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Original Article

Tecnologías digitales y formación docente para la educación inclusiva

Digital technologies and teacher preparation for inclusive education

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Resumen

El estudio investiga la efectividad de las tecnologías digitales en la preparación de futuros especialistas para trabajar en entornos educativos inclusivos. Se empleó un diseño de métodos mixtos que combinó enfoques teóricos, empíricos, experimentales y estadísticos. Los participantes incluyeron 90 estudiantes de educación superior, divididos en un grupo experimental (GE, n = 48) y un grupo de control (GC, n = 42). La intervención se basó en la creación de un entorno educativo digital inclusivo, la implementación de tecnologías de aprendizaje digital, trayectorias educativas individualizadas y métodos de enseñanza innovadores. La preparación para la actividad profesional en educación inclusiva se evaluó a través de componentes motivacionales, cognitivos y relacionados con la actividad. El análisis estadístico se realizó utilizando la prueba de chi-cuadrado de Pearson y el coeficiente de tamaño del efecto V de Cramer. Los resultados demostraron niveles de preparación sustancialmente más altos entre los estudiantes del GE en comparación con el GC. Al final del experimento, se identificó un alto nivel de preparación en el 73,8% de los estudiantes del GE frente al 19,2% de los estudiantes del GC, mientras que se observó una baja preparación en el 3,2% y el 32,1% de los estudiantes, respectivamente. Los valores t de Student obtenidos superaron el valor crítico (t > 2), lo que confirma un efecto experimental positivo. Los resultados indican que la integración de tecnologías digitales y condiciones pedagógicas específicas mejora significativamente la preparación de los futuros especialistas para trabajar en entornos educativos inclusivos.

Palabras clave: tecnologías digitales, educación inclusiva, preparación de futuros especialistas, educación especial.

Abstract

The study investigates the effectiveness of digital technologies in preparing future specialists to work in inclusive educational environments. A mixed-methods design combining theoretical, empirical, experimental, and statistical approaches was employed. The participants included 90 higher education students, divided into an experimental group (EG, n = 48) and a control group (CG, n = 42). The intervention was based on the creation of an inclusive digital educational environment, the implementation of digital learning technologies, individualized educational trajectories, and innovative teaching methods. Readiness for professional activity in inclusive education was assessed through motivational, cognitive, and activity-related components. Statistical analysis was conducted using Pearson's chi-square test and Cramer's V effect size coefficient. The results demonstrated substantially higher readiness levels among students in the EG compared with the CG. At the end of the experiment, a high level of readiness was identified in 73.8% of EG students versus 19.2% of CG students, while low readiness was observed in 3.2% and 32.1% of

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students, respectively. The obtained Student's t-values exceeded the critical value (t > 2), confirming a positive experimental effect. The findings indicate that the integration of digital technologies and targeted pedagogical conditions significantly enhances future specialists' readiness to work in inclusive educational environments.

Keywords: digital technologies, inclusive education, readiness of future specialists, special education.

Introduction

The relevance and importance of inclusive education in the world stem from its role as a component of the social state's integral policy, reflecting global trends toward ensuring equal opportunities and rights for each individual. As a key factor in professional development and self-realization, higher education requires creating a barrier-free environment that ensures active participation in student life and access to knowledge, which are prerequisites for the successful socialization of each person. There are certain difficulties in many countries of the world in creating an inclusive educational environment and implementing inclusion tasks due to the inability of educational institutions to take into account and accept social challenges timely: to introduce pedagogical innovations, the latest digital technologies, in accordance with the nature and content of the organization of the educational process, new strategies for pedagogical interaction between students of the educational space and teachers based on personally oriented education, etc. (Ravichandran & Mahapatra, 2023).

In countries where inclusive education has only recently begun to be actively implemented, it is difficult to overcome socio-pedagogical stereotypes. After all, the creation of an inclusive educational environment and the implementation of an inclusive approach in education require an appropriate balance: each person with a disability receives appropriate educational services and feels a sense of personal significance in the educational environment (Veytia Bucheli et al., 2024).

