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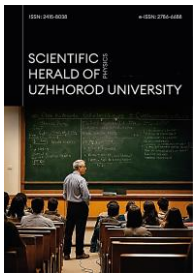

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Project-based teaching of computer science in inclusive education using digital technologies

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Abstract

Relevance. The relevance of the research is due to the rapid development of information technologies and the digital environment, which requires constant updating of educational methodologies and their adaptation for inclusive educational practices.

Purpose. This article aims to research and develop a methodology that would contribute to the effective implementation of project-based learning using digital technologies in inclusive education in the field of computer science.

Methodology. The leading method of researching this problem was system analysis. The following methods of scientific cognition were also applied: logical analysis, comparison, synthesis, deduction, and classification.

Results. The study reveals the indicators of inclusive education, including student involvement, accessibility, indicators of student achievement, and professional competence of teachers. It also highlights barriers and discrimination, funding, and cooperation. The concept of project-based learning, its functions, and aspects are disclosed. The relationship between project-based learning and inclusive education and the prospects for its application in inclusive education are explored. Four types of approaches in project-based learning that can be applied in teaching computer science are presented. Additionally, a methodology to improve the teaching of computer science is developed.

Conclusions. The study considered in detail the main principles, methodologies, and practices that affect the effectiveness and accessibility of inclusive education for diverse groups of students. It justified the prospects of project-based learning methodology as part of an effective strategy for inclusive education. The materials from the study can be used to improve

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curricula for inclusive classes, providing more effective teaching of computer science through the use of digital technologies.

Keywords: educational methodology; personalization; special educational needs; active participation; educational plans; computer literacy.

Introduction

Modern society is increasingly dependent on informatics and digital technologies, which play a key role not only in our daily lives but also in the economy [1]. Therefore, ensuring access to computer science education for all students becomes a necessity. Inclusive education is an increasingly important goal in today's educational environment, and ensuring equal educational opportunities for all students, including those with various physical, mental and social disabilities, has become a priority for educational institutions in many countries [2]. This is an important direction in the field of education, and, in this context, the study of the topic of project-based learning of computer science in inclusive education with the use of digital technologies is particularly relevant.

The problem of inclusive education in computer science is not new. It began to make itself known with the appearance of the subject "Information Technology" in the programmes of educational institutions. Today's situation is characterized by the growing dependence of society on digital technologies, which leads to an increased demand for knowledge in the field of information technologies. This situation raises questions about ensuring access to knowledge for all learners, including those who may need inclusive support, and requires identifying ways to address this issue.

The problem of introducing project-based learning technology in higher education in Kazakhstan was considered in their work by G. Abishova et al. [3]. The authors analysed the difficulties and obstacles faced by educators and students in implementing project-based learning methodology in the educational process and identified the reasons why this approach may face difficulties. Namely, they pointed out the limited access to modern technologies, lack of trained teachers, as well as cultural and structural features of higher education in Kazakhstan. M. Maulsharif et al. [4] investigated the path to inclusive education in Kazakhstan and identified barriers that need to be overcome on this path. The authors assessed the current state of the inclusive education system in the country, identified what problems and barriers may hinder its development, and offered recommendations to overcome these barriers and promote inclusive education in Kazakhstan. P. Guo et al. [5] reviewed studies related to the application of project-based learning methodology in higher education and its impact on students' academic performance. The authors of the article analysed various aspects of project-based learning, evaluated its effectiveness and considered methods of measuring student achievement. As a result of the study, it was shown that students achieve higher academic performance when using project-based learning methodology.

The process of transition of schools to inclusive education in Kazakhstan was considered in the work of T.M. Makoelle [6]. The scholar analysed the changes in the education system and school practices related to the introduction of inclusive approaches and described the experience of different schools in Kazakhstan to identify the challenges they face in the process of transition to a more inclusive education system. The challenges and barriers facing inclusive education in Kazakhstan have been highlighted in the work of M.B. Turlubekova and R.O. Bugubayeva [7]. The authors analysed the organizational aspects of inclusive education in Kazakhstan, explored opportunities for its further development, investigated the process of introducing an inclusive model of education in the country and described what steps have already been taken to ensure equal educational opportunities for all learners.

