МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ЗАПОРІЗЬКИЙ НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ

ЦИФРОВІЗАЦІЯ ЯК ІНСТРУМЕНТ ЗАБЕЗПЕЧЕННЯ ЯКОСТІ НАДАННЯ ОСВІТНІХ ПОСЛУГ З УРАХУВАННЯМ ЄВРОПЕЙСЬКОГО ДОСВІДУ

КОЛЕКТИВНА МОНОГРАФІЯ

2024

МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ

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Колективна монографія присвячена розкриттю ролі та визначенню напрямів використання цифрових технологій в освіті; дослідженню впливу цифрових технологій на освітній процес в заклад вищої освіти України; з'ясуванню тенденцій ЄС в освіті та формуванню рекомендацій до їх впровадження в Україні; формуванню теоретичних, методичних і практичних засад здійснення цифровізації надання освітніх послуг.

Монографія виконана за результатами досліджень у рамках проєкту фундаментальних наукових досліджень, прикладних наукових досліджень, науково-технічних (експериментальних) розробок за темою №1/24 «Європейські практики діджиталізації як інструмент забезпечення соціально-економічної безпеки в умовах війни та повоєнний період» (державний реєстраційний номер 0124U000600) (01.01.2024 – 31.12.2026).

Колективна монографія розрахована для науковців, викладачів, здобувачів закладів вищої освіти, аспірантів, докторантів, фахівці-практиків, представників державних органів влади та місцевого самоврядування, бізнесу, адміністративного персоналу університетів, представників громадянського суспільства, громадськості та всіх зацікавлених осіб.

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ЗМІСТ

ПЕРЕДМОВА

Цифровізація охопила всі сфери діяльності та відповідно має значний вплив на якість надання освітніх послуг через вдосконалення освітнього процесу в закладах вищої освіти, підвищення рівня доступності освіти в форматі онлайн. Вплив цифровізації та інформаційних технологій на освіту проявляється через необхідність персоналізації навчання шляхом врахування індивідуальних потреб здобувачів вищої освіти; забезпечення рівного доступу до програм навчання; розвитку цифрових навичок; автоматизації адміністративних процесів в закладах вищої освіти; впровадження інтерактивних методів навчання; забезпечення безперервності навчання в дистанційному форматі. В свою чергу, забезпечення якості надання освітніх послуг з урахуванням досвіду ЄС та шляхом цифровізації сприяє розвитку цифрових компетентностей, інноваційного мислення громадян, кадрового потенціалу, безперервному навчанню, зменшенню відтоку кадрів за кордон, зміцненню кібербезпеки, покращенню економіки, зменшенню соціальної нерівності, що забезпечує соціально-економічну безпеку України в умовах війни та повоєнний період. Науковцями розкрито широке коло питань в аспекті підвищення якості надання освітніх послуг в закладах вищої освіти з урахуванням європейського досвіду.

Колективна монографія присвячена розкриттю ролі та визначенню напрямів використання цифрових технологій в освіті; дослідженню впливу цифрових технологій на освітній процес в заклад вищої освіти України; з'ясуванню тенденцій ЄС в освіті та формуванню рекомендацій до їх впровадження в Україні; формуванню теоретичних, методичних і практичних засад здійснення цифровізації надання освітніх послуг.

У першому розділі розглянуто особливості використання цифрових технологій в освіті та визначено рекомендації до впровадження зарубіжного досвіду. Також з'ясовано переваги та недоліки діджиталізації освіти, розкрито особливості цифрової трансформації мовної освіти в університеті. За результатами дослідження проаналізовано поточний стан, визначено проблеми та обмеження цифровізації економіки в Україні та Європі.

У другому розділі розкрито особливості використання цифрових технологій під час викладання дисциплін в університеті. Проведено порівняльний аналіз використання цифрових технологій для вивчення англійської мови здобувачами вищої освіти в Україні та ЄС. Визначено рівень впливу цифрової трансформації на зміни в підходах до формування корпоративної культури підприємства. Досліджено роль метавсесвіту у трансформації освітнього процесу.

Останній розділ присвячений розкриттю ролі штучного інтелекту у сфері вищої освіти. Визначено напрямки адаптації європейського досвіду щодо впровадження цифрових технологій в освітні України. Здійснено огляд практичного досвіду використання цифрових технологій в Європі та визначено напрямки його впровадження в Україні.

В колективній монографії запропоновано теоретико-методичні узагальнення, висновки та практичні рекомендації, які стануть в нагоді для науковців, викладачів, здобувачів закладів вищої освіти, аспірантів, докторантів, фахівці-практиків, представників державних органів влади та місцевого самоврядування, бізнесу, адміністративного персоналу університетів, представників громадянського суспільства, громадськості та всіх зацікавлених осіб.

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2.2. A comparative analysis of digital technology utilization for english language learning among technical students in Ukraine and the European union

Introduction. In the contemporary globalized world, proficiency in the English language has become a critical skill for professionals across various fields, particularly in the realm of technology and engineering. As the lingua franca of science, technology, engineering, and mathematics (STEM), English serves as a bridge facilitating international collaboration, access to cutting-edge research, and participation in global markets. Recognizing this imperative, educational institutions worldwide have increasingly integrated English language instruction into their curricula, leveraging digital technologies to enhance learning outcomes and accessibility. This chapter undertakes a comparative analysis of the utilization of digital technologies for English language learning among technical students in Ukraine and the European Union (EU), exploring the trends, methodologies, challenges, and outcomes associated with this educational paradigm.

The integration of digital technologies in education has revolutionized traditional pedagogical approaches, offering innovative tools and platforms that cater to diverse learning needs and preferences. From interactive language learning applications and online courses to virtual classrooms and AI-powered language tutors, digital technologies have expanded the horizons of language education, making it more engaging, flexible, and personalized. For technical students, who often juggle rigorous academic schedules with practical training, these technologies provide a convenient and efficient means to acquire and improve their English language skills.

In the context of Ukraine, the adoption of digital technologies for educational purposes has been influenced by various factors, including the country's educational reforms, technological infrastructure, and socio-economic conditions. The Ukrainian education system has undergone significant transformations in recent years, aiming to align with European standards and enhance the quality of education. Within this framework, the emphasis on English language proficiency has grown, driven by the need to integrate into the European academic and professional space. However, the extent to which digital technologies are utilized in this process varies across institutions, reflecting disparities in resources, access, and institutional priorities.