Digital technologies contribute to the development of key competencies in future specialists in inclusive education. The use of digital technologies today is a tool, not just a requirement of the time, which allows: to expand the reach of quality education to vulnerable and remote population groups; to take into account the circumstances of each higher education seeker and their individual needs through the personalization of educational process methodologies and curricula; to quickly analyze and track the effectiveness of various approaches and pedagogical strategies, ensuring constant optimization of the educational process (Abdullah et al., 2025); easily integrate, creating inclusive flexible educational environments through the use of digital technologies, new resources, pedagogical tools and courses; use online platforms to provide social support and psychological assistance; maximize through digital optimization of management and educational processes in the education system through the use of available innovative resources.

In the field of inclusive education, the professional training of future specialists must address contemporary challenges by equipping them with the knowledge and skills necessary for effective practice. The integration of digital technologies into higher education enhances the quality of instruction by introducing innovative teaching methods and providing both technical and methodological support for learning (Espinosa Domínguez et al., 2025).

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A key advantage of digital technologies in inclusive education is their ability to adapt learning to individual student needs. Through interactive resources, personalized curricula, and assistive digital tools, educators can ensure equal learning opportunities and support the successful inclusion of all students in the digital educational environment. Research highlights several benefits of digital technologies for inclusive education. These include overcoming communication barriers, increasing learner autonomy, providing flexible access to educational resources, and supporting the development of digital competence and communication skills. Digital tools also enable students to learn at their own pace, increase motivation and engagement, facilitate repeated practice through virtual simulations, and stimulate cognitive development (Page et al., 2021; Main et al., 2016).

Additional assistive technologies, including voice recognition systems and adapted text formatting, support learners with dyslexia, dysgraphia, and other learning difficulties (Taxiarchis, 2023).

Artificial intelligence further enhances inclusive education through chatbots, virtual assistants, and speech synthesis tools that facilitate communication and learning for students with diverse needs (Mohammed & Watson, 2019). The integration of such technologies contributes to the creation of inclusive digital learning environments where all students can participate fully and realize their potential (Elsin & Sathya, 2024).

Moreover, digital technologies support innovative teaching approaches, including interactive learning activities and personalized curricula. Their use promotes the development of essential competencies such as digital literacy, critical thinking, communication, and collaboration, thereby improving the quality and effectiveness of specialist training in inclusive education (Viner et al., 2022).

Despite the growing body of research on inclusive education and the integration of digital technologies into teaching and learning, limited attention has been devoted to the systematic development of future specialists' readiness to work in inclusive digital educational environments. Existing studies primarily focus on technological tools, accessibility issues, teachers' attitudes, or institutional factors, while insufficient evidence is available regarding pedagogical conditions that effectively foster motivational, cognitive, and practical readiness among future professionals.

The scientific contribution of this study lies in the development and experimental validation of a pedagogical model that integrates digital technologies with inclusive educational practices and evaluates its effectiveness through empirical and statistical analysis.

Literature Review

In the field of inclusive education, a wide range of research covers theoretical and methodological principles, practical aspects of its implementation, and the research of scientists, Rojas Gonzalez & Ramirez Sanchez (2025), which covers the influence of subjective factors on the success of integration, allowing for a comprehensive understanding of the challenges in the field and the current state of the educational process.

Researchers Long et al. (2025) focused on factors that significantly influence the implementation of inclusive education in general education institutions. The

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researchers examined teachers' roles and attitudes, self-competence, and readiness to work in inclusive education. The researchers show the practical determinants and difficulties of successful integration, which are important today for understanding the basic mechanisms of creating an inclusive educational environment through the use of digital technologies.

Rubio-Pacheco & Fino (2023) analyze the role of digital technologies and innovation in transforming modern education through a documentary review. The study demonstrates that ICT integration significantly improves teaching and learning processes by creating flexible, interactive, personalized, and inclusive learning environments. The authors emphasize that digital tools have become essential components of contemporary educational ecosystems, contributing to higher educational quality and more effective student engagement and development.

Hernández Mendoza et al. (2025) emphasize that technology has transformed contemporary educational practices by enabling innovative models such as project-based learning, personalized education, and digital learning platforms. The authors argue that these approaches promote active student participation, collaboration, and engagement while allowing educators to adapt teaching strategies to learners' needs. The study also highlights challenges in teacher training and equitable access to technological resources, underscoring the importance of creating inclusive learning environments that foster students' critical and creative skills through effective use of technology.

