MODERN TRENDS IN THE TRAINING OF FUTURE COMPUTER SCIENCE TEACHERS IN THE CONDITIONS OF DIGITAL TRANSFORMATION OF EDUCATION

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Digital transformation has revolutionized the field of computer science, and as a result, education and student training in the field has also evolved. The article, based on the analysis of scientific literature and statistics, reflects the current trends in the training of future computer science teachers in the conditions of the digital transformation of education.

In the process of analysis, general trends in the training of future informatics teachers were revealed, such as computer literacy, use of interactive technologies, development of practical skills, and improvement of teachers' qualifications.

Particular attention was paid to the specifics of training future computer science teachers in the conditions of digital transformation of education, such as the use of online courses and webinars, the development of pedagogical skills in the use of the latest technologies, and the creation of a creative and innovative environment. The requirements for the competencies of future informatics teachers were analyzed, in particular, attention was paid to the need to possess not only technical knowledge, but also communication skills and the ability to adapt to new technologies and situations. The article highlights key concepts and practices that shape the preparation of future computer science teachers in the age of digital transformation, including interdisciplinary approaches, experiential learning, industry partnerships, and ethical considerations. The article also discusses the challenges and opportunities associated with these trends and provides recommendations for educators and institutions to effectively prepare students for the digital age.

Based on the analysis, it was concluded that the training of future informatics teachers needs constant updating and adaptation to the new requirements of the digital age. To achieve success in this field, it is necessary to use the latest technologies and innovative approaches to learning. Summarizing, the article proposes orientation to ensure access to quality education for all students,
Цифрова трансформація зробила революцію в галузі інформатики, і, як наслідок, освіта та підготовка студентів у цій галузі також еволюціонувала. У статті на основі аналізу наукової літератури та статистичних відображено сучасні тенденції підготовки майбутніх учителів інформатики в умовах цифрової трансформації освіти.

У процесі аналізу було виявлено загальні тенденції підготовки майбутніх учителів інформатики, такі як комп'ютерна грамотність, використання інтерактивних технологій, розвиток практичних навичок та підвищення кваліфікації вчителів.

Окрему увагу було приділено особливостям підготовки майбутніх учителів інформатики в умовах цифрової трансформації освіти, таким як використання онлайн-курсів та вебінарів, розвиток педагогічної майстерності у використанні новітніх технологій та створення творчого та інноваційного середовища. Прогнозовано вимоги до компетенцій майбутніх учителів інформатики, зокрема звернено увагу на необхідність володіння не тільки технічними знаннями, але й комунікативними навичками та здатністю адаптуватися до нових технологій та ситуацій. У статті висвітлюються ключові концепції та практики, які формують підготовку майбутніх учителів інформатики в епоху цифрової трансформації, включаючи міждисциплінарні підходи, навчання на досвід, галузеві партнерства та етнічне міркування. У статті також обговорюються виклики та можливості, пов'язані з цими тенденціями, і надаються рекомендації для викладачів та установ щодо ефективної підготовки студентів до епохи цифрових технологій.

На основі аналізу було зроблено висновок, що підготовка майбутніх учителів інформатики потребує постійного оновлення та адаптації до нових вимог цифрової епохи. Для досягнення успіху у цій галузі необхідно використовувати не тільки викладачів інформатики, але й інші навчальні групи. У статті пропонується орієнтація на міждисциплінарні підходи, навчання на досвід, галузеві партнерства та етнічне міркування. У статті також обговорюються виклики та можливості, пов’язані з цими тенденціями, і надаються рекомендації для викладачів та установ щодо ефективної підготовки студентів до епохи цифрових технологій.

Зазначені результати дослідження можуть бути корисними для викладачів вищих освітніх закладів, які займуються підготовкою майбутніх учителів інформатики, а також для керівників освітніх установ, які планиють впровадження цифрового середовища та використання цифрової трансформації. Для цього важливо не лише надавати студентам необхідні знання та навички, але і створювати умови для їх розвитку творчого мислення інноваційної діяльності. Крім того, важливим є підвищення рівня мотивації студентів до вивчення інформатики, наприклад, за допомогою використання новітніх технологій та інтерактивних методів навчання. Ці підходи дозволять підготувати майбутніх учителів інформатики, які зможуть успішно працювати у сучасному цифровому світі та сприятимуть подальшому розвитку цифрової трансформації в освіті.
Introduction of the issue. In recent years, Ukraine and the world have increasingly focused on the development of the digital transformation of education. With the advent of digital technology and its impact on society, education has also undergone significant changes. Today, digital transformation has become a necessity, and it affects all aspects of education, including the training of future computer science teachers.

The problem is that the changing requirements and needs of the labor market require future computer science teachers to have deeper knowledge and skills in the field of digital technologies. However, the training of informatics teachers does not always meet these requirements, there are problems with updating the content of education, using modern pedagogical methods and providing students with practical skills.

It is also important to consider that in the context of digital transformation, future computer science teachers must have creative thinking and be ready for constant learning and adaptation to new technologies.

So, the problem is how to ensure the training of future computer science teachers in accordance with the requirements of digital transformation, taking into account modern trends in education and the labor market.

The research topic is relevant in the context of the rapid development and improvement of ICT, the spread of digital technologies and the introduction of digital educational platforms that allow organizing distance learning and developing digital educational resources. In this regard, educational environment responds to these changes and occur new requirements for the qualification characteristics of teachers. In digital reality, digital competence teachers get bigger and bigger value in education context. The growing need for computer literacy and understanding of digital technologies makes the training of future computer science teachers a priority.
science teachers an important task that requires constant updating and adaptation to new requirements. Consideration of modern trends in the training of future informatics teachers is necessary for improving the educational process and training specialists who will be able to work effectively in a digital society.

