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EMPOWERING TEACHERS IN HIGHER EDUCATION: PREPARING TO SUPPORT STUDENTS WITH SPECIAL NEEDS

CAPACITAÇÃO DE PROFESSORES NO ENSINO SUPERIOR: PREPARAÇÃO PARA APOIAR ESTUDANTES COM NECESSIDADES ESPECIAIS

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ABSTRACT

A prerequisite for effectively integrating higher education students with special needs into the educational process and their professional development is the preparation of teachers to work with this category of students. The article is devoted to studying the problem of inclusive education in higher education, namely, preparing teachers to work with students with special needs. The study used questionnaires, a comparison of teachers' training levels in an inclusive learning environment before and after the training of teachers to work with students with special needs and statistical calculation of the results. A pedagogical model of teacher training for working with students with special needs has been developed, which consists of five blocks of teacher training: theoretical, general practical, practical and technological, psychological and social, monitoring and analytics. The result of implementing the proposed model is the acquisition by teachers of competences in developing and implementing inclusive educational environments and readiness to work with students with special needs. Basic, sufficient and advanced levels define the readiness of teachers to work with students with special needs. According to Pearson's criterion, a statistical assessment of teachers' readiness was carried out using four criteria: theoretical and content, practical and technological, psychological and social, and performance and analytical. A comparison of indicators before and after implementing the outlined model showed increased teachers' readiness to work with students with special needs for each criterion. The training of teachers to work with students with special needs should be based on an integrated approach that includes theoretical knowledge on the formation of inclusive environments, practical aspects of training, including methodological, didactic, technical and technological means, psychological training and development of analytical competences of teachers to form personalised educational trajectories of higher education students.

Keywords: inclusive education, teacher training, higher education institutions, ensuring accessibility of education, higher education students, special educational needs.

RESUMO

A preparação dos professores para trabalhar com esta categoria de estudantes é uma condição prévia para a integração efectiva dos estudantes do ensino superior com necessidades especiais no processo educativo e para o seu desenvolvimento profissional. O artigo dedica-se a estudar o problema da educação inclusiva no ensino superior, nomeadamente a preparação dos professores para trabalharem com alunos com necessidades especiais. O estudo recorreu a questionários, à comparação dos níveis de formação dos professores num ambiente de aprendizagem inclusivo antes e depois da formação de professores para trabalharem com alunos com necessidades especiais e ao cálculo estatístico dos resultados. Foi desenvolvido um modelo pedagógico de formação de professores para trabalhar com alunos com necessidades especiais, que consiste em cinco blocos de formação de professores: teórico, prático geral, prático e tecnológico, psicológico e social, monitorização e análise. O resultado da aplicação do modelo proposto é a aquisição, por parte dos professores, de competências no desenvolvimento e implementação de ambientes educativos inclusivos e a preparação para trabalhar com alunos com necessidades especiais. Os níveis básico, suficiente e avançado definem a preparação dos professores para trabalhar com alunos com necessidades especiais. De acordo com o critério de Pearson, foi efectuada uma avaliação estatística da preparação dos professores utilizando quatro critérios: teórico e de conteúdo, prático e tecnológico, psicológico e social, e de desempenho e analítico. A comparação dos indicadores antes e depois da implementação do modelo delineado revelou um aumento da preparação dos professores para trabalhar com alunos com necessidades especiais em cada critério. A formação de professores para trabalharem com alunos com necessidades especiais deve basear-se numa abordagem integrada que inclua conhecimentos teóricos sobre a formação de ambientes inclusivos, aspectos práticos da formação, incluindo meios metodológicos, didácticos, técnicos e tecnológicos, formação psicológica e desenvolvimento de competências analíticas dos professores para formarem percursos educativos personalizados de alunos do ensino superior.

Palavras-chave: educação inclusiva, formação de professores, instituições de ensino superior, garantia da acessibilidade da educação, estudantes do ensino superior, necessidades educativas especiais.

Introduction

Inclusive education aims to provide equal access to education, regardless of higher education students' psychological or physiological characteristics. An important aspect of developing and implementing inclusive educational environments is the training of highly qualified academic staff whose professional activities are based on the provision of adaptive forms and tools for learning, taking into account the diversity and characteristics of higher education students. Increasing the level of accessibility of higher education for students with special needs not only contributes to the acquisition of knowledge and professional development of higher education students in this category but also ensures a high level of social integration and equity and reduces discrimination. However, it should be noted that the readiness of teachers to work with students with special needs and

their professional development directly affects the level of inclusiveness in the educational environment. This pedagogical training is based on developing flexible teaching skills, ensuring a positive emotional atmosphere, individualising education, and acquiring knowledge about the specifics of pedagogical approaches to higher education students with disabilities.

Despite the increased attention to the development of inclusive forms of education, the main problems include the need for methodological and psychological training of teachers, limited material and technical resources, and a formal approach to creating educational environments for students with special needs.