Sánchez et al. (2024) examine the role of assistive technologies in distance and digital education for learners with disabilities through a literature review. The study highlights that assistive technologies enhance access, participation, autonomy, and independence in learning environments, particularly for individuals with visual and hearing impairments. The authors emphasize the importance of inclusive instructional design, teacher preparation, continuous professional development, and collaboration among educators, families, and communities. The findings also underscore the relevance of Universal Design for Learning and the need to address ongoing challenges in technological adaptation for inclusive digital education.

Thus, in the field of inclusive education, a wide range of research covers theoretical and methodological principles, practical aspects of its implementation, and pays insufficient attention to the development of future specialists' readiness to work in an inclusive educational environment through the use of digital technologies.

The reviewed studies consistently confirm the positive role of digital technologies in supporting inclusive education. Researchers emphasize that assistive technologies, adaptive learning systems, artificial intelligence tools, virtual learning environments, and digital educational resources improve accessibility, learner engagement, and educational outcomes for students with diverse educational needs. These findings suggest that digital technologies have considerable potential for enhancing inclusion in higher education.

However, the existing literature reveals several limitations and unresolved issues. First, many studies focus primarily on the effectiveness of specific technological tools rather than on the comprehensive preparation of future specialists for professional work in inclusive educational environments. While digital technologies are widely acknowledged as supportive instruments, there is limited evidence regarding how they contribute to the development of professional readiness, including motivational, cognitive, and practical competencies.

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Previous studies report inconsistent findings regarding the effectiveness of digital technologies in inclusive settings. Some researchers highlight substantial improvements in accessibility, engagement, and individualized learning, whereas others point to barriers related to insufficient digital competence, inadequate pedagogical support, limited institutional resources, and resistance to educational change. These contrasting findings indicate that technology alone does not guarantee successful inclusion and that pedagogical conditions play a critical mediating role.

Although numerous studies investigate inclusive education and digital transformation separately, relatively few examine their integration within a unified framework for professional training. The literature lacks experimentally validated models that explain how digital technologies can be systematically incorporated into the preparation of future specialists for work in inclusive educational environments.

A significant research gap remains regarding the design and empirical validation of pedagogical conditions that effectively combine digital technologies with inclusive educational practices. Addressing this gap provides the rationale for the present study and justifies the implementation of the proposed experimental intervention.

Research objective. Formation of the readiness of future specialists to work in an inclusive educational environment through the use of digital technologies.

Methodology

The study employed a mixed-methods research design combining theoretical, empirical, experimental, and statistical approaches to investigate the formation of future specialists' readiness to work in an inclusive educational environment through the use of digital technologies. The methodological framework was grounded in the principles of inclusive pedagogy, digital transformation of education, competency-based learning, and learner-centered educational approaches.

Research Design

The research was conducted in three consecutive stages: organizational, design, and diagnostic. The study included both an experimental group (EG) and a control group (CG). Students in the control group studied according to the traditional methodology, whereas students in the experimental group were trained using specially developed pedagogical conditions and digital technologies aimed at enhancing readiness for inclusive educational practice.

Participants

The study involved 90 undergraduate students enrolled in teacher education and special education programs at three higher education institutions. Participants were recruited using purposive sampling because all students were preparing for future professional activities in inclusive educational settings. Eligibility criteria included: (a) enrollment in pedagogical or special education programs; (b) completion of at least one year of university studies; and (c) consent to participate in the research. Students who had previously completed specialized courses in inclusive digital education were excluded from participation.

The sample consisted of 62 females (68.9%) and 28 males (31.1%), aged between 18 and 23 years (M = 20.4, SD = 1.3). Participants were assigned to an experimental

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group (EG, n = 48) and a control group (CG, n = 42). Prior to the intervention, no statistically significant differences were identified between groups regarding readiness levels for work in inclusive educational environments ($\chi^2(2) = 1.21$, $p = .546$), indicating initial comparability.

Research Instruments

Readiness for professional activity in inclusive digital educational environments was assessed using a comprehensive diagnostic framework consisting of three dimensions: motivational, cognitive, and activity-related readiness.

The motivational component was measured using a 15-item questionnaire assessing professional motivation, attitudes toward inclusive education, willingness to use digital technologies, and responsibility for educational decision-making. Responses were recorded on a five-point Likert scale.