Therefore, it can be concluded that the study of modern trends in the training of future informatics teachers in the conditions of the digital transformation of education is an important and urgent task. For the successful training of future computer science teachers, it is necessary to use innovative teaching methods and create a creative environment for students that allows them to develop their creative abilities and innovative potential. It is also important to motivate students to study computer science and develop their creative thinking. Research in this field will help solve problems related to the training of future informatics teachers in the conditions of digital transformation of education.

Current state of the issue. To date, there is a large number of scientific publications devoted to the topic of training future computer science teachers in the conditions of the digital transformation of education. Many studies are focused on problems related to the use of digital technologies in the educational process (Antonova O. [1], Melnyk A. [18], Familyarska L. [1], etc.), creating a creative and innovative environment for students (Hryb T. [13], Pyatnychuk T. [25], Shampan O. [27], etc.), by increasing the level of motivation to study informatics (Azadova E. [2], Cheporniuk N. [8], etc.). The latest research and publications in the field of training future computer science teachers in the conditions of the digital transformation of education indicate several important trends.

First, there is growing attention to the formation of competence of future computer science teachers in the field of digital technologies. Research shows that without proper training, future teachers will not be able to effectively implement digital technologies in the educational process [9].

Розгляд сучасних тенденцій у підготовці майбутніх учителів інформатики є необхідним для вдосконалення освітнього процесу та підготовки фахівців, які зможуть ефективно працювати в цифровому суспільстві.

Отже, можна зробити висновок, що вивчення сучасних тенденцій підготовки майбутніх учителів інформатики умовах цифрової трансформації освіти є важливим і актуальним завданням. Для успішної підготовки майбутніх учителів інформатики необхідно використовувати інноваційні методи навчання та створювати твірче середовище для студентів, що дозволяє їм розвивати свої творчі здібності та інноваційний потенціал. Також важливо забезпечувати мотивацію студентів до вивчення інформатики та розвивати їх творче мислення. Дослідження в цій галузі допоможуть вирішити проблеми, пов’язані з підготовкою майбутніх учителів інформатики в умовах цифрової трансформації освіти.

Аналіз останніх досліджень і публікацій. На сьогоднішній день існує велика кількість наукових публікацій, присвячених темі підготовки майбутніх учителів інформатики в умовах цифрової трансформації освіти. Багато досліджень зосереджені на проблемах, пов’язаних з використанням цифрових технологій в освітньому процесі (Антонова О. [1], Мельник А. [18], Фамілярська Л. [1] та ін.), створенням творчого та інноваційного середовища для студентів (Гриб Т. [13], Пятничук Т. [25], Шапран О. [27], та ін.), підвищенням рівня мотивації до вивчення інформатики (Азадова Е. [2], Чепорнюк Н.[8] та ін.). Останні дослідження та публікації в галузі підготовки майбутніх учителів інформатики в умовах цифрової трансформації освіти вказують на декілька важливих тенденцій.

По-перше, зростає увага до формування компетентності майбутніх учителів інформатики в галузі цифрових технологій. Дослідження показують, що без належної підготовки майбутні вчителі не зможуть ефективно впроваджувати цифрові технології в освітньому процес [9].

По-друге, значна увага приділяється використанню інтерактивних методів навчання. Багато досліджень (О. Власій, О. Дудка, І. Луцик, Л. Пироженко,
Secondly, considerable attention is paid to the use of interactive learning methods. Lots of research (O. Vlasy, O. Dudka, I. Lutsik, L. Pyrozhenko, O. Pometun, M. Stefanysyn, P. Shevchuk, etc.) testify that these methods help to increase the level of assimilation of the material by students, make learning more interesting and effective [33].

Thirdly, the importance of creating a creative and innovative environment for students is growing (Hryb T. [13], Pyatnychuk T. [25], Shapran O. [27], etc.). This allows students to develop their creative abilities and innovative potential, which will be useful in their future professional activities [12].

In addition, recent studies by M. Moskalyuk, N. Moskalyuk, O. Zakhar show that there is a need to increase the motivation of students in the conditions of distance learning during military operations [21], as well as to develop their creative thinking [34].

In general, recent studies and publications indicate that the study of modern trends in the training of future computer science teachers under the conditions of the digital transformation of education is an important and relevant area of research.

In the National strategies development higher of education in Ukraine [31] for the period from 2022 to 2032 is established task of preparation teachers to work with information technologies. With a separate strategy provides development and implementation new one’s programs studies that will allow the future teachers master computer and technical knowledge and skills, as well as use modern technologies in education process.

In addition, strategy provides creation innovative educational environments where teachers will have possibility work with modern hardware and software provision. Such environments will allow teachers get acquainted with new one’s technologies and teaching methods, as well as interact with colleagues and receive support from experts in the field informative technologies. V. Bykov [4], I. Verbovskiy [32][28] and others dealt with the problems of informatization of the educational

O. Pometun, M. Stefaniyshin, P. Shevchuk та ін.), свідчать про те, що ці методи допомагають підвищити рівень засвоєння матеріалу студентами, зробити навчання більш цікавим і ефективним [33].

По-третє, зростає значення створення творчого та інноваційного середовища для студентів (Гриб Т. [13], Пятничук Т. [25], Шапран О. [27], та ін.), Це дозволяє студентам розвивати свої творчі здібності та інноваційний потенціал, що стане у нагоді під час майбутньої професійної діяльності [12].