Thus, this paper aims to address the previously unexplored issue of the role of project-based learning in inclusive education for learning computer science and to develop a methodology aimed at improving the accessibility and quality of learning for all students.

Materials and Methods

The following methods of scientific knowledge were used in this study: system analysis, logical analysis, comparison, synthesis, deduction, and classification. With the help of systemic analysis, this paper conducted a comprehensive review of the current state of inclusive education in the context of computer science, including its basic principles, methodologies, and practices that affect the effectiveness and accessibility for diverse groups of students. The findings provided the basis for developing a methodology to improve the accessibility and quality of computer science education in inclusive classrooms using digital technologies. In addition, the systemic analysis allowed justifying the promising project-based learning methodology as part of an effective inclusive education strategy.

The logical analysis helped to identify the main problematic aspects in the implementation of inclusive education in computer science, such as insufficient number of personalized education programmes, limited access to digital educational resources and the need for additional professional training for teachers. It helped in describing the indicators of inclusive computer science education that were used to determine the effectiveness of the methodology. On this basis, specific research objectives were formulated to assess and improve the accessibility and quality of computer science education in inclusive classrooms.

The method of deduction was used as an auxiliary method of scientific cognition and made it possible to identify general regularities and principles underlying inclusive education and project-based learning methodology. It was used to formulate theoretical assumptions on the basis of which further work was based. The deductive method helped to establish theoretical links between key concepts such as inclusive education, digital technologies and project-based learning and to create a theoretical foundation for analysing and interpreting the findings.

The classification method was used to identify the main approaches of project-based learning. This method made it possible to systematize various types of projects, identify their features and characteristics, and identify their applicability to specific educational tasks and the needs of different groups of students.

The synthesis method was used to combine the information identified in the course of the work on indicators of inclusive education, technological solutions for inclusive education and project-based learning of informatics. It was also used to develop the methodology for improving the accessibility and quality of informatics education in inclusive education presented in the work. The synthesis provided a comprehensive view of the current state of inclusive informatics education, taking into account the use of digital technologies and the effectiveness of the project-based learning methodology. Through this method, key factors influencing the successful implementation of inclusive approaches were highlighted, and needs and ways of improvement in this area were identified. Thus, the synthesis method contributed to a deeper understanding of the complex interdisciplinary issues of inclusive education in the context of informatics and digital technologies.

The comparison method was used to compare the research findings with existing methodologies and research conducted by other scholars in the field of inclusive education and digital technologies. In particular, the developed project-based learning methodology was benchmarked against similar research. This enabled a deeper understanding of the contribution of the developed methodology to improving the accessibility and quality of computer science learning in inclusive classrooms, as well as identifying opportunities to further improve approaches to inclusive education using digital technologies.

Results

Indicators of inclusive education are quantitative and qualitative measures that are used to assess and compare the level of inclusion of education systems in different countries and regions of the world. These indicators help to determine how successful education systems are in ensuring accessibility, participation, and success for all learners, including those with diverse physical, mental, social or linguistic backgrounds.

Student engagement rates measure the percentage of students who are educated in a general education setting compared to those who are educated in special education settings or separate classrooms. A higher percentage of students involved in general education may indicate a more inclusive system. Access to education shows learners' access to educational resources and services, including the physical accessibility of educational facilities, the availability of learning materials and technology, and the availability of support for learners with special needs. Educational achievement measures the level of educational success of students with diverse needs. It may include data on standardized test scores, grades, completion of educational programmes and other indicators of success.

Teacher professional development assesses the level of teacher training and competencies in inclusive education. Includes data on professional training and support for teachers, as well as the availability of specialized teachers. The barriers and discrimination indicator can include data on the presence and removal of these indicators in the educational setting. It can be measured through complaints and reports of incidents of discrimination, and through actions taken to address such problems. Funding and resources demonstrates the level of funding for inclusive education and the availability of necessary resources, including financial support, specialized equipment and materials. Collaboration with parents and community assesses the extent to which educational institutions collaborate with parents, communities, and organizations working with children with special needs.