The cognitive component was evaluated through a 30-item knowledge test covering principles of inclusive education, assistive technologies, digital learning tools, individualized educational trajectories, and inclusive instructional design.

The activity-related component was assessed through practical case-based tasks requiring participants to design inclusive digital learning activities, select appropriate digital tools, and propose educational adaptations for students with special educational needs.

Content validity of the instruments was established through expert evaluation involving seven specialists in inclusive education and educational technologies. The Content Validity Index (CVI) was .91. Internal consistency demonstrated satisfactory reliability: motivational scale (Cronbach's $\alpha = .87$), cognitive test (KR-20 = .84), and activity-related assessment (Cronbach's $\alpha = .89$). Pilot testing with 25 students not involved in the main study confirmed the clarity and applicability of all instruments.

Educational Intervention

The intervention was implemented during one academic semester (16 weeks) and consisted of four interconnected pedagogical conditions.

First, an inclusive digital educational environment was established using Moodle, Microsoft Teams, and Google Classroom. Students gained access to adapted learning materials, multimedia resources, discussion forums, and collaborative digital workspaces.

Second, digital learning technologies were systematically integrated into coursework. Participants used Mindomo for concept mapping, Khan Academy for self-paced learning, ClassDojo for feedback and monitoring, and assistive technologies such as text-to-speech software, screen readers, adaptive keyboards, and interactive whiteboards.

Third, individualized educational trajectories were developed for each participant. Students selected learning modules, completed differentiated assignments, and received personalized feedback according to their professional interests and competence levels.

Fourth, innovative instructional methods were employed, including project-based learning, case-study analysis, collaborative problem-solving, simulation exercises,

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reflective practice, and microteaching activities focused on inclusive educational scenarios.

Throughout the intervention, participants completed practical tasks involving the design of inclusive lesson plans, development of digital learning resources for students with special educational needs, implementation of assistive technologies, and evaluation of accessibility in digital educational environments.

The control group followed the standard curriculum without additional digital-inclusive pedagogical conditions.

Components and Criteria of Readiness

The study identified three structural components of readiness for professional activity in an inclusive educational environment through digital technologies:

1. **Motivational component** – characterized by tolerance, initiative, stimulation, professional interest, awareness, and positive attitudes toward inclusive education.
2. **Cognitive component** – reflected the level of theoretical, methodological, and specialized knowledge related to inclusive education and digital technologies.
3. **Activity component** – included professional skills, practical application of digital tools, and the ability to organize inclusive educational interaction.

Three levels of readiness were distinguished: low, average, and high.

Research Methods

To achieve the research objective, the following methods were applied:

- **Theoretical methods:** analysis, synthesis, comparison, systematization, generalization, and interpretation of psychological, pedagogical, methodological, and scientific literature related to inclusive education and digital technologies.
- **Empirical methods:** observation, questionnaires, interviews, conversations, and reflection.
- **Experimental methods:** ascertaining and formative pedagogical experiments.
- **Statistical methods:** Pearson's chi-square criterion, Student's t-test, and correlation analysis for evaluating the effectiveness of the experimental intervention.

Experimental Procedure

At the ascertaining stage, participants' initial readiness levels were diagnosed through questionnaires and assessment tasks. The findings demonstrated insufficient motivation, low confidence in applying digital technologies in inclusive education, and inadequate preparedness for individualized educational practice.

During the formative stage, the experimental group was exposed to specially designed pedagogical conditions, including:

- Creation of an inclusive digital educational environment.
- Implementation of digital educational technologies.
- Use of individualized educational trajectories.

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- Application of innovative teaching methods.
- Stimulation of professional motivation and responsibility.
- Organization of collaborative learning based on partnership pedagogy.

The experimental methodology incorporated digital tools and platforms, including Microsoft Teams, Google Classroom, Moodle, Mindomo, Duolingo, ClassDojo, and Khan Academy. Assistive technologies, interactive whiteboards, visualization software, and adaptive digital resources were also integrated into the learning process.

Data Analysis

Quantitative data were analyzed using Pearson's chi-square test to compare the distribution of readiness levels between the experimental and control groups. To assess the practical significance of the obtained differences, Cramer's V was calculated as an effect size measure. Statistical significance was established at $p < .05$.