Крім того, останні дослідження М. Москалюк, Н. Москалюк, О. Захар показують, що існує потреба в підвищенні мотивації студентів в умовах дистанційного навчання під час військових дій [21], а також в розвитку їх творчого мислення [34].

Загалом, останні дослідження та публікації свідчать про те, що вивчення сучасних тенденцій підготовки майбутніх вчителів інформатики умовах цифрової трансформації освіти є важливим і актуальним напрямком досліджень.

У Національній стратегії розвитку вищої освіти в Україні [31] на період з 2022 по 2032 рік встановлено завдання щодо підготовки вчителів до роботи з інформаційними технологіями. Зокрема, strategія передбачає розробку та впровадження нових програм навчання, які дозволять майбутнім вчителям оволодіти комп’ютерно-технічними знаннями та навичками, а також використовувати сучасні технології в освітньому процесі.

Крім того, стратегія передбачає створення інноваційних освітніх середовищ, де вчителі матимуть можливість працювати з сучасним обладнанням та програмним забезпеченням. Такі середовища дозволяють вчителям ознайомитися з новими технологіями та методиками навчання, а також взаємодіяти з колегами та отримувати підтримку від експертів у галузі інформаційних технологій. Проблемами інформатизації освітнього процесу займались Биков В. [4], Вербовський І. [32], Калініна Л. [30], Мороз Н. [19], Шаров С. [28] та інші.
Therefore, training teachers to work with information technologies is one of the priority tasks in the National Strategy for the Development of Higher Education in Ukraine for the period from 2022 to 2032. This is an important step in security quality education and training future generations to a successful one career in conditions quickly changing the world.

In September 2022, the Agreement on the participation of Ukraine in program EU "Digital Europe" (2021-2027) [24], which aimed at the development of advanced digital skills, implementation of digital technologies in entrepreneurship, development digital infrastructure, availability digital services for citizens and public institutions of member states of the European Union (EU) and others joined to Programs countries.

The article "Digital Transformation in Education: The Preparation of Future Teachers for the 21st Century" [19] by Pedro Membiela, Carmen Lloret and Ana García-Serrano is a study of trends in the training of future computer science teachers in the context of the digital transformation of education. The authors consider the current challenges and opportunities arising in connection with the digital transformation of education and identify the key competencies that future computer science teachers should acquire.

The article describes the need to develop the competencies of future computer science teachers, such as technology knowledge, data management, information security, digital creativity, and technical literacy. It was also stated that it is necessary to provide computer science teachers with the necessary knowledge and skills to develop students’ digital literacy.

The authors of the article analyzed approaches to the training of future computer science teachers in different countries and identified the most effective teaching methods. In particular, it was found that the use of interactive technologies and video materials in the learning process is effective.

The authors of the article provided recommendations for improving the training of future informatics teachers in priorитетных завдань у Національній стратегії розвитку вищої освіти в Україні на період з 2022 по 2032 рік. Це є важливим кроком у забезпеченні якісної освіти та підготовки майбутніх поколінь до успішної кар’єри в умовах швидко змінюючогося світу.

У вересні 2022 року підписано Угоду про участь України в програмі ЄС "Цифрова Європа" (2021-2027) [24], яка спрямована на розвиток передових цифрових навичок, впровадження цифрових технологій у підприємництві, розбудову цифрової інфраструктури, доступність цифрових послуг для громадян та публічних інституцій країн-членів Європейського Союзу (ЄС) й інших долучених до Програми країн.


У статті описано потребу у розвитку компетенцій майбутніх учителів інформатики, таких як знання про технології, управління даними, інформаційна безпека, цифрова креативність та технічна грамотність. Також було зазначено, що необхідно забезпечити вчителів інформатики необхідними знаннями та навичками для розвитку цифрової грамотності студентів. Автори статті провели аналіз підходів до підготовки майбутніх учителів інформатики в різних країнах та визначили найбільш ефективні методи навчання. Зокрема, було виявлено, що ефективним є використання інтерактивних технологій та відеоматеріалів в процесі навчання.

Автори статті надали рекомендації щодо вдосконалення підготовки майбутніх учителів інформатики в умовах цифрової трансформації освіти, таких як впровадження інноваційних методів та технологій навчання, підвищення рівня мотивації студентів до вивчення
the conditions of the digital transformation of education, such as the introduction of innovative teaching methods and technologies, increasing the level of motivation of students to study informatics and ensuring access to the necessary resources and infrastructure.

The article "The Impact of Digital Transformation on Teacher Education and Learning" [7] by Dilek Çelikler et al. (2021) is an interesting study on the impact of digital transformation on computer science teacher training. The article examines the attitude of computer science teachers to digital technologies and their readiness to use these technologies in the educational process.

The authors note that the study shows the great role of digital technologies in the training of computer science teachers. However, the authors also emphasize the need to develop pedagogical competencies of teachers, which relate to the use of digital technologies in the educational process. In addition, research shows that teachers who use digital technologies in their work have better learning outcomes and ensure more active participation of students in the educational process.

The article also examines the challenges that arise in connection with changing approaches to the training of informatics teachers in the conditions of the digital transformation of education, in particular, the challenges associated with the development of relevant programs, the provision of the necessary equipment and software for the training of informatics teachers, as well as the provision of access to digital resources.

The article "The Digital Transformation of Teacher Education: A Conceptual Framework" [16] by Johan Lundin, Jonas Ivarsson, and Maria Spante (2020) analyzes the digital transformation of education and the role of technology in training future teachers. The authors proposed a conceptual model that includes three main aspects of digital transformation in education: (1) digital technologies, (2) pedagogical practices, and (3) development of teacher competencies.