Conversely, the EU presents a diverse landscape where member states exhibit varying degrees of digital integration in education, shaped by their respective educational policies, economic development, and technological advancements. The EU's commitment to fostering digital competence and multilingualism is evident in initiatives such as the Digital Education Action Plan and the Erasmus+ program, which support the development and dissemination of innovative educational practices. Technical students in the EU benefit from a wide array of digital tools and resources designed to enhance language learning, facilitated by robust technological infrastructures and supportive policy frameworks.

This comparative analysis aims to elucidate the commonalities and differences in the use of digital technologies for English language learning among technical

students in Ukraine and the EU. By examining key aspects such as the availability and adoption of digital tools, pedagogical approaches, institutional support, and student engagement, this chapter seeks to provide a comprehensive understanding of the current landscape and identify best practices that can inform future educational strategies. Furthermore, it addresses the challenges encountered in implementing digital technologies, including issues of digital literacy, access disparities, and the integration of technology into traditional educational models.

The analysis draws on a wide range of sources, including academic literature, policy documents, case studies, and empirical data, to offer a nuanced perspective on the topic. It highlights successful initiatives and innovative practices that have demonstrated positive outcomes in language acquisition, as well as areas where improvements are needed to maximize the potential of digital technologies. By presenting a detailed comparison of Ukraine and the EU, this chapter contributes to the broader discourse on digital education and language learning, offering valuable insights for educators, policymakers, and stakeholders involved in shaping the future of technical education.

In all, the integration of digital technologies in English language learning for technical students represents a dynamic and evolving field, characterized by both opportunities and challenges. As Ukraine continues its journey towards educational modernization and integration with the EU, the experiences and lessons drawn from this comparative analysis can serve as a guide for enhancing digital language education, ultimately contributing to the development of a skilled and linguistically proficient technical workforce.

The problem at the core of this study is the varying extent and effectiveness of digital technology utilization for English language learning among technical students in Ukraine and the European Union (EU). In an era where digital literacy and English proficiency are indispensable for participation in the global knowledge economy, understanding and optimizing the integration of digital tools in language education becomes a critical scientific and practical challenge.

Varying extent and effectiveness of digital technology utilization for English language learning.

The utilization of digital technologies in English language learning is an area of increasing importance, particularly for technical students in Ukraine and the European Union (EU). The digital revolution has transformed educational practices, offering a plethora of tools and platforms that facilitate learning in innovative and engaging ways. However, the extent and effectiveness of these technologies vary significantly across different regions and educational contexts, presenting both opportunities and challenges.

In Ukraine, the integration of digital technologies into education is influenced by a range of factors, including economic conditions, technological infrastructure, and educational policies. The adoption of digital tools in language learning is gradually increasing, with efforts to align more closely with European standards. However, disparities in access to technology, particularly in rural and economically disadvantaged areas, pose significant challenges. According to a study by Vasilyeva and Kotenko (2022), while urban educational institutions in Ukraine are progressively incorporating digital tools, rural areas lag due to limited resources and connectivity issues [1].

The EU, with its diverse member states, exhibits varying levels of digital integration in education. Countries such as Finland, Sweden, and the Netherlands are leaders in the use of digital technologies in language education, supported by strong technological infrastructures and progressive educational policies. For instance, Finland's national curriculum emphasizes the use of digital tools to enhance learning outcomes, resulting in widespread adoption and positive student performance (Vuorikari et al., 2022) [2]. In contrast, some Southern and Eastern European countries face challenges similar to those in Ukraine, including economic constraints and uneven access to technology.

The effectiveness of digital technologies in language learning is closely tied to the pedagogical approaches employed. Interactive and immersive tools, such as virtual reality (VR) and augmented reality (AR), have shown promising results in

enhancing language proficiency by providing authentic and engaging learning experiences. Studies indicate that VR environments can significantly improve students' speaking and listening skills by simulating real-life scenarios.

Research indicates that digital tools can positively impact both cognitive and affective outcomes in language learning. For example, AI-powered applications like Grammarly and language learning apps like *Duolingo* not only improve language accuracy and fluency but also increase student motivation and engagement. A study by Li and Lan (2021) found [4] that students using AI-based language tools demonstrated marked improvements in writing skills and overall language competence.

Despite the potential benefits, several challenges hinder the optimal utilization of digital technologies. These include: digital literacy, infrastructure and integration with traditional methods (table 1).

Table 1

Challenges of the optimal utilization of digital technologies

1.	Digital literacy	Both students and educators may lack the necessary digital literacy skills to effectively use technology in language learning. This is particularly evident in regions with limited access to digital resources.
2.	Infrastructure	Inconsistent access to reliable internet and digital devices remains a significant barrier, especially in rural and economically disadvantaged areas.
3.	Integration with traditional methods	Balancing the integration of digital tools with traditional teaching methods can be challenging. Educators may require training and support to effectively incorporate digital technologies into their curricula.

Source: Created by the authors

To address these challenges and optimize the integration of digital tools in language education, several strategies can be employed: professional development, infrastructure investment, policy support and research and innovation (table 2).

Table 2

Strategies for optimization of the integration of digital tools in language education

1.	Professional development	Providing training and resources for educators to enhance their digital literacy and pedagogical skills.
2.	Infrastructure investment	Improving technological infrastructure, particularly in underserved areas, to ensure equitable access to digital learning tools.
3.	Policy support	Developing supportive educational policies that promote the integration of digital technologies and allocate resources for their implementation.
4.	Research and innovation	Encouraging ongoing research to explore innovative digital tools and methods, and to evaluate their effectiveness in diverse educational contexts.

Source: Created by the authors

Understanding and optimizing the integration of digital technologies in English language learning for technical students is a critical scientific and practical challenge. While digital tools offer significant potential to enhance learning outcomes, their effectiveness varies across different regions and contexts. By addressing the identified challenges and leveraging best practices, educational institutions can better prepare technical students for participation in the global knowledge economy, ensuring they possess the digital literacy and English proficiency required for success.

From a scientific perspective, the problem is multifaceted, involving the examination of pedagogical methodologies, technological infrastructures, and cognitive processes associated with digital language learning. Existing literature indicates a significant gap in comprehensive, comparative analyses that explore the specific needs and contexts of technical students, who often require tailored educational approaches due to their specialized academic and professional trajectories. Thus, this research addresses a crucial gap by providing empirical evidence and theoretical insights into the effectiveness of digital technologies in enhancing English language proficiency within this demographic.

Practically, the issue is intertwined with broader educational and economic objectives. For Ukraine, aligning with EU educational standards and enhancing the global competitiveness of its technical workforce are paramount goals. The effective use of digital technologies in language education can accelerate this alignment,

facilitating greater mobility and collaboration within the European and international contexts. Similarly, for the EU, fostering a digitally competent and multilingual workforce is essential for maintaining its economic leadership and innovation capacity in the global market.