Results and Discussion

Experimental study of the formation of readiness of future specialists to work in an inclusive educational environment through the use of digital technologies.

To assess the readiness of future specialists to work in an inclusive educational environment through the use of digital technologies, three interconnected components were identified: motivational, cognitive, and activity-based.

The motivational component reflects students' willingness to engage in inclusive professional practice and is assessed through indicators such as aspiration, awareness, attitudes, interests, and the need for professional development. The cognitive component encompasses theoretical and specialized knowledge related to inclusive education and digital technologies, reflecting the understanding necessary for effective professional activity. The activity component refers to the practical application of knowledge and the development of professional skills required for work in inclusive digital learning environments.

Based on these components, three levels of readiness were distinguished: low, average, and high. The implementation of the proposed pedagogical conditions was carried out through three consecutive stages: organizational, design, and diagnostic.

Organization of the ascertaining stage of research and experimental work.

Let us present the results of the ascertaining experiment and describe the process of the research we conducted.

Thus, the following results were obtained for the question "Do you consider it necessary to create an inclusive educational environment through the use of digital technologies?":

- 13.0% of respondents answered "yes".
- 44.1% of respondents answered "no".
- 42.9% of respondents answered, "I do not know".

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Such results indicate a lack of awareness of the importance of creating an inclusive educational environment through digital technologies.

The answers to the question “Are you ready to use special methods to prepare for work in inclusive education, to take responsibility for the selection of digital technologies, innovative techniques, effective methods, forms, and means in inclusive education?” showed that most future specialists are not confident that they can take responsibility for the specified content components of inclusive education. We confirm this statement with the following results:

- 19.1% of respondents answered “yes”.
- 64.7% of respondents answered “no”.
- 16.2% of respondents answered, “I do not know”.

Answers to the question: “Are you ready for the individualization of the educational process, for building and developing an individual educational trajectory for each individual and for the cooperation of all subjects, taking into account the principles of partnership pedagogy?”

We received the following results:

- 12.9% of respondents answered “yes”.
- 54.9% of respondents answered “no”.
- 32.2% of respondents answered, “I do not know”.

Such survey results, collected at the ascertaining stage of the study, indicate insufficient motivation to increase their professional level in the field of study at higher education institutions during the study process.

Students are convinced that “To increase the level of their readiness for the outlined problem in the conditions of inclusive education, they need pedagogical conditions that we have developed and implemented in the EG. This is also emphasized by the results of the ascertaining stage on the levels of development of the identified components of the readiness of future specialists to work in an inclusive educational environment through the use of digital technologies.

The levels of formation of the identified components regarding the readiness of future specialists to work in an inclusive educational environment through the use of digital technologies at the ascertaining stage of the study:

- A low level was shown by 38.0% of respondents.
- An average level was shown by 53.1% of respondents.
- 8.9% of respondents indicated a high level, which indicates inefficiency in the traditional organization of professional training for specialists in higher education institutions in terms of the formation of the studied components.

To test the research hypothesis, we used non-parametric criteria and established parametric criteria: Pearson's correlation coefficient, Student's t-test, and correlation analysis.

Modern education seeks pedagogical conditions that would contribute to the formation of the specified readiness of future specialists and ensure the assimilation of a certain amount of information through digitalization, the implementation of

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experimental methods, and the creation of an inclusive educational environment using digital technologies.

We have identified pedagogical conditions for the effectiveness of forming the readiness of future specialists to work in an inclusive educational environment through the use of digital technologies:

- Creation of an inclusive educational environment through the use of digital technologies.
- Use of special methods for preparing for work in inclusive education, taking responsibility for the selection of digital technologies, innovative techniques, effective methods, forms, and means in inclusive learning.
- Individualization of the educational process, to build and develop an individual educational trajectory for each individual.
- Cooperation of all subjects, taking into account the principles of partnership pedagogy.
- Stimulating future specialists to have a responsible and motivational attitude towards acquiring knowledge, skills, and abilities in inclusive education.
- Directing educational and pedagogical practice towards improving the inclusive educational environment through the use of digital technologies.