The article also discusses the impact of digital transformation on the training of informatics and emphasizes the need for teachers to be well-prepared in this field.

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future teachers, including challenges and opportunities arising from changes in pedagogical practices and requirements for teacher competencies. The authors indicate the need to develop the competencies of teachers related to digital technologies, as well as the role of teachers in the appropriate training of future teachers.

In recent publications, various aspects of the training of future informatics teachers in the conditions of the digital transformation of education are considered, in particular, competence in the field of digital technologies, the use of interactive teaching methods, the development of creative thinking, etc. They provide a basis for further research and improvement of approaches to the training of future computer science teachers in digital transformation.

One of the urgent problems is ensuring the competence of future computer science teachers in the field of digital technologies. In accordance with this, a study was conducted, which made it possible to establish that the purposeful formation of the competence of future teachers is one of the most important trends in the training of informatics teachers.

The results of the research conducted among teachers of the Ivan Franko State University, testify to a significant interest of teachers to use digital technologies, in particular:

- ensuring joint activity in the educational process, which is not limited by geographical distance between participants and is carried out with the help of digital technologies;
- using a mobile device as a personal library of educational -methodical and reference materials; as a means for recording visual information in digital format, as well as photo and video cameras; as an audio player for recording and playback of audio lectures; as a multimedia guide;
- connecting a mobile device to the corporate network of an educational institution for use with multimedia equipment, measuring equipment and devices;
- organization of controlled distribution of electronic educational resources, including access to educational and research content, podcasts, webinars, use of digital technologies, as well as the role of teachers in the appropriate training of future teachers.

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- using a mobile device as a personal library of educational -methodical and reference materials; as a means for recording visual information in digital format, as well as photo and video cameras; as an audio player for recording and playback of audio lectures; as a multimedia guide;
- connecting a mobile device to the corporate network of an educational institution for use with multimedia equipment, measuring equipment and devices;
- organization of controlled distribution of electronic educational resources, including access to educational and research content, podcasts, webinars, use of digital technologies, as well as the role of teachers in the appropriate training of future teachers.

One of the urgent problems is ensuring the competence of future computer science teachers in the field of digital technologies.

In accordance with this, a study was conducted, which made it possible to establish that the purposeful formation of the competence of future teachers is one of the most important trends in the training of informatics teachers.

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- organization of controlled distribution of electronic educational resources, including access to educational and research content, podcasts, webinars, use
of social networks and other digital tools.

In light of this, higher education institutions have two key goals: first, to teach students to effectively use digital technologies and provide them with access to convenient tools and services; secondly, to monitor the use of mobile devices and their applications to ensure the protection of information security and data privacy in the educational environment of higher education institutions (Koellner & Jacobs, 2015) [15].

Another important aspect is the use of interactive learning methods. Many studies show that the use of interactive methods helps to increase the level of learning of the material by students, to make learning more interesting and effective.

Creating a creative and innovative environment for students is also an important aspect. This allows students to develop their creative abilities and innovative potential, which will be useful in their future professional activities.

Therefore, the analysis of publications and studies on the topic of training future computer science teachers in the conditions of digital transformation shows that one of the key problems is the competence of future computer science teachers in the field of digital technologies. The importance of using interactive learning methods and creating a creative and innovative environment for students is also noted. These aspects are important in the training of future informatics teachers, as they allow more effective formation of the necessary competencies and skills for working with digital technologies. It is also worth noting that in order to improve the quality of training of future computer science teachers, a lot of attention is paid to the implementation of the latest technologies and pedagogical innovations in the educational process.

**Aim of research** is to analyze the current trends in the training of future computer science teachers in the conditions of the digital transformation of education, in particular, to find out the current problems and determine the ways to solve them.

**Results and discussion.** The rapid development of digital technologies has led to a paradigm shift in various fields, having two key metas: first, to teach students to effectively use digital technologies and provide them with access to convenient tools and services; secondly, to monitor the use of mobile devices and their applications to ensure the protection of information security and data privacy in the educational environment of higher education institutions (Koellner & Jacobs, 2015) [15].

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including computer science. The way we use and interact with technology has changed dramatically, and this has necessitated a transformation in the education and training of future computer science teachers. With the growing demand for skilled professionals who can navigate the digital space, it is imperative for educators to adapt their teaching methods to prepare students for the challenges and opportunities of the digital age.

One of the main trends in the training of future computer science teachers in the conditions of the digital transformation of education is to increase the level of computer literacy, which involves the ability to use various software products, make calculations, create presentations, process graphic images and videos, work with e-mail and Internet resources. In addition, future teachers must have sufficient knowledge of pedagogy and psychology in order to effectively use these technologies in their work with pupils and students. Today, this competence is the most important for informatics teachers because it allows to understand various software and hardware tools, to work with them and to transfer this knowledge to students [34].

Another important trend is the use of interactive technologies, which is one of the main trends in the training of future computer science teachers. This includes the use of interactive whiteboards, virtual classrooms, webcams, multimedia presentations, video conferences and other digital tools to ensure active participation of students in the educational process and create interactive lessons. The possibility of using artificial intelligence and virtual reality in the educational process is also currently being actively studied. The use of these technologies helps create a more effective and engaging learning environment that promotes student engagement and understanding of complex concepts. In addition, the use of interactive technologies provides an opportunity to individualize learning and take into account the personal needs of each student [12].

Another major trend is the change in the approach to learning, in particular the transition from traditional face-to-face
learning to more interactive and differentiated methods. This involves the use of individual and group projects, the development of critical thinking and creative skills of students, as well as the use of methods of independent work and self-organization of the educational process.