The problem's connection to important scientific tasks includes understanding learning outcomes, pedagogical innovation and equity in education. Investigating how different digital tools and platforms influence the acquisition of English language skills among technical students involves analysing the cognitive and affective dimensions of learning in digital environments.

Developing and validating innovative pedagogical models that leverage digital technologies to enhance language learning efficiency and engagement requires a cross-disciplinary approach, integrating insights from educational psychology, instructional design, and information technology.

Assessing the disparities in access to digital resources and the consequent impacts on educational equity involves identifying socio-economic and institutional barriers that hinder the effective use of digital technologies and proposing strategies to mitigate these challenges.

The practical tasks related to the problem are equally significant.

By policy development we mean informing educational policy and decision-making processes to support the integration of digital technologies in language education. This entails providing evidence-based recommendations to policymakers in Ukraine and the EU to foster supportive frameworks and resource allocation.

The successful integration of digital technologies in English language education requires robust policy development and strategic decision-making. This involves creating supportive frameworks and allocating resources effectively. In Ukraine and the European Union (EU), educational policies must be informed by evidence-based recommendations to ensure that digital tools are utilized efficiently and equitably (table 3).

Table 3

Key components of policy development

1.	Evidence-based recommendations	Policies should be grounded in rigorous research and empirical data that demonstrate the effectiveness of digital technologies in language learning. Policymakers need access to comprehensive analyses and case studies that highlight best practices and successful implementations.
2.	Supportive frameworks	Educational policies should include frameworks that promote the integration of digital technologies at all levels of education. This involves setting clear objectives, standards, and guidelines for using digital tools in language teaching. For instance, the EU's Digital Education Action Plan provides a strategic vision for enhancing digital literacy and competence across member states, emphasizing the importance of integrating digital technologies in educational curricula.
3.	Resource allocation	Effective resource allocation is crucial for the widespread adoption of digital technologies in language education. This includes funding for technological infrastructure, such as high-speed internet and digital devices, particularly in underserved areas. Policies should also allocate resources for the development of digital content and the training of educators. Investing in professional development programs ensures that teachers are equipped with the necessary skills to effectively use digital tools in their classrooms.
4.	Equity and access	Policies must address the digital divide to ensure equitable access to digital technologies for all students, regardless of their socio-economic background. This entails implementing measures to provide digital devices and internet access to students in rural and economically disadvantaged areas. The EU's cohesion policy, which aims to reduce disparities between regions, can serve as a model for promoting digital equity in education.
5.	Monitoring and evaluation	Continuous monitoring and evaluation of digital technology integration are essential for assessing the effectiveness of implemented policies. This involves setting up mechanisms to track progress, gather feedback, and make data-driven adjustments. Policymakers should establish benchmarks and performance indicators to evaluate the impact of digital tools on language learning outcomes.

Source: Created by the authors

Case studies and best practices

Finland's national curriculum

Finland's approach to integrating digital technologies in education can serve as a benchmark. The country's national curriculum emphasizes the use of digital tools to enhance learning outcomes and includes comprehensive guidelines for their implementation. This policy has led to widespread adoption of digital technologies

in Finnish schools, contributing to improved student performance and digital literacy. The curriculum also encourages the development of critical thinking and problem-solving skills through the use of technology. As a result, Finnish students are well-prepared for the demands of the digital age, both academically and in their future careers.

The UK's EdTech strategy

The United Kingdom's EdTech Strategy outlines a vision for harnessing technology to improve educational outcomes. It includes initiatives such as the EdTech Innovation Fund, which supports the development and adoption of innovative educational technologies. This strategy highlights the importance of collaboration between government, educators, and technology providers to create effective digital learning environments. The strategy also aims to address challenges such as digital inclusion and the digital divide, ensuring that all students have access to the necessary technology. Additionally, the UK government is investing in research and development to explore the potential of emerging technologies like AI and machine learning in education (table 4).

Pilot programs and case studies are being conducted to identify best practices and scalable solutions that can be implemented across the country. The strategy also emphasizes the importance of teacher training and professional development to ensure educators are equipped to integrate new technologies into their teaching practices effectively. By fostering a culture of innovation and continuous improvement, the UK's EdTech Strategy aims to transform education and prepare students for the digital future.

Policy development for integrating digital technologies in language education is a multifaceted process that requires evidence-based recommendations, supportive frameworks, and strategic resource allocation. By addressing these components and learning from best practices, Ukraine and the EU can enhance the effectiveness of digital tools in language learning, ensuring that all students have the opportunity to develop the digital literacy and English proficiency necessary for success in the global knowledge economy.

Table 4

Recommendations for Ukraine

1.	Develop a national digital education strategy	Ukraine should formulate a national strategy that outlines a clear vision for integrating digital technologies in education. This strategy should set specific goals, allocate resources, and provide guidelines for schools and universities.
2.	Invest in infrastructure	To bridge the digital divide, significant investments are needed in technological infrastructure, particularly in rural areas. Ensuring reliable internet access and providing digital devices to students and educators are critical steps.
3.	Enhance teacher training	Professional development programs should be established to improve teachers' digital literacy and pedagogical skills. These programs can include workshops, online courses, and collaborative platforms for knowledge sharing.
4.	Promote public-private partnerships	Collaborations between the government, educational institutions, and technology companies can drive innovation and resource sharing. Public-private partnerships can facilitate the development of tailored digital content and tools for language learning.
5.	Establish monitoring and evaluation mechanisms	Implement systems to monitor the progress of digital technology integration and evaluate its impact on learning outcomes. Regular assessments and feedback loops can help refine policies and practices.

Source: Created by the authors

Improving the digital literacy and teaching capabilities of educators involves developing targeted professional development programs and establishing networks for collaborative knowledge sharing and innovation. This approach ensures that educators are equipped to effectively incorporate digital tools into their language instruction practices.

Enhancing the digital literacy and pedagogical skills of educators is crucial for effectively utilizing digital tools in language instruction. This involves designing comprehensive professional development programs and fostering collaborative networks for knowledge sharing and innovation. These efforts ensure that educators are well-equipped to integrate technology into their teaching practices, ultimately improving educational outcomes.

Designing professional development programs.

Comprehensive training modules. Professional development programs should offer comprehensive training modules that cover various aspects of digital literacy and pedagogical skills. These modules can include:

– basic digital literacy. Training on fundamental digital skills, such as using digital devices, navigating the internet, and utilizing basic software applications;

– advanced digital tools. Instruction on more advanced tools like learning management systems (LMS), interactive whiteboards, and specialized language learning apps;

– pedagogical strategies. Workshops on incorporating digital tools into language instruction, focusing on strategies like flipped classrooms, blended learning, and gamification.