These indicators serve as tools for monitoring and evaluating the level of inclusion of education systems in different countries and help to identify areas where further improvements are needed to ensure equal educational opportunities for all learners. An analysis of the distribution of pupils with a formal decision on special educational needs in different forms of education in schools in 30 European countries showed that in 2014, the proportion of such pupils in mixed classes averaged 2.36%, and in 2016 it increased to 2.73%. Importantly, the variation in this proportion among the countries examined ranged from 0.12% to 19.05%, highlighting the differences in approaches to inclusive education between different regions and the considerable diversity in inclusive education practices around the world [8]. Studies and reports on the situation of inclusive education in Kazakhstan, in turn, do not provide specific data on the proportion of students with special educational needs in mixed classes, but point to the special attention of the state government to this issue, the annual improvement of the situation of students with special educational needs and the development of inclusive education in general [9-11].

Inclusive computer science education brings with it a range of benefits, among which is the opportunity for every student, regardless of their physical, mental or social characteristics, to fulfil their potential in computer science, which helps to reduce inequalities and creates equal opportunities for all. Inclusive computer science education promotes diversity and inclusion in the technology industry because the variability of experiences, knowledge. The perspectives provided by inclusive education enriches innovation processes and fosters more creative research and development of information technology, leading to products and solutions that better meet the needs of diverse user groups. It develops co-operation and collaboration skills in the learning environment: students learn to work in teams, to take into account the differences and unique abilities of other students, which is important for their future successful integration into society and professional life. Thus, inclusive computer science education is not only a moral necessity, but also a strategic decision, as it helps to reduce inequalities, creates diversity in the technological field and develops skills necessary for successful adaptation of society in the rapidly changing world of information technology.

Modern digital technologies play a fundamental role in inclusive education by making educational materials accessible and personalized [12]. Effective use of digital tools enhances educational opportunities for students with diverse needs and enables the creation of learning

programmes tailored to the individual needs of each student, which is particularly valuable in inclusive education where students may have different levels of knowledge and ability [13]. These technology solutions include:

– read-aloud and audiobook technologies allow students with dyslexia or visual challenges to access textual information orally. Read-aloud programmes convert text to speech, making learning materials more accessible and comprehensible;

– accessibility tools in web applications provide font size options, alternative text descriptions for images, and keyboard control options to facilitate the use of digital resources by students with disabilities;

– educational apps and platforms designed to meet the needs of learners with special educational needs, such as audio-guided maths apps or communication skills training apps;

– adaptive learning apps use algorithms and artificial intelligence to personalize the learning experience. They can adapt the level of complexity of the materials, the speed of learning and the type of tasks depending on the needs and abilities of each student;

– virtual and augmented reality technologies provide learners with unique educational experiences. For example, virtual field trips and training in virtual environments can help students with physical disabilities have experiences that would not be available to them in the real world.

All of these digital tools contribute to an inclusive educational environment where every student has an equal opportunity to learn and develop. Project-based learning is a pedagogical method based on the active participation of students in the learning process. Instead of the traditional transmission of knowledge by the teacher, project-based learning involves them in solving real-life problems and problem situations. It promotes the development of critical thinking, independence, practical skills and stimulates interest in the subject as students see a direct link between what they are learning and real-life situations. The main advantage of project-based learning is that it prepares students to solve real-life problems they may encounter in their future professional activities, teaches them to apply knowledge in practice and develop creative and innovative solutions. Instead of learning to simply memorize facts, students learn to analyse information, search for resources and develop practical solutions, which is a necessary skill in today's information society. This method of learning also develops co-operation and communication skills, as many projects are done in groups, where students learn to listen and respect other points of view.