One of the significant trends in the training of future computer science students is the integration of interdisciplinary approaches into the curriculum. Computer science is no longer limited to coding and programming, but intertwines with other fields such as data science, artificial intelligence, cybersecurity, and human-computer interaction. As a result, educators recognize the importance of interdisciplinary approaches to provide students with a holistic understanding of computer science in the context of real-world applications.

Interdisciplinary approaches involve the integration of knowledge and skills from different disciplines to solve complex problems. For example, students who are studying informatics, they can work with students from such fields as mathematics, psychology or business to develop solutions to real problems. This interdisciplinary approach encourages students think critically, collaborate with diverse teams and apply your knowledge of computer science in interdisciplinary contexts [26].

Experimental there is still learning one important a trend in preparation future student’s informatics. Traditional approaches based on lectures are supplemented practical, project and experimental teaching methods, which provide students with practical experience and real skills. Experimental teaching allows students to apply your theoretical knowledge to real problems and issues, thereby improving your skills problem solving, critical thinking and innovation.

Experimental approaches to learning they can comprise internship, final projects, hackathons and competitions where students work on real projects or tasks. This experience allows students to develop practical skills, access the industry and contribute innovation and creativity. In
addition, experimental teaching also helps understanding growth because students learn from failures, repeat your solutions and develop stability [34].

Industry partnerships are becoming more and more important in preparation future student’s informatics. Cooperation between academia and industry provides students with real experience, knowledge industries and opportunities work on industry projects. Industry partnerships as well eliminate gap between academic knowledge and industry needs, ensuring that students have corresponding skills and ready to work after end training.

Industry partnership can comprise guest’s lectures, seminars, internships, joint research projects and programs mentoring. This one cooperation allows students to learn from experts’ industry, to receive knowledge about the latter trends industry and apply your skills in real projects. Industry partnerships as well help students understand practical consequences their work and how to do it you can apply in real scripts, thus doing theirs teaching more relevant and effective.

As the field of computer science continues to evolve in the era of digital transformation, ethical considerations are becoming increasingly important in the education of future students. The ethical implications of technologies such as artificial intelligence, virtual reality, big data, and cybersecurity are complex and multifaceted, and it is critical for students to understand and address these ethical issues in their work.

Educators emphasize the importance of ethical considerations in computer science education, including discussions of privacy, security, bias, fairness, and transparency in the design, development, and use of technology. Students are encouraged to think critically and reflect on the ethical implications of their work and how it may affect society, culture and individuals. This ethical awareness helps students develop a responsible and ethical approach to technology and prepares them to be responsible digital citizens in the digital age.

Another general trend in the training of future informatics teachers is the active розумінню зростання, оскільки студенти вчаться на невдачах, повторюють свої рішення та розвивають стійкість [34].

Галузеві партнерства стають все більш важливими у підготовці майбутніх студентів інформатики. Співпраця між академічними та промисловими колами надає студентам реальний досвід, знання галузі та можливості працювати над галузевими проектами. Галузеві партнерства також усувають розрив між академічними знаннями та галузевими потребами, гарантуючи, що студенти мають відповідні навички та готові до роботи після закінчення навчання.

Галузеве партнерство може включати гостьові лекції, семінари, стажування, спільні дослідницькі проекти та програми наставництва. Ця співпраця дозволяє студентам вчитися у експертов галузі, отримувати знання про останні тенденції галузі та застосовувати свої навички в реальних проектах. Галузеві партнерства також допомагають студентам зрозуміти практичні наслідки їхньої роботи та те, як її можна застосувати в реальних сценаріях, таким чином роблячи їхне навчання більш актуальним та ефективним.

Оскільки сфера інформатики продовжує розвиватися в епоху цифрової трансформації, етичні міркування стають все більш важливими в навчанні майбутніх студентів. Етичні наслідки таких технологій, як штучний інтелект, віртуальна реальність, великі дані та кібербезпека, є складними та багатогранними, і для студентів дуже важливо розуміти та вирішувати ці етичні проблеми у своїй роботі.

Педагоги наголошують на важливості етичних міркувань у навчанні інформатики, включаючи дискусії про конфіденційність, безпеку, упередженість, справедливість і прозорість у проектуванні, розробці та використанні технологій. Студентів заохочують критично мислити та розмірювати свої етичні наслідки іхньої роботи та про те, як вони можна вплинути на суспільство, культуру та окремих людей. Це етичне усвідомлення допомагає студентам розвивати відповідальний та етичний підхід до технології та готує їх бути відповідальними цифровими громадянами в епоху цифрових технологій.

Ще однією загальною тенденцією
use of the Internet as a source of information and educational resources. It is also important that during the training of future computer science teachers, attention is paid not only to technical aspects, but also to the development of their pedagogical competence, adaptability and critical thinking regarding the use of digital technologies in education.

For the effective training of future computer science teachers, it is also important to develop their practical skills. This means that in addition to theoretical knowledge, teachers must have practical experience with computers and other digital technologies. It is important that upcoming teacher’s computer science had the possibility of practical application digital technologies in education process. It may comprise development own digital educational resources, use of online platforms and tools, development skills work with electronic resources and use digital pedagogical methods. It is also important that teachers are prepared to work with new digital tools and teaching aids that may emerge in the future.