Therefore, an important way to solve these problems is to introduce teacher training programmes and courses on the specifics of working in an inclusive environment and adaptive teaching methods based on the real needs of students. It is also necessary to introduce modern technologies for working with students with special needs to provide methodological and didactic support for teachers in working with specialised software. The experience of working with students with special needs can be challenging for unprepared teachers; therefore, psychological preparation is an important aspect. Barth and Grütter (2024) identified the importance of promoting positive social norms for teaching students with special needs and the role of the teacher in this process. Hayar et al. (2022), Yazici and Uzuner (2024) outline the need to ensure accessibility of education for students with special needs and to conduct regular training for teachers. Davis et al. (2021) and Morsa et al. (2022) emphasise the need to implement in-service training programmes on inclusive education for teachers and to provide academic staff with consultations, mentoring and mentoring practices. Therefore, preparing teachers to work with students with special needs is an urgent issue of professional education and requires the use of the teaching staff's latest technologies and professional development and a systematic approach that considers all problematic issues.

The study is devoted to creating inclusive educational environments in higher education institutions and developing a model for training teachers to work with students with special needs.

Literature review

In their studies, Myhovych (2019) and Elavarasi et al. (2024) note the need for institutional support to train teachers to work with students with special needs to create inclusive educational environments. Syriopoulou-Delli et al. (2024) reviewed the most successful cases of higher education programmes that include training for people with autism spectrum disorders (ASD), including the integration of students with ASD into the educational community based on the assistance of a peer mentor to support the organisational and social skills of students with ASD.

Sokhibov and Azamjonov (2024) detailed the role of artificial intelligence in making education more accessible and inclusive, especially for students with disabilities. The paper establishes the importance of ethical frameworks and regulatory mechanisms to mitigate risks when implementing artificial intelligence in inclusive educational environments. Grindei et al. (2019) emphasise the importance of considering the individual needs of higher education students and providing teachers working with inclusive students with professional and methodological support.

Altes et al. (2024) outline the problem of insufficient understanding of inclusion by higher education teachers. Babenko et al. (2022) determined that analysing successful practices and regular professional development of teachers helps mitigate this problem. Shivani et al. (2024) and Šumak et al. (2024) emphasise the need to support the administration of higher education institutions in creating inclusive environments. Trishch et al. (2024) outline an approach to the learning management system using qualimetric methods, considering individualised trajectories of work with people with special needs. In their studies, Yim et al. (2024) and Zhao et al. (2024) outline the need for training in methods that consider the unique needs of higher education students, both physiological and psychological, when forming their learning paths.

An important aspect of ensuring inclusive education in higher education is modernising approaches to teaching students with disabilities. Yuhana et al. (2019) outline a gamified approach to learning mathematics based on the MathBarata

CompViewer game, which contains inclusive design options for displaying questions and a module for measuring and displaying competences achieved by the student. Modern digitalised learning tools provide advantages for teaching students with special needs; Lin et al. (2024) emphasise the effectiveness of AR and VR tools for creating personalised educational trajectories.

Researchers in modern pedagogical science, Oliynyk et al. (2020) focused on using digital learning tools and integrating STEM-based approaches to support educational environments for students with special needs. Homaira et al. (2022) outlined an educational model for students with disabilities based on machine learning algorithms. Machine learning algorithms can provide valuable insights because, based on learning data, they offer the most appropriate models for gaining equal access to learning for all categories of higher education students.

McInnes et al. (2023), in their study, paid attention to the issue of vocational training for people with disabilities in order to provide jobs for vulnerable groups of the population. It was determined that internships have a practical impact on the development of professional skills of inclusive-oriented segments of the population. However, such training requires teachers specially trained to provide knowledge for people with special needs.

Rajan et al. (2022) outlined a tool called Geomentoy that aims to help students in the Divyang community (blind and deaf) learn the basics of mathematical logic and geometry through a gamification approach with real-time learning. Also presented is a literacy tool for self-directed learning and a tactile tablet that allows visually impaired people to engage with graphical content using Braille. Recommendations for teaching students with disabilities and preparing teachers to work with this category of students are also provided. The issue of introducing inclusive education in higher education is relevant today, given the growing number of students with special needs. However, the key aspect of the literature analysis was the proper preparation of teachers to create inclusive educational environments.

Methods

The study of the problem of inclusive education in higher education used the methods of questioning teachers who took a course of preparation for working with students with special needs. During this course in the academic year 2023–2024, a pedagogical model for forming an inclusive environment in higher education institutions was presented and tested, and teachers were trained to work with students with special needs. This model was implemented as part of a course to train teachers to work with students with special needs at the Mykhailo Drahomanov Ukrainian State University. The course covered 120 hours and 4 ECTS credits, each corresponding to a specific block of the pedagogical model. It was assessed according to one of the four pre-formed criteria for teacher training. The course was created with the help of inclusive education experts, practising psychologists and technical specialists who develop and implement adaptive learning tools. The result was teachers' acquisition of competences in developing and implementing inclusive educational environments. Each module outlined the acquisition of competences within one of the four assessment criteria.