The modern range of digital resources and tools enables the design of a variety of pedagogical strategies within the created inclusive educational environment for teaching children with special needs. Let us name the possibilities and ways of using digital technologies in the inclusive process that were offered to EG students during their pedagogical practice:

- Compensatory purposes mean the use of digital technologies for support and technical assistance that allow students with special needs to engage in communication and interaction processes (e.g., help for a child with a motor impairment when writing, and for a child with vision problems when reading). Therefore, digital technologies can facilitate a person's interaction with the world and immediate environment, provide open access to educational information for a child, and partially replace the absence of or compensate for natural functions.
- For communication purposes, the use of digital technologies and the creation of an inclusive educational environment are tools that make it easier for people with communication disorders to exchange information more conveniently, can serve as intermediaries in communication between people with special needs, and can be alternative forms of communication.
- For didactic purposes, the inclusive educational environment enables the implementation of special services for geographically remote participants in the educational process through digital technologies.

Digital tools in the modern, inclusive educational environment within the context of higher education development play a key role and serve as a significant basis for ensuring the quality of education for applicants with special educational needs.

In EG, we implemented digital technologies within the newly created inclusive educational environment, thereby influencing the quality of inclusive and special education. The main ones were:

- Online platforms such as Microsoft Teams, Google Classroom, Moodle, and virtual classrooms, which allow students with disabilities to communicate with teachers and peers, and access educational materials, are necessary to ensure

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equal conditions for all participants in the educational process, regardless of physical limitations or their place of residence.

- Visualization software: Mindomo and Inspiration, which significantly helped students with special needs to structure and organize information, significantly facilitating the educational process and making it more effective.
- Mobile applications designed for personal development and learning, such as Duolingo, ClassDojo, and Khan Academy, provided students with the opportunity to independently complete tasks and study materials at a time convenient for them. This approach to learning is important for students with special needs because it allows them to learn at their own pace and in accordance with their abilities.
- Assistive technologies, such as specialized keyboards and mice, text-reading software, and devices that control a computer with gaze, help students with cognitive or physical disabilities participate actively in the educational process. These technologies allow you to adapt educational materials to each applicant's individual needs, significantly increasing the efficiency of the educational process.
- Interactive whiteboards (SMART Board) allow you to conduct interactive lessons, involve applicants in active participation in the educational process, which contributes to the development and better assimilation of the material, and the formation of communication and cooperation skills.

The introduction of these digital tools into special and inclusive education has helped create an inclusive educational environment in which each applicant has the opportunity to realize their potential. Such digital tools help to improve the quality of education, providing applicants with special educational needs with individual support and an approach to learning.

The introduction of digital technologies into the newly created inclusive educational environment during the professional training of specialists requires a scientifically sound and systematic approach, as implemented in the EG.

Let us list the principles on which the inclusive educational digital environment is based, which were proposed in the EG:

- Equal access for all participants in the educational process and the provision of quality education by creating an inclusive digital educational environment.
- The use of digital innovative technologies.
- Creation by society of certain conditions for their implementation by each student, enabling them to determine and take into account the ability to quality learning.
- Adherence to partnership pedagogy with all participants in the educational space;
- Ensuring access to all digital resources and realizing each child’s right to develop within the family circle.
- Development of individual child development programs, curricula, calendars, and thematic planning based on individual and personally oriented approaches.
- Implementation of the results of modern practices and research in the implementation of an inclusive model of learning in the educational digital environment.

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Formative experiment and results of research and experimental work.

At the stage of the experimental study, we implemented an experimental methodology, established pedagogical conditions for the formation of the specified readiness of future specialists, applied pedagogical and experimental influence by creating an inclusive educational environment using digital technologies, and monitored the development outcomes and processes of specific components of the studied qualities.

The results of the study showed that the levels of formation of the identified components regarding the readiness of future specialists to work in an inclusive educational environment using digital technologies at the formative stage of the study in the EG were significantly higher than at the ascertaining stage (Fig. 1):

In the EG:

- 3.2% of respondents had a low level of readiness of future specialists in inclusive education.
- 25.6% of respondents had an average level of readiness of future specialists in inclusive education.
- 73.8% of respondents had a high level of readiness of future specialists in inclusive education.

In the CG:

- 32.1% of respondents had a low level.
- 48.7% of respondents showed an average level.
- 19.2% of respondents showed a high level.

Thus, no significant changes were observed in the CG.