One of the key aspects of applying project-based learning is the selection of appropriate projects. In an inclusive environment, it is important to recognize the differences between students and choose projects that can be accessible and interesting to all, including adapting tasks, taking into account special needs and providing support during the project. Organizing collaborative work is also an important aspect. It may involve teamwork or liaising with parents and carers to ensure continuity of education and to make adjustments to learning if necessary. As students with different characteristics may require modified tasks, additional resources or personalized materials, a tool for individual adaptation of projects and materials should be used to help each student feel confident and successful in completing the project. An important aspect of the practical implementation of project-based learning in an inclusive environment is assessment and feedback. Teachers should develop clear assessment criteria and provide feedback, taking into account the individual needs of each student to motivate and support learners. Reflection promotes the development of metacognitive skills and self-regulation of learners who are able to review their experiences, identify achievements and areas for growth.

In project-based learning in computer science, there are several approaches that can be effectively applied in educational institutions. These approaches focus on different aspects of the learning process and structure learning according to the goals and objectives of the lesson or course:

1. Projects based on real-world problems. This approach involves developing projects that solve real-world problems in computer science. In them, students work on problems that may be relevant to business, science, or society. This approach emphasizes the practical application of skills knowledge and encourages students to seek innovative solutions to existing problems.

2. Creativity-centred projects. In this approach, students have the freedom to choose the topic of the project and how to realize it. This approach allows developing creative thinking, independence and a research approach to teaching computer science. Students can create their own programmes, websites, applications, and other information products.

3. Collaborative projects. This approach implements joint project work by students in groups. Collaborative project-based learning promotes communication skills, teamwork and team problem-solving, which is especially important in computer science, as the development of programmes and applications often requires teamwork.

4. Research-oriented projects. This approach involves conducting research as part of a project. Students can investigate different aspects of computer science, analyse data, test hypotheses and draw conclusions. This approach teaches students critical thinking and the scientific method. All the discussed approaches to project-based learning in computer science can be adapted depending on the goals and capabilities of the educational institution.

Taking into account the aspects of project-based learning application, project-based learning approaches and technological solutions for the implementation of inclusive education, a methodology for improving the accessibility and quality of informatics education in inclusive education was developed (Table 1).

Table 1. Methodology for improving the accessibility and quality of computer science education in inclusive education

Stage	Actions and description
Special Needs Analysis	– conducting a differentiated analysis of the needs of each student, taking into account their individual characteristics and special educational needs in computer science. – determining the level of knowledge and skills of each student, as well as their preferences and needs for adapted materials and technological support.
Selection of digital tools	– systematically select and evaluate digital tools and resources based on student needs. – selecting software with functionality that promotes accessibility (for example, read-aloud programs, alternative keyboards).
Development of individual educational plans (IEP)	– creating an IEP for each student, including specific goals, objectives, and methods for assessment and progress. – integrating elements of project-based learning into IEP, identifying projects that take into account the characteristics of each student and support his interests. – adapting the IEP in accordance with changes in the needs and progress of students in the learning process.
Adaptation of educational materials	– individualization of educational materials, including textbooks, teaching aids and assignments, taking into account the characteristics of each student. – providing access to alternative formats of materials, such as audio, larger versions of texts or texts in Braille.
Teacher training	– organizing regular training and education for teaching staff on the principles of inclusive learning and the effective use of digital tools. – preparing teachers to integrate project-based learning into the educational process and develop project tasks that correspond to students' IEP.
Rating and Feedback	– development of individual assessment criteria and assessment methods, taking into account the needs and successes of each student. – integration of projects into an evaluation system, where projects are evaluated based on the achievement of goals and objectives defined in the IEP. – providing feedback to students that is targeted to specific development points and areas for improvement, and providing transparent peer review mechanisms.
Monitoring and adjustment	– establishing a system of regular monitoring and evaluation of the effectiveness of the methodology, based on data on student progress and their educational results. – analysis of monitoring results and correction of IEP and educational practices, if necessary, to ensure maximum effectiveness.
Re-training	– organizing regular refresher training and professional development sessions for teachers and professionals to maintain their competence and consistency in the application of the methodology.