The first module was dedicated to the theoretical preparation of teachers to work with students with special needs. It included lecture material covering the following issues: peculiarities of development and needs of students with special needs, psychological aspects of working in an inclusive environment and ensuring the principles of accessibility and equality in education. To consolidate the knowledge gained, teachers were asked to take a module test and make a brief overview of the most successful global inclusive educational practices in their opinion. The second module was dedicated to general practical and technological training of teachers. The practical sessions covered the issues of adapting teaching materials to meet the needs of students with special needs, assistive technologies and technological solutions for inclusive education, the use of artificial intelligence, AR and VR, and gamification in inclusive education. As a practical consolidation of this module, teachers were asked to apply and implement one of the outlined

practical methods of inclusive education or its elements in presenting educational material in their teaching disciplines.

The third module was devoted to the psychological and social training of teachers. It included lecture material on developing empathy skills and providing emotional support to students with special needs and their social integration. The outcome of this module was a roundtable discussion of strategies for managing classroom behaviour in teams with students with special needs. The last module aimed to develop monitoring and analytical skills among teachers. Approaches to assessing learning outcomes and monitoring the learning progress of students with special needs were considered. This module's final task was to self-evaluate teachers' professional activities in the context of inclusive education. The result of the course is the acquisition by teachers of competences in developing and implementing inclusive educational environments and readiness to work with students with special needs.

There was an input and output measurement of the level of competence in the development and implementation of inclusive educational environments, which was carried out by deriving the average of self-assessment and teacher assessment by course coaches. The assessment was carried out according to the outlined criteria on a 12-point scale. In total, 76 teachers participated in the pedagogical experiment based on the pedagogical training.

An input and output survey of teachers working with students with special needs was conducted. The survey was conducted based on a questionnaire (Appendix 1), which was formed based on previously defined criteria and levels of teachers' preparation for working with students with special needs. To analyse the survey results, statistical methods were used, namely, comparing the level of teachers' preparation for working with students with special needs based on the formed training criteria and statistical calculation of the results obtained by Pearson's criterion χ^2.