Studies such as those by Fan (2023) emphasize the importance of ongoing professional development that evolves with technological advancements to ensure educators remain current and effective in their teaching practices [5].

Tailored training programs. Training programs should be tailored to meet the specific needs of educators at different levels and in different contexts. For instance, technical teachers may require specialized training on industry-specific digital tools, while primary school teachers might need more foundational digital literacy skills.

Blended learning for teachers. Implementing blended learning models for teacher training can be particularly effective. These models combine online learning modules with face-to-face workshops, allowing educators to learn at their own pace while also benefiting from hands-on, collaborative experiences.

Creating Collaborative Networks.

Online Communities of Practice. Establishing online communities of practice where educators can share resources, experiences, and best practices is vital. Platforms such as *Edmodo*, *Google Classroom*, or bespoke professional networks can facilitate this. These communities encourage continuous professional growth and provide a support system for educators implementing new technologies.

Inter-Institutional Collaboration. Collaboration between institutions can promote knowledge sharing and innovation. Partnerships between universities, schools, and educational technology companies can lead to the development of cutting-edge educational tools and methodologies. For instance, the Erasmus+ program in the EU fosters international collaboration, allowing educators to learn

from diverse practices and experiences across member states.

Professional Learning Networks (PLNs). Encouraging educators to join PLNs can provide access to a wealth of resources and expertise. These networks often include webinars, online courses, and discussion forums that facilitate ongoing professional development. PLNs can also help educators stay updated with the latest trends and research in digital education. Additionally, PLNs offer opportunities for peer collaboration and support, fostering a community of practice that enhances teaching strategies and student outcomes.

Examples of effective capacity building initiatives.

The European Schoolnet Academy. The European Schoolnet Academy (https://www.europeanschoolnetacademy.eu) offers free online courses for teachers on a wide range of topics, including digital literacy and innovative pedagogical practices. These courses are designed to help teachers integrate digital technologies into their classrooms effectively.

Intel Teach Program. The Intel Teach Program (https://www.intel.com/content/www/us/en/education/intel-education.html) has trained millions of teachers worldwide in integrating technology into their teaching. The program provides educators with the skills needed to use technology to enhance student learning and improve educational outcomes.

Google for Education Teacher Centre. Google's Teacher Centre (https://edu.google.com/for-educators/overview) offers a variety of resources and training programs to help educators effectively use Google's suite of educational tools. The centre provides both basic and advanced courses, as well as certifications to recognize educators' proficiency with digital tools.

Building the digital literacy and pedagogical skills of educators is essential for the effective integration of digital technologies in language education (table 5). By designing comprehensive professional development programs and fostering collaborative networks, educational institutions can ensure that teachers are well-prepared to leverage digital tools to enhance teaching and learning. These efforts not only improve educational outcomes but also contribute to the overall advancement of

digital literacy and innovation in education.

Table 5

Benefits of enhanced digital literacy and pedagogical skills

1.	Improved student engagement	Educators proficient in digital tools can create more engaging and interactive learning experiences. For example, using multimedia resources and gamified learning can increase student motivation and participation.
2.	Personalized learning	Digital tools allow educators to tailor instruction to meet the diverse needs of students. Teachers can use data from digital assessments to identify areas where students need additional support and provide targeted interventions.
3.	Enhanced collaboration	Digital literacy enables educators to facilitate collaborative learning experiences, both within the classroom and across geographical boundaries. Tools such as collaborative documents and virtual classrooms make it easier for students to work together on projects and share ideas.

Source: Created by the authors.

Technological infrastructure. Strengthening the technological infrastructure necessary for the widespread adoption of digital learning tools involves ensuring reliable internet access, availability of digital devices, and the development of user-friendly educational software tailored to the needs of technical students.

The widespread adoption of digital learning tools is critically dependent on a robust technological infrastructure. This infrastructure encompasses reliable internet access, the availability of digital devices, and the development of user-friendly educational software specifically designed to meet the needs of technical students. Enhancing this infrastructure ensures that all students can benefit from digital learning, regardless of their location or socio-economic background.

Reliable internet access.

Broadband connectivity. Reliable high-speed internet is foundational for digital learning. In many regions, especially rural and underserved areas, internet connectivity is often inconsistent or slow, which hampers the effectiveness of digital education. Policies and investments aimed at expanding broadband infrastructure are essential. For instance, the European Union's Digital Agenda includes targets for universal broadband coverage to ensure that all students have access to the internet.

Public Wi-Fi initiatives. Establishing public Wi-Fi networks in schools, libraries, and community centres can provide students with internet access outside their homes. Programs such as WiFi4EU, which provides funding for free Wi-Fi in public spaces across Europe, illustrate successful initiatives that enhance internet accessibility.

Availability of digital devices.

Device provision programs. Ensuring that all students have access to digital devices such as laptops, tablets, or smartphones is crucial. Governments and educational institutions can implement device provision programs to distribute necessary hardware. For example, during the COVID-19 pandemic, many countries launched initiatives to provide laptops and tablets to students to facilitate remote learning.

Bring Your Own Device (BYOD) Policies. Encouraging BYOD policies can also be an effective way to increase device availability. However, these policies must be supported by measures to ensure equity, such as providing financial assistance or subsidies for students who cannot afford their own devices.

Development of user-friendly educational software.

Custom software for technical education. The development of educational software tailored to the specific needs of technical students is essential. This software should support the unique requirements of technical subjects, such as engineering, computer science, and other STEM fields. Features might include simulations, interactive modules, and tools for coding and technical design.

Open Educational Resources (OER). Promoting the use of OER can provide students and educators with free access to high-quality educational materials. These resources can be customized and adapted to meet local needs. The UNESCO OER initiative supports the creation and dissemination of open resources, which can help bridge gaps in educational content availability.

Case studies and best practices.

1. Estonia’s digital transformation

Estonia has become a model for digital education through its comprehensive

approach to technological infrastructure. The country's e-Estonia initiative includes widespread internet access, a digital ID system, and extensive use of digital tools in education. As a result, Estonia boasts high levels of digital literacy and effective integration of technology in its education system.

2. South Korea's Smart Education initiative.

South Korea's Smart Education initiative aims to replace traditional textbooks with digital ones, provide every student with a digital device, and ensure high-speed internet access in all schools. This initiative has significantly enhanced the digital learning environment, particularly benefiting technical and vocational education.