Source: compiled by the authors.

The developed methodology, using digital technologies, can effectively introduce the following topics and directions in the discipline of "Informatics" for students requiring an inclusive approach in education:

– basics of computer literacy: teaching students computer skills, including operating the operating system, using the keyboard and mouse, and the basics of working with files and folders;

– programming basics: introducing the basics of programming using block graphical languages that allow students to create simple algorithms and programmes without having to type in text code;

– Office applications: teaching students how to use word processing, spreadsheet, and presentation software. These skills can be useful for future work and everyday life;

– online safety: teaching the basics of internet safety, including protecting personal data and recognizing potentially dangerous situations online;

– information technology basics: an introduction to basic information technology concepts, including understanding the structure of computers, networks, and data storage;

– information retrieval and evaluation: skills in searching and analysing information on the Internet and evaluating its reliability and quality;

– communication and online interaction: teaching students effective communication and online interaction skills, including email, social networking, and other online interactions;

– computer science and special needs: teaching students with special needs to use specialized software and technology to access content;

– applying computer science to everyday life: teaching students to use their newly acquired skills in everyday tasks such as managing finances and planning events;

– developing critical thinking and problem-solving: teaching students analytical skills, logical thinking and problem-solving abilities using information technology.

The programme can be adapted to the specific needs of students, making it a promising option for use in inclusive classrooms.

Discussion

In the article, Z. Nurbekova et al. [14] investigated the application and effectiveness of project-based learning technology in the context of microcontroller programming. The authors presented a case study on the use of project-based learning to teach students programming and microcontroller skills, in which students were offered real-life projects related to programming microcontrollers to solve practical problems. The projects included building devices, automating processes and developing applications using microcontrollers. The authors analysed the results of student learning with the use of this methodology and assessed the extent to which project-based learning contributed to an in-depth understanding of the material, the development of practical problem-solving skills and student motivation. The results of the study revealed a positive effect of project-based learning. The study confirmed the effectiveness of project-based learning and, when combined with the methodology developed in this study to improve the accessibility of computer science through digital technology, project-based learning can enhance students' understanding of the material and motivation in inclusive classrooms. Both approaches have the potential to improve education among students with different learning needs.

A study by M.A. Almulla [15] focused on evaluating the effectiveness of project-based learning methodology as a tool to enhance the learning process and increase students' interest in learning. The author analysed the impact of project-based learning on students' motivation and interest in learning materials and active participation in the educational process. The study included analysing the results of learning projects, comparing the performance of students who studied using project-based learning methodology with those who used traditional teaching methods. It also provided data on the level of students' participation in discussions, research papers and other activities that were motivated by the project-based learning methodology. The reviewed article and the conducted study have a common feature, such as the focus on increasing students' motivation and interest in the learning process through project-based learning methodology. However, the study presented a specific method for improving educational accessibility, while the author's paper examined the results of project-based learning on a more general level.

An overview of two important learning techniques: project-based learning and computational thinking, and the identification of their role in the learning process was presented in the work of A. Saad and S. Zainudin [16]. The authors analysed how project-based learning and computational thinking can be successfully integrated into educational practices and what benefits they can bring to students. The paper provided an overview of existing research and practices related to the use of project-based learning and computational thinking in different educational contexts, examples of the implementation of these techniques, and demonstrated the relationship with learning objectives and how these techniques contribute to the development of key competences in students. In addition, the article presented an evaluation of the impact of project-based learning and computational thinking methodologies on the development of skills such as analytical thinking, problem-solving and creative thinking in students. By comparing the results of the studies, it is possible to note their focus on the development of key competences in students, which can be supported by both project-based learning techniques and the developed methodology using digital technologies. Both studies emphasized the importance of modern educational methods and their impact on students' development, contributed to the enrichment of educational practice and understanding of how to learn and develop students in the modern world.