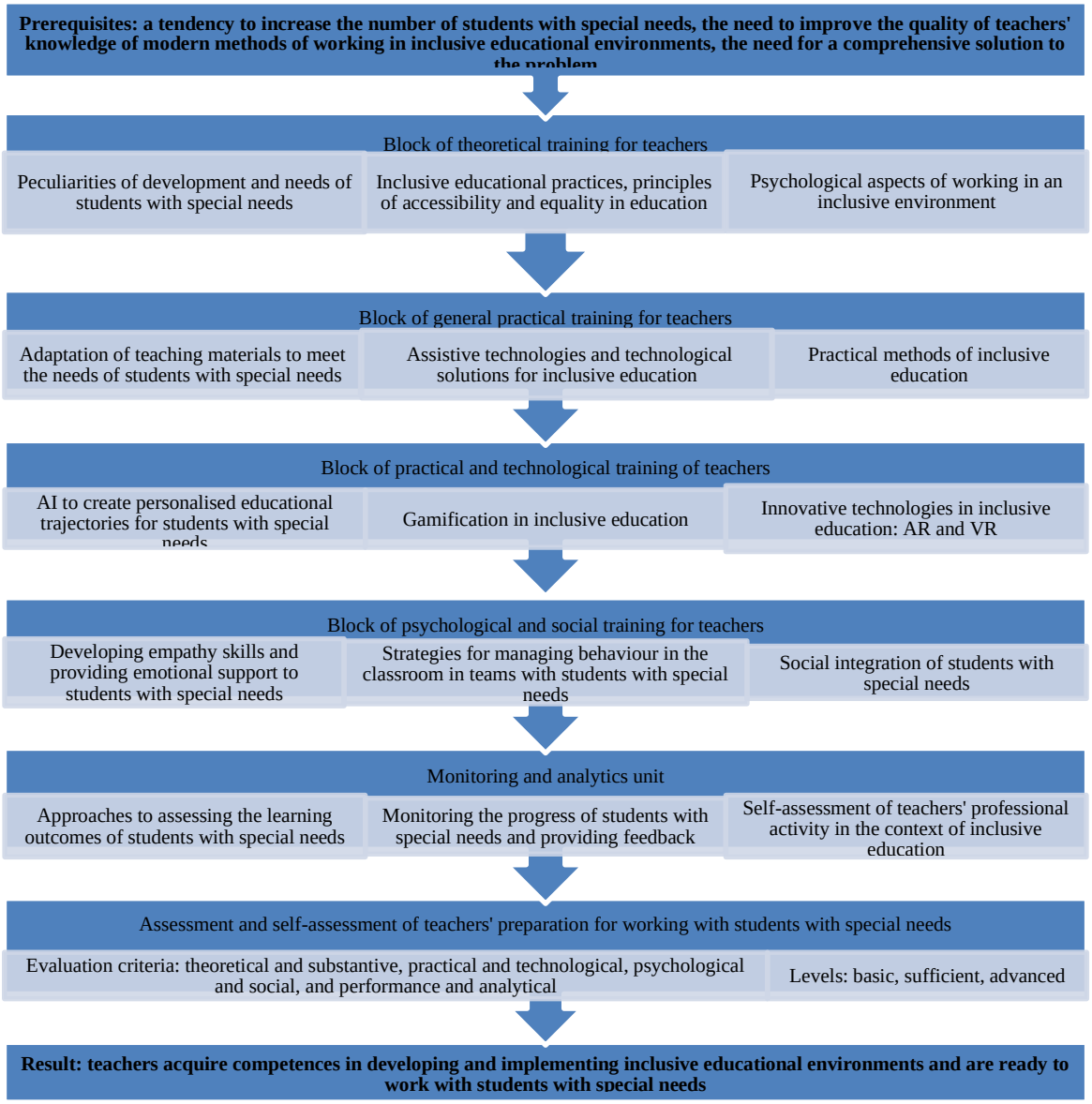
Results

To develop inclusive education in higher education, a pedagogical model for training teachers to work with students with special needs has been developed (Figure 1). This model is comprehensive and covers the key aspects of the problem: theoretical, practical, psychological, and analytical.

The model of training teachers to work with students with special needs is comprehensive and includes five blocks, each covering three key aspects of forming inclusive educational environments. The prerequisites for applying this pedagogical model are the tendency to increase the number of students with special needs, the need to improve the quality of teachers' knowledge of modern methods of working in inclusive educational environments and the need for a comprehensive solution to the problem.

The first block is the theoretical training of teachers, which includes the provision of fundamental knowledge about the needs and characteristics of this category of students. Also, in implementing this block of the pedagogical model, it is advisable to consider the most common inclusive educational approaches and the most successful cases of implementing inclusive educational practices. In addition, when forming inclusive educational environments of higher education institutions, it is necessary to adhere to the principles of equality and accessibility of education, and teachers should master psychological approaches for effective interaction in the following stages.

Figure 1 – Pedagogical model of training teachers to work with students with special needs



Source: compiled by the author.

The following two blocks of the model are devoted to practical training for working with students with special needs, which have the same result but different means to achieve it. The block of general practical training of teachers to work with students with special needs aims to develop pedagogical and technological skills to work in an inclusive environment. The ability to adapt teaching materials and educational programmes to the needs of students with disabilities through the use of different formats: text, audio, video and the use of assistive technologies and

programmes to support vision and hearing are the main components of the general practical training block. Also, in the context of this block, such practical, inclusive teaching methods are presented as: the formation of personalised learning paths, an individual approach to higher education students, and group and differentiated learning. Practical and technological training is aimed at studying the principles of using innovative technologies, such as the use of AI to create personalised learning paths, the use of gamification to improve the engagement of students with special needs, the use of AR, VR to create practice-oriented content, which is especially relevant for students with mobility impairments.

The block of psychological and social training of teachers is aimed at providing techniques of psychological support by teachers and levelling the social adaptation problems of students with special needs. Providing recommendations for the development of empathy and emotional support for this category of higher education students, methods of resolving conflict situations in teams where students with special needs study, and promoting the social integration of students with disabilities are considered in the context of this block of the pedagogical model of teacher training.

The monitoring and analytics block is aimed at assessing learning outcomes, monitoring educational trajectories and making adjustments to teaching methods based on the information received. An important aspect of this part of the pedagogical model is not only the analysis of learning outcomes for students with special needs but also the adaptation of assessment methods to personalised learning trajectories, concluding possible adjustments to teaching tools, methods, and educational trajectories based on feedback from students and self-assessment of their professional performance.

Self-assessment and evaluation by coaches of the course of training teachers to work with students with special needs was based on the following criteria: theoretical and content, practical and technological, psychological and social, and performance and analytical. According to the outlined pedagogical model, competences for working in inclusive educational environments can be formed at basic, advanced and sufficient levels. The result of applying the pedagogical model

of training teachers to work with students with special needs is the acquisition by teachers of competences in developing and implementing inclusive educational environments and readiness to work with students with special needs.

It is crucial to consider in detail the evaluation criteria and levels of implementation of the pedagogical model of training teachers to work with students with special needs. Table 1 presents the criteria for evaluating the application of the pedagogical model and its indicators.