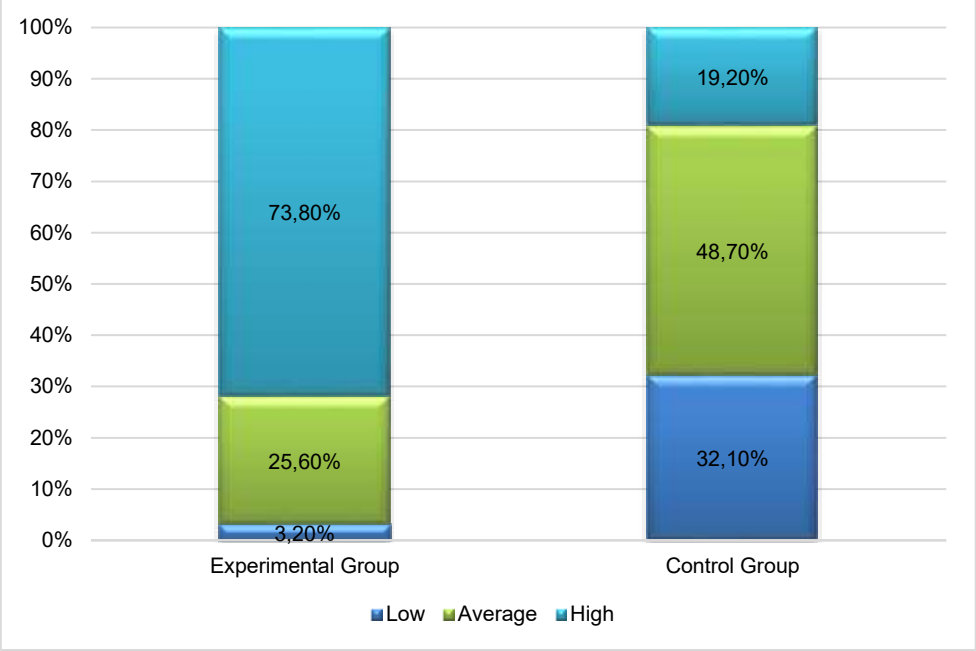

Figure 1. Readiness Levels of Future Specialists for Inclusive Education Using Digital Technologies (EG vs. CG)

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The results of the formative experiment demonstrated substantial differences between the experimental group (EG) and the control group (CG). In the EG, 73.8% of participants achieved a high level of readiness, compared with 19.2% in the CG. At the same time, only 3.2% of EG students demonstrated a low level of readiness, whereas this proportion reached 32.1% in the CG.

To determine whether these differences were statistically significant, Pearson's chi-square test was applied. The analysis revealed a significant association between group membership and readiness level, $\chi^2(2, N = 90) = 24.86$, $p < .001$. The effect size, measured using Cramer's V, was 0.53, indicating a large practical effect. These findings confirm that the distribution of readiness levels differed significantly between the experimental and control groups.

The obtained results provide empirical evidence that the implementation of the proposed pedagogical conditions and digital technologies contributed substantially to the development of future specialists' readiness to work in inclusive educational environments.

In order to analyze the general level of students' readiness to work in an inclusive educational environment through the use of digital technologies in CG and EG, as well as to integrate the indicators of the outlined components, the following quantitative indicators were determined using the formula "averaged relative":

$$P = \frac{n_k + n_e + n_p}{3}$$

$$P = \frac{5{,}8 + 6{,}7 + 3{,}28}{3}$$

$$P = 2{,}6$$

P – in the % "average relative" indicator, which reflects, with the same level of formation of components, the number of future specialists, their readiness for the outlined phenomenon in the conditions of inclusive education.

n – the number of students of a certain level of readiness for the outlined phenomenon in the conditions of inclusive education.

Based on the readiness indicators, we calculated the "average relative" preparedness of future specialists for the phenomenon outlined in the context of inclusive education for the experimental and control groups.

The results of the evaluation of educational tasks and the survey questionnaire of respondents of the EG are higher than those of the students in the CG. Thus, the implementation of experimental methods in the EG, pedagogical conditions for the formation of the readiness of future specialists to work in an inclusive educational environment through the use of digital technologies, pedagogical and experimental influence through the creation of an inclusive educational environment through the use of digital technologies led to the understanding that such experimental training is necessary for EG students, which determines better indicators of the level of formation of all components of the readiness of EG respondents, compared to the corresponding results of CG respondents.