Inclusive education and teachers' attitudes towards inclusive education in the context of Japan and Finland were highlighted in a study by S. Moberg et al. [17]. The authors conducted a comparative analysis of approaches to inclusive education in the two countries and conducted surveys and interviews among 362 Finnish and 1518 Japanese teachers to understand their attitudes towards it. The article also looked at the differences in approaches to education between Japan and Finland and identified factors influencing teachers' attitudes towards inclusive practice. The main difference was identified as a vision of educational effectiveness, as a result of which Finnish teachers were more critical of inclusive education than Japanese teachers. This study of inclusive education practices showed a more biased attitude in a European country (Finland) than in an Asian country (Japan). The statistics presented in this paper also showed a rather low percentage of inclusion of students with special needs in mainstream classrooms in Europe. All this points to the need to continue working in this direction to improve the current situation.

The application of Universal Instructional Design (UID) in the context of inclusive education was revealed in the work of M.A. Eliseo et al. [18]. The scholars reviewed the literature and research related to the use of this design to support inclusive education and considered its principles and importance in creating learning environments that support the diverse needs of learners. In addition, the authors provided examples of best practices, demonstrating how UID can be effectively integrated into the educational process and provided recommendations for the application of UID by teachers and educational institutions in order to promote inclusive education. Both studies indicated the importance of inclusive education and aimed to improve educational practices in this area. Consequently, both studies, although focussing on different aspects of inclusive education, can complement each other by providing both theoretical frameworks and practices as well as concrete tools to improve education for all learners.

The article by M.M. Juraev [19] reveals the experience of using curricula developed by the University of Cambridge to ensure the continuity of educational programmes in computer science and information technology in the context of vocational education. The author examined the mechanism of implementation and adaptation of Cambridge curricula in the system of professional education in order to ensure the consistency and quality of education in computer science and information technology. The study provided information on the benefits and challenges of using Cambridge curricula in the field and described the results of their

implementation in practice. This study complemented the findings of the previous study and described a different approach to the implementation and adaptation of computer science and information technology curricula, which may enhance the possibilities of individualization of education in this area.

Important aspects of inclusive education and the availability of digital educational resources in Catalonia, Spain, during the COVID-19 pandemic have been reviewed in the work by M.A.E. Gelabert and A.T. Vallespí [20]. In the context of the pandemic, when educational institutions were forced to switch to distance learning, significant challenges emerged, especially for students from cultural minorities and with special educational needs (in particular migrant students). The authors of the article analysed what specific strategies and measures have been developed and applied in Catalonia to provide inclusive education in an online format, taking into account the needs of diverse learners. The study also looked at what technological solutions have been implemented to make educational resources accessible. Both studies emphasized the importance of inclusivity in education and the accessibility of educational resources. The topic of access to education during the pandemic highlighted in the reviewed work can serve as a valuable resource for educational institutions and educators seeking to develop and implement effective strategies and technological solutions to ensure educational accessibility and inclusion, especially in distance learning settings. This demonstrates the need for educational systems to adapt to changing conditions and the needs of diverse learners.

In his work, scholar J. Gonzalez Martinez [21] examined the concept of transmedia learning and its role in the development of digital inclusive education. As transmedia learning is an approach that utilizes a variety of media formats and channels to enrich students' educational experiences, the author explored how it can promote inclusivity in digital learning environments, ensuring accessibility and participation for a diverse group of learners, including those with special educational needs. The research involved analysing examples of transmedia learning in inclusive practice and evaluating its effectiveness in supporting learners with diverse needs, and as a result, showed the positive impact of transmedia learning in the context of personalizing learning and being accessible to all learners. The research reviewed supported the idea of the need to utilize digital technologies in inclusive education. The analysis of the case studies of digital technologies confirmed their potential to personalize the educational experience and create an environment where every student can learn successfully, regardless of their special educational needs.

