диференційованої програми фізичного виховання для студентів з особливими освітніми проблемами уможливило покращення впродовж періоду експерименту рівня здібності до ритмічної діяльності. Установлено, що реалізація передбаченого диференційованою програмою змісту тестового контролю у ході фізичного виховання студентів з особливими освітніми проблемами забезпечує позитивний ефект (на рівні $p<0,05$) у вирішенні поставлених завдань, про що свідчать результати тестування У підсумку, середні значення, з якими корелює рівень фізичного здоров'я, із таких, відповідали «низькому» рівню, перейшли у діапазон значень, які відповідають «нижчому за середній» (72,4 %), у інших показники фізичного здоров'я відзначалися тенденцією до поліпшення.

**Висновки.** Визначено, що особлива роль у контексті розв'язанні питання інклюзивного навчання у закладах вищої освіти відводиться фізичному вихованню, яке скероване на усунення наявних негативних тенденцій у фізичному розвитку та здоров›ї студентів з особливими освітніми проблемами. Аналіз підсумкових даних наприкінці експерименту свідчать

на користь упроваджених розробок педагогічних дій, що доводить необхідність впровадження нововведень, принципово нових підходів до формування програм інклюзивного фізичного виховання на основі диференційованого підходу/ Досліджено, що упровадження диференційованої програми забезпечує формування і вдосконалення рухових функцій, так от як здібності до ритмічної діяльності студентів з особливими освітніми проблемами, а, відтак, забезпечує певною мірою покращання стану фізичного здоров'я.

**Ключові слова:** інклюзія, фізичне виховання, студент з особливими освітніми проблемами, здоров'я, здібність до ритмічної діяльності, програма.

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**Cite this article as:** Blavt, O. (2003). Effectiveness of Inclusive Physical Education Classes on the Ability to Perform Rhythmic Activities of Students With Disabilities. *Journal of Learning Theory and Methodology, 4*(1), 19-25. https://doi.org/10.17309/jltm.2023.4.03

Received: 02.02.2023. Accepted: 23.02.2023. Published: 30.03.2023