Table 1 – Criteria for a pedagogical model of training teachers to work with students with special needs

Criterion	Indicator
C1: theoretical and substantive criterion	Understanding of the concept of accessibility and inclusiveness of higher education for students, as well as knowledge of regulations used to regulate the education of students with special needs.
	Awareness of the psychological and emotional characteristics of students with special needs (autism spectrum disorders, mobility, vision, hearing, psycho-emotional characteristics).
	Awareness of pedagogical methods and technologies for students with special needs.
C2: practical and technological criterion	Ability to adapt learning content to meet higher education students' inclusive needs, including using adaptive technologies.
	The use of assistive technologies, such as text-to-sound software, and setting up educational environments for students with visual and hearing impairments.
	Ability to develop personalised learning paths and individualised curricula for students with special needs.
C3: psychological and social criterion	Ability to communicate effectively with students with special needs and level of empathy.
	Ability to provide psychological support and ensure a comfortable and upbeat atmosphere when working in a team that includes students with special needs.
	The ability to manage an inclusive learning environment, including the ability to minimise potential conflicts and ensure a friendly atmosphere.
C4: performance and analytical criterion	Ability to correctly assess the acquired knowledge of higher education students with special needs and provide correct conclusions about the progress of this category of students by their characteristics.
	Ability to correct teaching methods when working with students with special needs promptly.
	Monitoring the effectiveness of pedagogical methods for working with students with special needs and timely adjustments to the educational process based on the data obtained.

Source: compiled by the author.

According to the self-assessment questionnaire presented in Appendix 1, a criterion-based assessment of teachers' preparation for working with students with special needs was carried out. For each criterion, the lowest score was 0 points, and

the highest score was 12 points. The basic level of teacher training was assessed from 0 to 4 points, sufficient – from 5 to 8 points, and advanced – from 9 to 12 points.

The basic level of teacher preparation to work with students with special needs outlines the acquisition of general knowledge on the principles of forming inclusive educational environments, the ability to adapt educational content to the needs of higher education students, empathy, and initial experience in an inclusive environment.

A sufficient level of preparation for teachers to work with students with special needs outlines knowledge of the principles of inclusive education and the psychological aspects of working in an inclusive environment. Teachers are able to use assistive technologies and develop personalised learning pathways, including adapting assessment methods.

The advanced level is characterised by in-depth knowledge of inclusive education theory, development and implementation of innovative, inclusive teaching methods and technologies, skills in analysing the implementation of individualised learning paths and their subsequent adjustment based on monitoring data, and practical psychosocial support skills for groups of students with special needs.

To conduct a pedagogical experiment, the essence of which was to assess the training of teachers to work with students with special needs in the context of implementing the developed pedagogical model of training, an unsatisfactory level of training was introduced for teachers who mastered the presented model at a level below the basic one.

In the context of studying the level of teachers' preparation for working with students with special needs, it is important to take into account each of the evaluation criteria and the uniformity of compliance with all criteria rather than a high level of acquisition of one of the criteria and low results of acquiring others, so the statistical evaluation of the effectiveness of the pedagogical model was carried out separately according to each of the criteria. The critical values of χ^2 for this sample are $\rho(0.05)\geq 9.49$, $\rho(0.01)\geq 13.28$. Table 2 presents the results of statistical

testing of the effectiveness of the pedagogical model of training teachers to work with students with special needs according to the theoretical and content criteria.

Table 2 – The results of statistical verification of the effectiveness of the pedagogical model of training teachers to work with students with special needs according to the theoretical and content criterion

Level	Number of % before E	n_i	Number of % after E	n_{i1}	$(n_i-n_{i1})^2$	$(ni-n_{i1})^2/n_{i1}$
Advanced	5,26%	4	21,05%	16	144	9,00
Sufficient	26,32%	20	51,32%	39	361	9,26
Basic	63,16%	48	25,00%	19	841	44,26
Unsatisfactory	5,26%	4	2,63%	2	4	2,00
Total amount	100,00%	76	100,00%	76		64,52

Note: n_i is the empirical frequency before the experiment, n_{i1} is the empirical frequency after the experiment, E is the experiment on the implementation of the model of training teachers to work with students with special needs.
Source: compiled by the author.

As a result of the analysis of Table 2, it was determined that the value of χ^2= 64.52 significantly exceeds the critical value, so we can conclude that the pedagogical model of teacher training for working with students with special needs is effective in the theoretical training of research and teaching staff and the acquisition of the content of inclusive education.

Table 3 presents the results of statistical testing of the effectiveness of the pedagogical model of training teachers to work with students with special needs according to the practical and technological criteria.

Table 3 – The results of statistical verification of the effectiveness of the pedagogical model of training teachers to work with students with special needs according to the practical and technological criterion

Level	Number of % before E	n_i	Number of % after E	n_{i1}	$(n_i-n_{i1})^2$	$(ni-n_{i1})^2/n_{i1}$
Advanced	3,95%	3	19,74%	15	144	9,60
Sufficient	25,00%	19	48,68%	37	324	8,76
Basic	64,47%	49	27,63%	21	784	37,33
Unsatisfactory	6,58%	5	3,95%	3	4	1,33
Total amount	100,00%	76	100,00%	76		57,02

Note: n_i is the empirical frequency before the experiment, n_{i1} is the empirical frequency after the experiment, E is the experiment on the implementation of the model of training teachers to work with students with special needs.
Source: compiled by the author.