The findings of the present study are consistent with previous research emphasizing the positive role of digital technologies in inclusive education. In particular, the substantial increase in readiness levels among students in the experimental group

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supports the conclusions of Rubio-Pacheco & Fino (2023), who reported that the integration of digital technologies contributes to more flexible, personalized, and inclusive learning environments. Similarly, the results corroborate the findings of Hernández Mendoza et al. (2025), who demonstrated that technology-enhanced educational models promote active participation, learner engagement, and the development of professional competencies.

The positive outcomes observed in the experimental group also align with the conclusions of Sánchez et al. (2024), who highlighted the importance of assistive technologies for improving accessibility, participation, and autonomy in inclusive educational settings. The implementation of digital platforms, adaptive resources, and assistive technologies in the present study appears to have contributed to the development of students' motivational, cognitive, and practical readiness for future professional activities.

At the same time, the present results partially extend previous research by demonstrating not only the educational benefits of digital technologies but also their contribution to the systematic formation of professional readiness among future specialists. While earlier studies primarily focused on accessibility, technological tools, or teachers' attitudes toward inclusion, the current study examined readiness as a multidimensional construct comprising motivational, cognitive, and activity-related components.

Nevertheless, several methodological limitations should be acknowledged. First, the study involved a relatively small sample (N = 90), which may limit the generalizability of the findings. Second, participants were recruited from a limited number of higher education institutions, and therefore the results may not fully represent future specialists from different educational contexts. Third, readiness levels were assessed using questionnaires and pedagogical assessments, which may be influenced by self-report bias and participants' subjective perceptions. In addition, the study evaluated outcomes immediately after the intervention; therefore, the long-term sustainability of the observed effects remains unclear.

Another factor that may have influenced the results is the increased engagement of students in the experimental group resulting from exposure to innovative digital tools and learning activities. Consequently, part of the observed improvement may be associated with the novelty effect rather than exclusively with the pedagogical conditions themselves. Future research should employ larger and more diverse samples, longitudinal designs, and validated measurement instruments to further examine the stability and transferability of the reported outcomes.

Overall, despite these limitations, the findings provide empirical evidence that the integration of digital technologies within purposefully designed pedagogical conditions can significantly enhance the readiness of future specialists to work in inclusive educational environments.

Conclusions

This study investigated the effectiveness of pedagogical conditions aimed at developing future specialists' readiness to work in inclusive educational environments through the use of digital technologies. The findings confirmed that the integration of digital technologies within a purposefully designed inclusive educational environment positively influences the formation of motivational, cognitive, and activity-related components of professional readiness.

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The proposed pedagogical conditions, including the creation of an inclusive digital educational environment, the implementation of digital learning technologies, individualized educational trajectories, innovative teaching methods, and collaborative learning practices, contributed significantly to students' professional development. Participants in the experimental group demonstrated substantially higher readiness levels than those in the control group, indicating the effectiveness of the implemented intervention.

Statistical analysis confirmed significant differences between the experimental and control groups ($\chi^2(2, N = 90) = 24.86$, $p < .001$, Cramer's $V = 0.53$), demonstrating a strong association between participation in the experimental program and higher levels of readiness for professional activity in inclusive educational settings. These results provide empirical support for the integration of digital technologies as an effective means of preparing future specialists for inclusive practice.

The study contributes to the existing literature by extending current understanding of how digital technologies can be systematically incorporated into specialist training within inclusive education. Unlike previous studies that primarily focused on accessibility, assistive technologies, or individual digital tools, the present research examined a comprehensive pedagogical framework integrating motivational, cognitive, and practical dimensions of readiness.

Several limitations should be acknowledged. The relatively small sample size and the involvement of students from a limited number of higher education institutions may restrict the generalizability of the findings. Furthermore, the study assessed outcomes immediately after the intervention, making it difficult to determine the long-term sustainability of the observed effects.

Future research should focus on longitudinal evaluation of readiness development, validation of the proposed model across diverse educational contexts, and investigation of the role of emerging technologies, including artificial intelligence, learning analytics, adaptive learning systems, and immersive technologies, in enhancing professional preparation for inclusive educational practice.

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