The next trend is improving the qualifications of computer science teachers. In connection with changes in the field of information technologies, teachers must constantly improve their qualifications and knowledge in order to ensure effective and high-quality training of students. For example, on the basis of the Ivan Franko State University, training courses for informatics teachers are held, where they can gain new knowledge and practical skills regarding the use of modern information technologies in the educational process. Other forms of professional development for teachers include workshops, seminars, trainings, conferences and other events that allow teachers to gain new knowledge and share their experience with colleagues. In addition, many teachers use online courses and webinars that allow them to acquire new knowledge and skills conveniently and efficiently without leaving their homes. Improving the qualifications of teachers is an important trend in the training of future computer science teachers, which allows to ensure high-quality and effective
preparation of students for life in the digital world.

The latest trend is the creation of a creative and innovative environment. Informatics teachers should create a favorable atmosphere for the development of students’ creative thinking and encourage them to use the latest information technologies to create their own projects. To do this, you can use different methods, for example, project-based learning, working in groups, creating presentations, etc.

Creating a creative and innovative environment also involves encouraging students to work independently and use information resources. Computer science teachers can create open educational resources that allow students to independently learn new technologies and apply them in their projects.

In general, the training of future computer science teachers in the conditions of the digital transformation of education should be aimed at ensuring computer literacy, using interactive technologies, developing practical skills, improving the qualifications of teachers, and creating a creative and innovative environment. The effectiveness of preparing students for life in the rapidly changing information environment depends on this.

In the conditions of the digital transformation of education, the training of future informatics teachers acquires new features and requires a deeper and more complex approach. Some of the features of training future computer science teachers in the conditions of digital transformation may include:

**Use of online courses and webinars:** this can help future computer science teachers deepen their knowledge in the field of information technology and become familiar with modern approaches to teaching. Online courses and webinars can be accessed from anywhere and at any time, making them a convenient and effective learning tool [16].

**Development of pedagogical skills in the use of the latest technologies:** an important element of the training of future informatics teachers is the development of their pedagogical skills in the context of the
use of the latest technologies in the educational process. Future computer science teachers must be able to effectively use digital tools and platforms to ensure effective learning for their students.

BYOD technology (Bring Your Own Device) is an approach to the organization of the educational process, in which students use their personal mobile devices (for example, smartphones, tablets, laptops) for learning and development, which makes it possible to solve current problems in modern education [5]:

The increasingly acute problem of "what to do with students' mobile phones in an educational institution?". Mass practice today consists in banning their use, which is quite clear and understandable [5]. Indeed, use mobile students can use their phones during classes create some problems, for example, this may distract attention students from educational process, as well as violate discipline in the classroom. However, the use is prohibited mobile of phones is not the only one possible decision problems.

You can use BYOD to provide students convenient and innovative tools for learning and allow using mobile devices in pedagogical goals. However, it is necessary follow certain rules and procedures to provide efficiency and safety use.

Others option is to use mobile phones as a tool training. For example, using special applications which allow students to learn the material is interactive mode and conduct independent work. Such applications can be developed teachers or use already existing platforms such as Quizlet, Kahoot! and others.

So, instead of simple prohibition of use mobile phones you can search alternative methods their use in education process. The main thing is to provide effective and safe use.

BYOD allows students to use your own devices for working with educational material. It can be especially convenient for students who used to work with a certain type of device and software provision. They can use your own devices for execution tasks, receiving additional information and interaction with other students and teachers.
The second aspect is convenience and speed work. Students can work online and earn processed results in short terms. They can pass surveys and tests that allows teachers quickly to evaluate level of knowledge students. In addition, students they can use your devices to create own bookmarks and storage educational materials that makes it easier they have access to the necessary information.

The third aspect is convenience of entering the personal account without login and password. Students can simply use with their devices to access your personal office, check schedule and others educational materials.

So, the use BYOD technology allows students to be more convenient, effective and productive in learning.

Creating a creative and innovative environment: This may include creating a space for collective collaboration and exchange of ideas between future computer science teachers. Such an environment can promote the development of creative and innovative approaches to learning and teaching computer science.

Taking into account the peculiarities of training future computer science teachers in the conditions of digital transformation, it can be noted that this requires higher education institutions to provide access to modern information technologies and infrastructure. It is also necessary to take into account the requirements of the labor market and provide future computer science teachers with the necessary knowledge and skills that are relevant and popular in the field of information technologies. In addition, an important element is the practical training of future informatics teachers, which allows them to gain practical experience in working with modern information technologies and prepare for work in a modern educational environment.

It is important to pay attention to the development of competencies that are necessary for teaching computer science in the modern world. These competencies include:

• Digital literacy: future computer science teachers must have an understanding of digital technologies and

BYOD дозволяє студентам використовувати свої власні пристрої для роботи з навчальним матеріалом. Це може бути особливо зручно для студентів, які звикли працювати з певним типом пристрою та програмного забезпечення. Вони можуть використовувати свої власні пристрої для виконання завдань, отримання додаткової інформації та взаємодії з іншими студентами та викладачами.

Другий аспект полягає у зручності та швидкості роботи. Студенти можуть працювати онлайн та отримувати опрацьовані результати в короткі терміни. Вони можуть проходити опитування та тести, що дозволяє викладачам швидко оцінити рівень знань студентів. Крім того, студенти можуть використовувати свої пристрої для створення власних закладок та зберігання освітніх матеріалів, що полегшує їм доступ до необхідної інформації.

Третій аспект – це зручність входу до особистого кабінету без логіну та паролю. Студенти можуть просто скористатися своїми пристроями, щоб отримати доступ до особистого кабінету, перевірити розклад та інші навчальні матеріали.

Отже, використання технології BYOD дозволяє студентам бути більш зручними, ефективними та продуктивними в навчанні.

Створення творчого та інноваційного середовища: це може включати створення простору для колективного співробітництва та обміну ідеями між майбутніми вчителями інформатики. Таке середовище може сприяти розвитку творчих та інноваційних підходів до навчання та викладання інформатики.