The role of teachers in successfully integrating digital resources and technology into learning, particularly to support diverse groups of learners, including children with special educational needs, was explored by H. Coker and D. Mercieca [22]. The study examined best practices and strategies that help teachers create inclusive learning environments using digital technology. The authors also discussed the challenges teachers face when working with diverse student populations and offered recommendations for overcoming them. As a result, the study emphasized the importance of teachers' professional development in digital competencies and inclusive education to enhance the integration of digital technologies into learning. Both studies paid attention to teachers' professional development and their role in integrating digital technologies in education, and suggested various methods to improve the situation and help teachers to improve their professional competences.

All the studies reviewed confirmed the importance of inclusive education, project-based learning and digital inclusion in supporting diverse groups of learners, including those with special educational needs.

Conclusions

The study has extensively analysed project-based learning and digital technologies for the implementation of inclusive computer science education. The paper presented a methodology for improving the accessibility and quality of computer science learning in inclusive education, and how this methodology can be applied in the process of learning computer science.

As the study aimed to identify the most effective methods of teaching informatics in inclusive education, it was confirmed that the use of project-based learning with digital technologies promotes the deepest understanding of informatics, practical skills and student motivation. It has been proved that project-based learning plays a key role in the modern educational process, enriching students with knowledge, skills and practical experience, it can prepare students for the complex challenges of the modern world, develop their creative thinking and promote students' active participation in their own education. This type of learning in an inclusive environment requires detailed practical preparation and adaptation, but if implemented well, it provides a unique opportunity to create an educational environment where every student can fulfil their potential and achieve success.

Project-based learning can also provide a personalized approach, which is particularly important in inclusive settings where students may have different learning needs. The study also looked at other aspects that are important for effective computer science learning, including the use of modern digital technologies, which provide unique opportunities for improving inclusive education. They make learning more accessible, personalized and interactive, which helps to develop the potential of every learner, regardless of their characteristics and special needs. These technologies play a key role in creating an educational environment where every learner can succeed.

It is recommended that further research should focus on developing the professional skills of teachers to successfully implement this methodology. This will enhance the effectiveness of inclusive learning strategies in computer science using digital tools and contribute to the development of this important area of education.

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Conflict of Interest

There is no conflict of interests.

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Проєктне навчання інформатики в інклюзивній освіті з використанням цифрових технологій

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Анотація

Актуальність. Актуальність дослідження зумовлена стрімким розвитком інформаційних технологій та цифрового середовища, що вимагає постійного оновлення освітніх методик та їх адаптації для інклюзивних освітніх практик.

Мета. Ця стаття спрямована на дослідження та розробку методології, яка б сприяла ефективному впровадженню проєктного навчання з використанням цифрових технологій в інклюзивній освіті в галузі інформатики.

Методологія. Провідним методом дослідження цієї проблеми став системний аналіз. Застосовувалися також такі методи наукового пізнання: логічний аналіз, порівняння, синтез, дедукція, класифікація.

Результати. У дослідженні виявлено індикатори інклюзивної освіти, зокрема залученість учнів, доступність, показники успішності учнів, професійної компетентності вчителів. Дослідження також висвітлює питання бар'єрів та дискримінації, фінансування та співпраці. Розкрито поняття проєктного навчання, його функції та аспекти. Досліджено взаємозв'язок між проєктним навчанням та інклюзивною освітою і перспективи його застосування в інклюзивній освіті. Представлено чотири типи підходів до проєктного навчання, які можна застосувати в навчанні інформатики. Додатково розроблено методику вдосконалення викладання інформатики.

Висновки. У дослідженні детально розглянуто основні принципи, методології та практики, які впливають на ефективність та доступність інклюзивної освіти для різних груп учнів. Обґрунтовано перспективи проєктної методики навчання як складової ефективної стратегії інклюзивної освіти. Матеріали дослідження можуть бути використані для вдосконалення навчальних програм для інклюзивних класів, забезпечення більш ефективного навчання інформатики за рахунок використання цифрових технологій.

Ключові слова: методика навчання; персоналізація; особливі освітні потреби; активна участь; навчальні плани; комп'ютерна грамотність.