The analysis of Table 3 shows that the value of χ^2= 57.02 significantly exceeds the critical value, so it can be concluded that the pedagogical model of teacher training for working with students with special needs is effective in the practical, technical and technological training of research and teaching staff and the development and implementation of inclusive educational environments.

Table 4 presents the results of statistical testing of the effectiveness of the pedagogical model of teacher training for working with students with special needs according to the psychosocial criterion.

As a result of the analysis of Table 4, it was determined that the value of χ^2= 50.65 significantly exceeds the critical value. Therefore, it can be concluded that the pedagogical model of training teachers to work with students with special needs is effective in creating a favourable psychological atmosphere in a team that includes students with special needs, integrating this category of students into the social life of the team and reducing the degree of psycho-emotional stress.

Table 5 presents the results of statistical testing of the effectiveness of the pedagogical model for training teachers to work with students with special needs according to performance and analytical criteria.

Table 4 – The results of statistical verification of the effectiveness of the pedagogical model of training teachers to work with students with special needs according to the psychological and social criterion

Level	Number of n_i % before E		Number of n_{i1} % after E		$(n_i-n_{i1})^2$	$(ni-n_{i1})^2/n_{i1}$
Advanced	7,89%	6	25,00%	19	169	8,89
Sufficient	27,63%	21	44,74%	34	169	4,97
Basic	61,84%	47	26,32%	20	729	36,45
Unsatisfactory	2,63%	2	3,95%	3	1	0,33
Total amount	100,00%	76	100,00%	76		50,65

Note: n_i is the empirical frequency before the experiment, n_{i1} is the empirical frequency after the experiment, E is the experiment on the implementation of the model of training teachers to work with students with special needs.
Source: compiled by the author.

Table 5 – The results of statistical verification of the effectiveness of the pedagogical model of training teachers to work with students with special needs according to the resultant analytical criterion

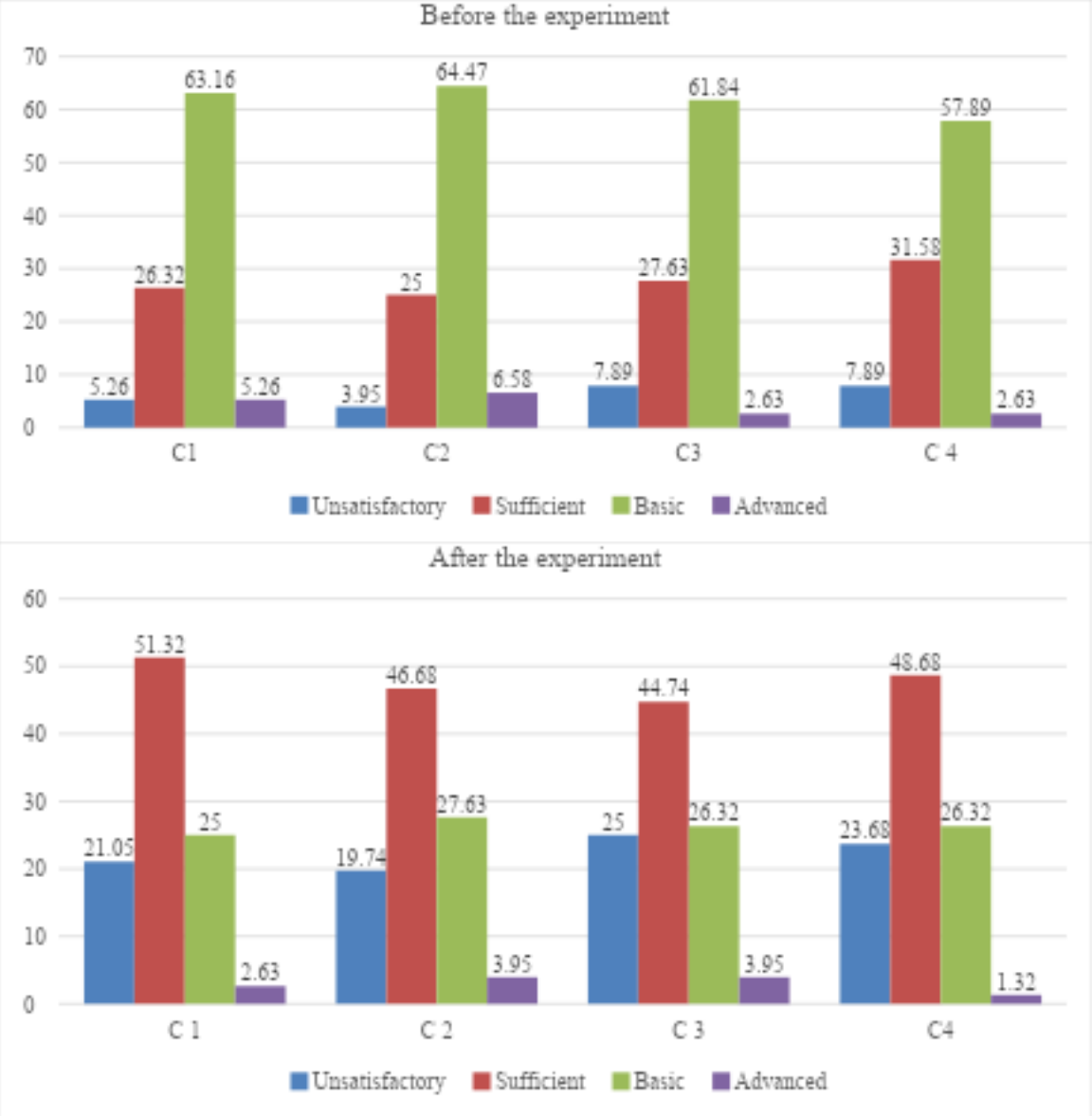
Level	Number of n_i % before E		Number of n_{i1} % after E		$(n_i-n_{i1})^2$	$(ni-n_{i1})^2/n_{i1}$
Advanced	7,89%	6	23,68%	18	144	8,00
Sufficient	31,58%	24	48,68%	37	169	4,57
Basic	57,89%	44	26,32%	20	576	28,80
Unsatisfactory	2,63%	2	1,32%	1	1	1,00
Total amount	100,00%	76	100,00%	76		42,37