Враховуючи особливості підготовки майбутніх учительів інформатики в умовах цифрової трансформації, можна зазначити, що це вимагає змикання вищої освіти забезпечення доступу до сучасних інформаційних технологій та інфраструктури. Також необхідно враховувати вимоги ринку праці та забезпечувати майбутніх вчителів інформатики необхідними знаннями та навичками, які є актуальними та популярними у сфері інформаційних технологій. Крім того, важливим елементом є практична підготовка майбутніх вчителів інформатики, яка дозволяє їм набувати практичний досвід роботи з сучасними
be able to use them in their work.

• Communication skills: Teaching computer science often requires communication with students and colleagues, so it is important to develop communication and collaboration skills.

• Critical Thinking: Future computer science teachers must have the ability to think critically and analyze information, which will enable them to help students understand and evaluate the information they find online. Competent computer science teachers should develop critical thinking in their students, including the ability to analyze, evaluate, and draw conclusions about digital information. The future teacher’s computer science must be able to teach students distinguish reliable and unreliable.

• Technical skills: future computer science teachers must be able to use modern technical tools and software, which will allow them to be successful in their professional activities.

• Creativity and innovation: teaching computer science requires creative and innovative approaches, so it is important to develop these competencies in future computer science teachers.

The development of these competencies can be achieved through the use of various methods and forms of work, including professional training, internships and practical classroom work. In addition, constant updating of knowledge and skills is important, as technologies are constantly developing, and the computer science teacher must be ready to use them in the educational process.

The training of future computer science teachers in the conditions of the digital transformation of education has great potential and may have several promising directions of development. Some of these may include:

1. The development of online learning and distance education: with the development of digital technologies and the beginning of the war in Ukraine, more and more educational institutions are moving to online learning and distance education. This opens up new opportunities for training future computer science teachers who can use online courses and webinars...
to gain new knowledge and skills.

2. Using artificial intelligence and other new technologies in the educational process: with the development of artificial intelligence and other new technologies, future computer science teachers can use them in their work. For example, the use of interactive whiteboards, game technologies and virtual reality can help make the teaching process more interesting and effective.

3. Ensuring access to quality education for all students: Due to the growing number of students and the demand for quality education, the training of future computer science teachers has an important task to ensure access to quality education for all students. This may include the use of digital technologies and innovative learning approaches to help ensure quality education for all students.

All these areas of development have great potential and can help prepare future computer science teachers for the challenges facing them in the changing world of the digital transformation of education. It is necessary to ensure the necessary conditions for the training of future informatics teachers, including access to appropriate resources and infrastructure, an up-to-date curriculum, and compliance of the training with the requirements of the labor market. In addition, it is important to develop cooperation between universities and educational institutions to ensure interaction between theory and practice, and to provide students with opportunities for practical work and internships in the field of informatics.

In general, the training of future informatics teachers in the conditions of the digital transformation of education requires a systematic approach and focus on the development of competencies that meet the requirements of the modern labor market and social needs. It is important to ensure access to the necessary resources and infrastructure, an up-to-date educational program and to promote the development of students' practical skills. This approach will help ensure quality training of future computer science teachers and ensure the development of

них можуть включати:

1. Розвиток онлайн-навчання та дистанційної освіти: з розвитком цифрових технологій та початком війни в Україні, все більше освітніх закладів переходять до онлайн-навчання та дистанційної освіти. Це відкриває нові можливості для підготовки майбутніх учительів інформатики, які можуть використовувати онлайн-курси та вебінари для отримання нових знань та навичок.

2. Використання штучного інтелекту та інших нововведень в освітньому процесі: з розвитком штучного інтелекту та інших нововведень в освіті, майбутні вчителі інформатики можуть використовувати їх у своїй роботі. Наприклад, використання інтерактивних дошок, ігрових технологій та віртуальної реальності може допомогти зробити процес викладання цікавішим та ефективнішим.

3. Забезпечення доступу до якісної освіти для всіх учнів: у зв’язку зі зростанням числа учнів та попиту на якісну освіту, підготовка майбутніх учительів інформатики має важливе завдання забезпечити доступ до якісної освіти для всіх учнів. Це може включати використання цифрових технологій та інноваційних підходів до навчання, які допоможуть забезпечити якісну освіту для всіх учнів.

Усі ці напрямі розвитку мають великий потенціал і можуть допомагати підготувати майбутніх учительів інформатики до викликів, що стоять перед ними у змінному світі цифрової трансформації освіти. Потрібно забезпечити необхідні умови для підготовки майбутніх учительів інформатики, включаючи доступ до відповідних ресурсів та інфраструктури, актуальний навчальний план та відповідність підготовки вимогам ринку праці. Крім того, важливо розвивати співпрацю між університетами та навчальними закладами, щоб забезпечити взаємодію між теорією та практикою, та надавати студентам можливості для практичної роботи та стажування в сфері інформатики.

В цілому, підготовка майбутніх учителів інформатики в умовах цифрової трансформації освіти потребує системного підходу та спрямованості на розвиток компетенцій, які відповідають вимогам сучасного ринку праці та соціальних
digital education in Ukraine.

Although the trends discussed above create significant opportunities for the education of future computer science students, there are also challenges that need to be addressed. One of the challenges is rapid technological progress, which requires educators to constantly update their educational programs and stay abreast of the latest industry trends. Another problem is necessity balance theoretical knowledge with practical skills and make sure that students have both.