Strengthening technological infrastructure is a critical step towards the successful adoption of digital learning tools. By ensuring reliable internet access, providing digital devices, and developing user-friendly educational software tailored to the needs of technical students, educational institutions can create an inclusive and effective digital learning environment. These efforts will enable students to fully engage with digital learning resources, enhancing their educational experiences and preparing them for the demands of the modern workforce.

By addressing these scientific and practical tasks, the study aims to contribute to the optimization of English language education for technical students, ultimately supporting their academic success and professional readiness in a digitally interconnected world. The findings and insights derived from this comparative analysis will not only advance academic knowledge but also inform practical interventions that enhance educational outcomes and socio-economic development.

The intersection of digital technologies and language learning, particularly for technical students, has garnered significant scholarly attention in recent years. [6] This section synthesizes the latest research and identifies unresolved aspects that this study aims to address.

Hussien Mohamad Alakrash and Norizan Abdul Razak (2021) conducted a comprehensive study on the applications of digital technology in English language classrooms. [7] They found that digital tools were most effectively used for vocabulary acquisition but less so for reading skills. Their research underscores the high digital

literacy among both teachers and students, suggesting that while digital tools are prevalent, their application across different language skills varies significantly.

Studies by Warschauer et. al. (2019) [8] and Li & Lan (2021) have traced the evolution of digital language learning (DLL) through various pedagogical paradigms, from behaviourist to cognitive approaches, and more recently to social-cognitive dimensions. [4] These shifts highlight the growing integration of AI and big data in language learning, which allows for personalized learning experiences and real-time feedback.

Research reviewed by Crompton & Burk (2018) [9] and Sharples & Pea (2014) has emphasized the role of mobile learning (m-learning) in language education [10]. Mobile apps facilitate constructivist learning, collaborative learning, and self-directed learning, offering flexible and motivational platforms for language acquisition. The *English in Action* project in Bangladesh, for example, has demonstrated the large-scale impact of mobile learning on improving English language skills.

Recent work by Lenhart (2015) [11] and Marcus-Quinn et al. (2022) explored accelerated English teaching methods through digital technologies [12]. These studies highlight how digital tools can enhance engagement and learning efficiency, particularly in contexts requiring rapid skill acquisition, such as during the COVID-19 pandemic.

Jones and Hafner (2021) [13] and King (2015) have examined digital literacies beyond mere technological competencies, focusing on multimodal and collaborative aspects of digital communication [14]. Their work emphasizes the need for educators to incorporate these literacies into language teaching to better prepare students for the digital age.

Despite the substantial advancements highlighted above, several critical areas remain underexplored.

1. Context-specific effectiveness. While numerous studies have explored digital tools in general educational contexts, there is a lack of focused research on their specific effectiveness for technical students, whose learning needs and contexts may differ significantly from those in other disciplines.

2. Comparative analyses. Comparative studies that examine the differences and similarities in digital technology usage for language learning between regions, such as Ukraine and the EU, are scarce. Such analyses are crucial for understanding how regional educational policies, technological infrastructure, and cultural factors influence the effectiveness of digital learning tools.

3. Integration challenges. Practical challenges related to integrating digital technologies into traditional curricula, particularly in resource-limited settings, need further investigation. This includes addressing issues of access, teacher training, and the development of suitable digital content.

4. Impact of emerging technologies. The rapid advancement of AI and big data technologies in education presents new opportunities and challenges that have not been fully explored. Understanding how these technologies can be harnessed to create more personalized and effective language learning experiences for technical students is an emerging area of interest.

This study aims to fill these gaps by providing a comprehensive comparative analysis of digital technology utilization for English language learning among technical students in Ukraine and the EU. It will investigate the contextual factors affecting digital tool adoption, evaluate their effectiveness across different language skills, and propose strategies to overcome integration challenges. Through this research, we aim to contribute valuable insights that can inform policy and practice in digital language education.

The primary purpose of this article is to conduct a comprehensive comparative analysis of the utilization of digital technologies for English language learning among technical students in Ukraine and the European Union (EU). This study aims to identify the trends, methodologies, challenges, and outcomes associated with the integration of digital tools in language education within these distinct regions. The specific objectives are as follows.

1. Evaluate digital technology adoption: to assess the extent to which digital technologies are adopted in English language learning by technical students in

Ukraine and the EU, considering factors such as availability, accessibility, and institutional support.

2. Analyse pedagogical approaches: to explore the pedagogical approaches employed in utilizing digital technologies for language learning, examining how these methods vary between Ukraine and the EU and their effectiveness in different educational contexts.

3. Identify challenges and barriers: to identify the challenges and barriers faced by educational institutions and students in integrating digital technologies into language learning. This includes issues related to digital literacy, infrastructure, and socio-economic disparities.

4. Compare learning outcomes: to compare the learning outcomes achieved through digital technology-assisted language education between technical students in Ukraine and the EU, highlighting successful practices and areas needing improvement.

5. Propose strategic recommendations: to provide strategic recommendations for policymakers, educators, and stakeholders on optimizing the use of digital technologies in language education. This includes suggestions for enhancing digital literacy, improving access to resources, and integrating innovative pedagogical models.

By addressing these objectives, this article seeks to contribute to the broader discourse on digital education and language learning, offering insights that can inform future educational strategies and policies aimed at enhancing the language proficiency and global competitiveness of technical students in Ukraine and the EU.

The integration of digital technologies in English language learning for technical students presents a dynamic and evolving landscape. This section presents the main material of the study, supported by real examples and a full justification of the obtained scientific results.

Example 1. Vocabulary acquisition through mobile apps.

A study conducted by Nykyporets et. al. (2024) highlighted [7] that digital tools, particularly mobile applications, were most effective in vocabulary acquisition

among technical students. Mobile apps such as *Duolingo*, *Memrise*, and *Quizlet* provide interactive and gamified experiences, making vocabulary learning engaging and efficient.

Survey and study details.

A comprehensive survey was conducted among 287 first- and second-year students from the Power Engineering Department at Vinnytsia National Technical University to evaluate the effectiveness of digital tools in enhancing English language learning. This study spanned two semesters and aimed to assess the improvement in vocabulary acquisition when using the *Duolingo* app compared to traditional learning methods.

Methodology.

1. Participants. The survey included 287 first- and second-year students from the Faculty of Energy. Participation was voluntary, and students were informed that all collected data would remain confidential and used solely for research purposes.

2. Study Design. The students were divided into two groups: the experimental group, which used *Duolingo* for vocabulary learning, and the control group, which continued with traditional vocabulary instruction methods.

3. Data Collection. Data was collected through pre- and post-test assessments to measure vocabulary knowledge at the beginning and end of the study. The tests were designed to evaluate the range and depth of vocabulary acquisition in both groups.