Note: n_i is the empirical frequency before the experiment, n_{i1} is the empirical frequency after the experiment, E is the experiment on the implementation of the model of training teachers to work with students with special needs.
Source: compiled by the author.

The analysis of Table 5 shows that the value of $\chi^2 = 42.37$ significantly exceeds the critical value, so we can conclude that the pedagogical model of teacher training for working with students with special needs is effective in forming and adjusting individual learning paths, adapting assessment methods to the needs of this category of students and improving teachers' self-improvement skills.

Figure 2 presents the generalised results of evaluating the pedagogical model of teacher training for working with students with special needs according to the criteria outlined.

Figure 2 – Generalised results of the comparison of the evaluation of the application of the pedagogical model of teacher training for working with students with special needs in percentage terms



Notes: C1– theoretical and content criterion, C2 – practical and technological criterion, C3 – psychological and social criterion, C4 – resultant and analytical criterion.
Source: compiled by the author.

Analysing the data in Figure 2, it can be concluded that the number and percentage of teachers with a high and sufficient level of training to work with students with special needs are increasing, and the percentage of teachers with a basic and unsatisfactory level is decreasing. Thus, the model proposed by the

authors is effective, and an integrated approach to the formation and work in inclusive educational environments is needed.

Discussion

In a sense, education creates the conditions for people to acquire the necessary skills for their independence, including people with disabilities. For this reason, it is necessary to adopt measures and practices to strengthen knowledge and help these people improve their quality of life. Soto Muñoz et al. (2020) outline a pedagogical technology for using video games to help people with disabilities understand activities or strengthen knowledge and support the intellectual development of these people. The authors propose the development of a video game that will help teachers strengthen the mathematical competences of students diagnosed with autism spectrum disorder. The analysis by González-Arias et al. (2021) identified the increase in the number of students with special needs over the past decade and the need for an intelligent educational platform that will allow teachers and parents to improve their teaching and learning skills through the use of an intelligent learning system that will support daily activities in the classroom and at home. The study also provided support from a multidisciplinary team of experts who provided solutions to educational problems. Considering the studies reviewed, the problem of inclusive education in higher education is widespread in today's conditions, and the quality training of teachers to work with students with disabilities is an urgent issue that requires the development and implementation of modern didactic, methodological, technical and technological approaches.

Hahn and Ur Rahman (2016) identified barriers to sharing instruction with students with disabilities and ways to overcome them using the free TeamViewer software in combination with Skype, Krut Computer Recorder and Zoomtext, as they allow all learning material to be transmitted in an accessible format in real-time from the lecture computer directly to the screen of the student with a disability. In addition, they provide effective one-on-one instruction by allowing visually impaired students to follow along with ZoomText without restricting the online

instructor's field of vision. These apps can increase computer lab time and give students with disabilities more time to complete lab assignments. Remote access to the instructor's computer allows lectures to be streamed directly to the screen of visually impaired students. Remote access to education programmes can improve online collaboration even for people without disabilities and help to better integrate people with disabilities into an increasingly specialised and competitive workforce. However, their use requires training and coaching, as well as training and professional development for teachers on how to work in an inclusive educational environment.