In addition, interdisciplinary approaches can be difficult to implement because it requires coordination and collaboration between different departments and fields of study. Also, may arise resistance change traditional lecture - based approaches to methods experimental learning and anxiety of assessment skills acquired through experimentation training. Industry partnerships as well they can face problems such as searching relevant industry partners, maintaining a balance between academic and industry requirements and provision mutually beneficial cooperation.

However, these challenges also create opportunities for growth and innovation. Application interdisciplinary approaches, experimental training, industry partnerships and ethical considerations may raise quality education in informatics, to prepare students to the era digital technologies and overcome gap between academic and industrial requirements.

Based on the trends discussed above, here are some recommendations for educators and institutions to effectively prepare future computer science students in the age of digital transformation:

1. Incorporating interdisciplinary approaches into the curriculum: Integrate knowledge and skills from different disciplines to provide students with a holistic understanding of computer science in the context of real-world applications.

2. Usage experimental one training: complete traditional approaches based on lectures, practical, project - based and experiential learning methods to provide students with practical experience and real skills.
3. Assistance Industry Partnerships: Work with industry partners to provide students with real knowledge, branch knowledge and capabilities work on industry projects.

4. Inclusion ethical them reasoning: discuss and reflect on ethical consequences technologies in education computer science and encourage students develop responsible and ethical approach to technologies.

5. Be aware industry trends: constantly update educational program to keep up from fast technological progress and requirements industry.

6. Software support interdisciplinary cooperation: providing resources and support interdisciplinary cooperation, including coordination and cooperation between different departments and branches training.

7. Evaluation and recognition skills acquired through experimentation training: development methods assessment for recognition and evaluation skills acquired through experimentation training, for example, internship, completion projects and competitions.

Conclusions and research perspectives. The training of future computer science teachers is an important task in connection with the growing importance of digital technologies and digital transformation in all spheres of life. The ability to teach informatics in accordance with modern requirements and to apply the latest technologies in the educational process is critically important for ensuring quality education for students.

With the development of online learning and distance education, future computer science teachers can use online courses and webinars to gain new knowledge and skills. The use of artificial intelligence and other modern technologies in the educational process can help make the teaching process more interesting and effective.

However, our time demands from future computer science teachers not only competences in digital technologies, but also communication skills and the ability to adapt to new technologies and situations. Therefore, the training of future studentsцілісне розуміння інформатики в контексті реальних додатків.

Використання експериментального навчання: доповніть традиційні підходи, засновані на лекціях, практичними, проектними та експериментальними методами навчання, щоб надати студентам практичний досвід і реальні навички.

3. Сприяння галузевим партнерствам: співпрацюйте з галузевими партнерами, щоб надати студентам реальні знання, галузеві знання та можливості працювати над галузевими проектами.

4. Включення етичних міркувань: обговорюйте та розмірковуйте про етичні наслідки технологій у навчанні інформатики та заохочуйте студентів розвивати відповідальний та етичний підхід до технологій.

5. Бути в курсі галузевих тенденцій: постійно оновлюйте освітню програму, щоб не відставати від швидкого технологічного прогресу та вимог галузі.

6. Забезпечення підтримки міждисциплінарного співробітництва: надання ресурсів і підтримки міждисциплінарного співробітництва, включаючи координацію та співпрацю між різними відділами та галузями навчання.

7. Оцінка та визнання навичок, набутих шляхом експериментального навчання: розробка методів оцінювання для визнання та оцінки навичок, набутих шляхом експериментального навчання, наприклад, стажування, завершення проектів та конкурсів.

Висновки з даного дослідження і перспективи подальших розвідок. Підготовка майбутніх учительів інформатики є важливим завданням у зв'язку зі зростанням важливості цифрових технологій та цифрової трансформації у всіх сферах життя. Уміння викладати інформатику відповідно до вимог сучасності та застосовувати нові телекомунікації в освітньому процесі є критично важливим для забезпечення якісної освіти для учнів.

З розвитком онлайн-навчання та дистанційної освіти, майбутні вчителі інформатики можуть використовувати онлайн-курси та вебінари для отримання нових знань та навичок. Використання штучного інтелекту та інших новітніх технологій у освітньому процесі може допомогти зробити процес викладання цікавішим та ефективнішим.

Однак, наш час вимагає від майбутніх
computer science teachers should include not only technical knowledge, but also the development of general culture, ethics, and psychological readiness to work with students.

In general, the development of the training of future computer science teachers should be focused on ensuring access to quality education for all students, the use of the latest technologies, and the development of general competencies of future teachers. Only in this way can we ensure that our students are prepared for life in the digital world and have the necessary skills to succeed in the future.

The training of future computer science students is evolving in the era of digital transformation, with a focus on interdisciplinary approaches, hands-on learning, industry partnerships and ethical considerations. These trends create significant opportunities for improving the quality of computer science education and preparing students for the age of digital technologies. However, there are also challenges that need to be addressed, such as keeping pace with rapid technological progress, coordinating interdisciplinary collaboration, and evaluating experiential learning.

To effectively educate future computer science students, educators and institutions must use interdisciplinary approaches, emphasize experiential learning, foster industry partnerships, consider ethical considerations, stay abreast of industry trends, support interdisciplinary collaboration, and develop methods for evaluating experiential learning. By implementing these recommendations, computer science education can be more relevant, impactful, and responsive to industry and societal demands.

In summary, the field of computer science is constantly evolving, and it is imperative for educators and educational institutions to adapt their teaching methods to prepare students for the challenges and opportunities of the digital age. By applying interdisciplinary approaches, learning experiences, industry partnerships and ethical considerations, we can ensure that future computer
Science students are well prepared to navigate the complex and rapidly changing technology environment and make a positive contribution to society.


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