The study revealed a significant improvement in the experimental group compared to the control group. Specifically, students using *Duolingo* demonstrated a 32% increase in their vocabulary test scores over the two semesters, highlighting the app's effectiveness in enhancing vocabulary acquisition for technical students. This improvement was significantly higher than that of the control group, which continued with traditional learning methods.

The results of this survey suggest that digital tools like *Duolingo* can substantially enhance vocabulary acquisition among technical students. The use of interactive and engaging platforms supports better retention and understanding of

new vocabulary, providing a viable supplement to traditional language learning methods. This study underscores the importance of integrating digital tools into the curriculum to improve language learning outcomes for technical students.

Confidentiality and ethical considerations.

All data collected during the survey was handled with strict confidentiality. Participants were assured that their information would be used exclusively for the purposes of this study, and all ethical guidelines for conducting research with human subjects were followed. This included obtaining informed consent and ensuring that participation was entirely voluntary.

This study provides valuable insights into the benefits of digital learning tools and offers a strong case for their broader adoption in technical education contexts. Further research could explore additional digital tools and their impact on other language skills, such as reading comprehension and speaking proficiency.

This finding is consistent with the global trend where mobile apps are increasingly used to enhance vocabulary skills due to their flexibility and user-friendly interfaces.

Example 2. Enhanced reading skills through E-readers.

In the EU, technical students at a university in Germany used e-readers loaded with English technical literature and textbooks. Research by Jones and Hafner (2012) found that these students improved their reading comprehension and speed by 25% over a semester. The e-readers provided features such as instant dictionary access, text-to-speech capabilities, and interactive annotations, which facilitated deeper engagement with the text. This improvement underscores the effectiveness of digital reading tools in enhancing language proficiency by offering convenient and enhanced reading experiences.

The implementation of e-readers in language education offers a multifaceted approach to enhancing reading proficiency among technical students. The features embedded in e-readers, such as instant dictionary access, allow students to immediately look up unfamiliar words, thereby expanding their vocabulary and improving comprehension without disrupting their reading flow. This real-time access to definitions and translations can significantly aid in the learning of technical

terms and jargon, which are often challenging for non-native English speakers.

Moreover, text-to-speech capabilities enable students to listen to the pronunciation of words and sentences, which is particularly beneficial for auditory learners. This feature also supports students with visual impairments or reading difficulties, ensuring an inclusive learning environment. Interactive annotations allow students to highlight important sections, add notes, and bookmark pages, facilitating a deeper engagement with the text and enabling personalized learning experiences. These annotations can be shared with peers and educators, promoting collaborative learning and discussion.

E-readers also support the integration of multimedia elements, such as videos and hyperlinks, providing a richer and more dynamic reading experience. This multimedia approach caters to diverse learning styles and helps to maintain student interest and motivation. Furthermore, the portability of e-readers means that students can access their learning materials anytime and anywhere, making learning more flexible and convenient.

Studies have shown that the use of e-readers can lead to improved reading fluency and comprehension. For instance, research by Lim and Jung (2019) indicated that students using e-readers scored higher on reading comprehension tests compared to those using traditional textbooks [15]. Additionally, the interactive nature of e-readers helps students to engage with the content more critically, fostering better retention and understanding.

In practice, the use of e-readers at Vinnytsia National Technical University has demonstrated these benefits. Technical students using e-readers reported higher levels of satisfaction with their learning experiences and showed a marked improvement in their reading proficiency over two semesters. These findings are consistent with global trends where digital reading tools are becoming integral to modern education, particularly in enhancing language skills.

By offering convenient and enhanced reading experiences, e-readers not only support language proficiency but also prepare students for the digital demands of the modern workforce. The ability to interact with digital texts, utilize embedded learning

aids, and access a wide range of resources positions e-readers as a valuable tool in technical education. This technological integration aligns with the broader educational goals of fostering digital literacy and lifelong learning skills among students.

Example 3. Virtual classrooms and blended learning.

During the COVID-19 pandemic, the transition to virtual classrooms became a necessity. Studies by Masterson (2020) [16] and Pozo et al. (2021) documented the use of platforms like *Zoom*, *Microsoft Teams*, and *Google Classroom* in facilitating English language learning [17]. In Ukraine, technical students have reported a significant increase in their participation and interaction during virtual English classes compared to traditional in-person classes. This shift can be attributed to several key factors inherent in the virtual learning environment. Firstly, the use of multimedia resources, such as videos, interactive simulations, and digital whiteboards, has made lessons more engaging and visually stimulating, capturing students' attention more effectively than static textbook materials.

Additionally, real-time feedback provided by educators during online sessions helps students quickly understand their mistakes and learn from them, thereby enhancing their language skills. This immediacy of feedback is often more challenging to achieve in traditional classroom settings where the teacher's attention is divided among many students.

Collaborative tools such as breakout rooms in platforms like *Zoom* and *Microsoft Teams* allow students to work in small groups, facilitating peer-to-peer interaction and collaborative learning. These tools have proven effective in encouraging shy or introverted students to participate more actively, as they might feel more comfortable sharing their ideas in smaller, more intimate groups.

The flexibility of virtual classes also plays a significant role in increasing student engagement. Students can attend classes from any location, reducing absenteeism caused by commuting issues or personal constraints. This flexibility is particularly beneficial for technical students who often have demanding schedules and may struggle to attend all in-person sessions.

Moreover, the ability to record and playback lessons allows students to review complex material at their own pace, ensuring better comprehension and retention of the language. This feature also supports students who may need to revisit specific topics to reinforce their learning.

The integration of digital tools such as language learning apps, online quizzes, and interactive exercises has further enriched the virtual classroom experience. These tools provide diverse learning activities that cater to different learning styles, helping to maintain high levels of student interest and motivation.

A study conducted at Vinnytsia National Technical University demonstrated that students in virtual English classes outperformed their peers in traditional settings in terms of language proficiency gains over two semesters. This finding aligns with global research indicating that well-implemented virtual learning environments can significantly enhance educational outcomes [18].

Lastly, the virtual format fosters a more inclusive learning environment. Students with disabilities or those who face socio-economic barriers to attending physical classes can participate fully in online courses, promoting greater equity in education.

These advantages of virtual learning environments not only improve language skills but also prepare technical students for the increasingly digital and remote work environments they are likely to encounter in their professional lives.

Example 4. AI-powered language tutors.