The article by Scherer et al. (2022) aims to improve the understanding of supporting students with disabilities in customising learning environments based on their requests. Specifically, the authors documented the experiences of this category of students in an undergraduate summer research programme to identify the benefits they derive from participation, the specific challenges these students face, and new ways to promote inclusion. The study revealed the specific benefits, challenges and facilitators of participation in undergraduate research for students with physical disabilities, as obtained directly from the students themselves. In the context of practical training of teachers working with students with disabilities, the main facilitators for improving students' personal growth and increasing their confidence in their independence are the positive attitudes of teachers and the promotion of disability awareness among other categories of students, as well as emphasising the equality of the educational process.

Providing quality training for teachers to work with students with special needs can help this category of students feel more involved in the educational process. The pedagogical model of teacher training for working with students with special needs outlined in this article provides a variety of inclusive mechanisms that form a personalised learning path from accessibility to participation and aims to engage teachers with a different range of experience, interests and skill levels and shows positive results in terms of teacher training and improved abilities to work with students with special needs. A comprehensive approach to teacher training for inclusive educational environments should take into account the theoretical,

practical, psychological and analytical aspects of the issue and include the provision of knowledge from different categories of professionals, such as inclusive education specialists, psychological practitioners and technical specialists who develop and implement adaptive learning tools. Therefore, the professional training of teachers to work with students with special needs requires, first of all, practical methods and pedagogical technologies for implementing inclusive education in higher education.

Conclusion

Preparing teachers to work with students with special needs requires not only considering their characteristics and adapting teaching methods to meet their needs but also developing communication skills, empathy and a personalised approach. Teachers at higher education institutions need not only to provide academic knowledge but also the ability to integrate students with special needs into the learning process and adapt to each student's needs. Therefore, teachers need professional training to work with this category of students through specialised training that provides knowledge on developing personalised educational trajectories and modern adaptive learning tools.

The article presents a pedagogical model for training teachers to work with students with special needs. The result of implementing the proposed model is the readiness to work with students with special needs and the acquisition of competences by teachers in developing and implementing inclusive educational environments. The following evaluation criteria are presented to evaluate the effectiveness of the outlined pedagogical model: theoretical and content, practical and technological, psychological and social, and performance and analytical. The readiness of teachers to work with students with special needs is defined as basic, sufficient and advanced levels. The effectiveness of the proposed model was statistically confirmed during the calculation according to the Pearson criterion. It has been determined that creating an inclusive educational environment requires advanced training of teachers to be aware of modern methods and means of teaching students with special needs. Such training should also include information

on technical solutions for teaching aids and psychological aspects of interaction with students with special needs, and, therefore, such knowledge should be provided by specialists in inclusive education, technical specialists and psychologists.

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Appendix 1

QUESTIONNAIRES TO DETERMINE THE INPUT AND OUTPUT LEVEL OF TEACHERS' PREPARATION FOR WORKING WITH STUDENTS WITH SPECIAL

Please rate your level of preparation for working with students with special needs from 0 to 4, answering the questions about your professional level according to the assessment criteria. Notes: 0 is the lowest score, 4 is the highest score.

C1. Theoretical and substantive preparation of a teacher to work with students with special

Assess the level of your understanding of the concept of accessibility and inclusiveness of higher education and knowledge of regulations used to regulate the education of higher education students with special needs.

0	1	2	3	4

Assess the level of your awareness of the psychological and emotional characteristics of students with special needs (autism spectrum disorders, mobility, vision, hearing, psycho-emotional characteristics).

0	1	2	3	4

Assess your awareness of pedagogical methods and technologies used to work with students with special needs.

0	1	2	3	4

C2. Practical and technological preparation of teachers to work with students with special needs

Assess your ability to adapt educational content to higher education students' inclusive needs, including using adaptive technologies.

0	1	2	3	4

Assess your use of assistive technologies, such as text-to-sound software, in setting up educational environments for students with visual or hearing impairments.

0	1	2	3	4

Assess your ability to develop personalised learning paths and individualised curricula for students with special needs.

0	1	2	3	4

C3. Psychological and social preparation of teachers to work with students with special needs

Assess your ability to communicate effectively with students with special needs, including your level of empathy.

0	1	2	3	4

Assess your ability to provide psychological support and ensure a comfortable and upbeat atmosphere when working in a team that includes students with special needs.

0	1	2	3	4

Assess your ability to manage an inclusive learning environment, including your ability to minimise potential conflicts and ensure a friendly atmosphere.

0	1	2	3	4

C4. Effective and analytical preparation of a teacher to work with students with special needs

Assess your ability to correctly evaluate the knowledge acquired by higher education students with special needs and provide correct conclusions about the progress of this category of students by their characteristics.

0	1	2	3	4

Evaluate your ability to adjust teaching methods promptly when working with students with special needs.

0	1	2	3	4

Based on the data obtained, evaluate your level of monitoring the effectiveness of pedagogical methods for working with students with special needs and timely adjustments to the educational process.

0	1	2	3	4