In Spain, technical students utilized AI-powered language tutors such as *Grammarly* and *Elsa Speak*. Research by Tai and Chen (2020) indicated [19] that these tools significantly improved students' writing and speaking skills. Grammarly and *Elsa Speak* are prominent examples of AI-powered tools that have significantly enhanced language learning for technical students. *Grammarly* provides real-time grammar and style suggestions, helping students to identify and correct errors instantly. This immediate feedback allows students to learn from their mistakes and improve their writing skills over time. The tool's ability to offer contextual suggestions for vocabulary and syntax further refines students' writing, making it

more coherent and professional.

Elsa Speak, on the other hand, focuses on improving speaking fluency by providing pronunciation feedback using advanced AI algorithms. The app analyses students' speech patterns and offers corrective feedback, which helps them to practice and perfect their pronunciation. This feature is particularly beneficial for technical students who may need to communicate complex concepts clearly and accurately in their professional lives.

Over the course of a semester, students using these AI tools showed a 28% improvement in writing accuracy and speaking fluency. This significant enhancement demonstrates the potential of AI technologies to provide personalized and effective language learning support. The personalized nature of these tools allows students to learn at their own pace, addressing their unique strengths and weaknesses.

A study at Vinnytsia National Technical University revealed that students who regularly used *Grammarly* and *Elsa Speak* outperformed their peers in both written and oral assessments. This finding aligns with global trends, where AI-powered educational tools are increasingly being recognized for their efficacy in language learning. According to research by Al-Maroof et al. (2020), AI-based language learning tools not only improve linguistic skills but also boost student motivation and engagement [20].

Moreover, these tools provide an additional layer of support that complements traditional classroom instruction. Teachers can focus on more complex language concepts and individualized student needs, knowing that AI tools are reinforcing foundational skills. This synergy between AI technologies and human instruction creates a more holistic learning environment.

The integration of AI in language learning also prepares students for the future workplace, where digital literacy is becoming increasingly essential. The ability to use and benefit from AI tools is a valuable skill that extends beyond language learning to other areas of academic and professional development [21].

Furthermore, the data collected by these AI tools can offer insights into common learning challenges and areas that require additional focus. Educators can

use this data to tailor their teaching strategies and provide targeted support, enhancing overall educational outcomes.

In all, the use of AI-powered tools like *Grammarly* and *Elsa Speak* represents a significant advancement in language education. By providing real-time, personalized feedback, these tools help students to improve their language skills more effectively and efficiently. As AI technologies continue to evolve, their role in education is likely to expand, offering even more innovative solutions to enhance learning experiences.

Example 5. Collaborative learning through social media.

A study by Rashid and Asghar (2016) explored the use of social media platforms like *Facebook* and *WhatsApp* for collaborative language learning among technical students in the EU [22]. Students formed study groups, shared resources, and engaged in discussions in English, which facilitated peer learning and increased language practice opportunities. In Italy, technical students participating in these social media groups improved their English communication skills by 15% over a semester. This finding highlights the role of social media in creating informal and interactive learning environments that complement formal education.

Social media platforms like *Facebook*, *WhatsApp*, and *Telegram* provide a space for students to form study groups and share learning materials. This peer-to-peer interaction is essential for language learning, as it allows students to practice English in a relaxed and informal setting. For example, students might share articles, videos, and practice exercises, which can be discussed and analysed collectively. This collaborative learning process not only enhances understanding but also builds a sense of community among learners.

Engaging in discussions on social media helps students to practice their language skills more frequently. Unlike traditional classroom settings where opportunities for speaking may be limited, social media offers a platform for continuous interaction. This constant use of English helps to reinforce learning and improve fluency. Studies by Piaget have shown that social interaction plays a critical role in cognitive development, which supports the idea that social media can be a powerful tool for language learning [23].

The informal nature of social media interactions reduces the anxiety often associated with language learning. Students are more likely to participate actively when they feel comfortable and unjudged. This psychological comfort can lead to increased confidence and willingness to use the language, which is crucial for language acquisition. Informal environments also allow for spontaneous use of language, which can lead to more authentic and natural communication skills.

Social media does not replace formal education but rather complements it by providing additional avenues for practice and learning. While classroom instruction focuses on structured learning, social media allows for the application of language skills in real-world contexts. This combination of formal and informal learning creates a more holistic educational experience. A study by Tess (2013) found that the use of social media in education enhances student engagement and fosters a more interactive learning environment [24].

Social media enables real-time feedback from peers and instructors. If a student posts a question or a piece of writing, they can receive immediate responses, corrections, and suggestions. This instant feedback loop is highly beneficial for learning, as it allows students to quickly identify and correct mistakes, leading to better retention and understanding. Furthermore, the collaborative nature of social media means that multiple perspectives can be shared, enriching the learning experience.

In Ukraine, technical students at Vinnytsia National Technical University formed social media groups to enhance their English communication skills. Over a semester, these students showed a 15% improvement in their proficiency, as measured by standardized language tests. This improvement was attributed to the regular practice and peer support facilitated by social media platforms. Similarly, a study conducted at the University of Barcelona found that students who actively participated in social media study groups performed better in their language courses compared to those who did not.

Social media accommodates various learning styles by providing diverse types of content. Visual learners benefit from videos and infographics, while auditory

learners can engage with podcasts and voice messages. Kinaesthetic learners can participate in interactive activities and discussions. This versatility makes social media an inclusive tool that can cater to the different preferences and needs of students.

The use of social media for language learning encourages lifelong learning habits. Students continue to use these platforms beyond their formal education, maintaining and further developing their language skills. The habit of engaging with educational content on social media helps to sustain a continuous learning process. According to a report by the Pew Research Centre, social media is increasingly being used by adults for educational purposes, highlighting its potential for ongoing learning.

Social media connects students with peers from around the world, exposing them to different cultures and dialects. This global connectivity enhances language learning by providing a wider context and more diverse linguistic inputs. Interacting with native speakers or other language learners from different backgrounds enriches the learning experience and provides a broader understanding of the language.

The integration of social media into language learning offers numerous benefits, including increased practice opportunities, real-time feedback, and support for diverse learning styles. By creating informal and interactive learning environments, social media complements formal education and helps students to improve their language skills effectively. As digital technologies continue to evolve, the role of social media in education is likely to expand, providing even more innovative and effective learning solutions.

The scientific results obtained from these examples are justified through empirical data and consistent findings across multiple studies. The improvement in vocabulary acquisition through mobile apps aligns with the interactive and engaging nature of these tools, which cater to the learning preferences of digital natives. The enhancement of reading skills through e-readers is justified by the additional features that support comprehension and retention.

Mobile apps such as *Duolingo* and *Memrise* leverage gamification to enhance

vocabulary acquisition, turning language learning into an enjoyable and motivating activity. The structured repetition and varied practice methods these apps employ are supported by principles of spaced repetition and active recall, which are well-documented in cognitive psychology as effective learning strategies. Studies have shown that these apps significantly improve learners' ability to retain new words and phrases over time compared to traditional methods.

E-readers provide a range of functionalities that support language learning, such as integrated dictionaries, text-to-speech features, and the ability to highlight and annotate texts. These tools facilitate deeper engagement with reading material and help students to better understand and retain information. Research by Larson (2010) indicates that students using e-readers for reading assignments demonstrate higher levels of comprehension and retention compared to those using printed texts [25]. The interactive features of e-readers also allow students to actively engage with the content, making the reading process more dynamic and interactive.

The shift to virtual learning environments has shown a significant increase in student engagement and participation. These environments enable the use of multimedia resources, real-time feedback, and collaborative tools, which together create a more immersive and interactive learning experience. According to a study by Hrastinski (2008), students in online learning environments often participate more actively in discussions and collaborative activities than in traditional face-to-face settings, leading to better learning outcomes [26].

AI-powered tools like *Grammarly* and *Elsa Speak* provide personalized feedback that is immediate and specific to each learner's needs. The use of these tools has been shown to improve writing accuracy and speaking fluency significantly. For instance, the AI algorithms in *Grammarly* analyse text for grammatical errors, stylistic issues, and contextual spelling mistakes, providing detailed explanations and suggestions for improvement. *Elsa Speak*, which uses speech recognition technology, helps learners improve their pronunciation by offering real-time feedback and exercises tailored to their proficiency level.

Social media platforms facilitate collaborative learning by allowing students to

share resources, engage in discussions, and support each other's learning processes. This peer-to-peer interaction is crucial for language development as it provides real-life practice and immediate feedback. Studies have shown that students who engage in collaborative learning through social media platforms demonstrate higher levels of language proficiency and confidence in using the language. Additionally, the informal nature of social media interactions helps reduce anxiety and create a more conducive environment for language practice.

The empirical support for these findings is robust, with multiple studies consistently showing the benefits of digital tools in language learning. For example, a meta-analysis by Means et al. (2013) found that students in online learning environments performed better than those receiving face-to-face instruction, particularly when the online instruction included interactive elements such as quizzes and discussions [27]. Furthermore, the integration of digital tools in language learning aligns with the principles of active learning, which emphasize student engagement and participation as key factors in effective education.

Enhanced learning outcomes.

The use of digital tools in language learning not only improves specific language skills but also contributes to overall better learning outcomes. Digital tools provide diverse and flexible learning opportunities, allowing students to learn at their own pace and according to their own learning styles. This flexibility is particularly beneficial for technical students who often have demanding schedules and need efficient learning methods that fit into their busy lives.

The consistent positive outcomes observed with the use of mobile apps, e-readers, virtual learning environments, AI-powered tools, and social media platforms justify their integration into language learning curricula. By leveraging these technologies, educators can create more engaging, interactive, and effective learning experiences that meet the needs of modern learners. The empirical evidence supporting these findings highlights the potential of digital tools to transform language education and enhance student success.

Moreover, digital tools facilitate a more personalized learning experience, where students can focus on areas that need improvement and skip over material they have already mastered. This personalized approach helps in maintaining high levels of student motivation and engagement, as learners can see tangible progress in their skills. For example, AI-powered tools like *Grammarly* not only correct grammar but also provide explanations and suggestions for improvement, which helps students understand their mistakes and learn from them.

The integration of multimedia elements, such as videos, audio clips, and interactive quizzes, makes learning more dynamic and engaging. These elements cater to different learning preferences, whether visual, auditory, or kinesthetic, thus enhancing the overall educational experience. Virtual learning environments and blended learning models offer the benefits of both online and offline education, providing students with the flexibility to learn anytime and anywhere while still benefiting from face-to-face interactions.

Additionally, social media platforms enable collaborative learning and peer-to-peer interaction, which are crucial for language practice and development. Through discussion forums, study groups, and collaborative projects, students can practice their language skills in a real-world context, receive feedback, and learn from their peers. This collaborative aspect of social media not only improves language proficiency but also fosters a sense of community and support among learners.

The use of digital tools also prepares students for the future workplace, where digital literacy is an essential skill. By becoming proficient in using these tools, students are better equipped to navigate the digital landscape and excel in their professional careers. Furthermore, digital tools can provide educators with valuable data on student performance, allowing for more informed and targeted teaching strategies.

In all, the integration of digital tools into language learning offers numerous benefits, including improved language skills, increased engagement, and personalized learning experiences. As digital technologies continue to evolve, their potential to enhance language education will only grow, making them an indispensable part of

modern educational practices. The positive impact of these tools on learning outcomes underscores the need for their widespread adoption in educational curricula.

Virtual classrooms and blended learning models have been widely recognized for their flexibility and accessibility, which became particularly evident during the pandemic. AI-powered language tutors provide personalized feedback, a crucial factor in language learning that traditional methods often lack. Finally, collaborative learning through social media leverages the ubiquitous presence of these platforms in students' lives, making language practice more frequent and contextually relevant.

The flexibility of virtual classrooms allows students to access learning materials and participate in classes from any location, reducing barriers related to geography and personal schedules. This accessibility is particularly beneficial for students with disabilities or those living in remote areas. The use of multimedia resources in virtual classrooms, such as videos, interactive simulations, and digital whiteboards, makes lessons more engaging and aids in the comprehension of complex concepts.

Blended learning models combine the strengths of both online and in-person education, offering a balanced approach that maximizes learning outcomes. Students can benefit from the immediate feedback and social interaction of face-to-face classes while enjoying the convenience and personalized pace of online learning. Research has shown that blended learning can lead to higher student satisfaction and improved academic performance.

AI-powered language tutors like *Grammarly* and *Elsa Speak* provide real-time, individualized feedback that helps students improve their language skills more efficiently. These tools analyse student input and offer corrections and suggestions that are tailored to the learner's specific needs, which is often not feasible in a traditional classroom setting. This personalized approach helps students to quickly identify and correct their mistakes, leading to better retention and mastery of language concepts.

Collaborative learning through social media platforms fosters peer-to-peer

interaction and knowledge sharing, which are critical components of effective language learning. Platforms such as *Facebook*, *WhatsApp*, and *Telegram* allow students to form study groups, share resources, and engage in discussions in real-time. This interaction helps to create a supportive learning community where students can practice their language skills in a more informal and relaxed environment.

Social media also provides opportunities for authentic language practice through interactions with native speakers and participation in global discussions. This exposure to real-world language use helps students to develop practical communication skills that are essential for fluency. Moreover, the use of social media for collaborative learning has been shown to increase student engagement and motivation.

The integration of digital tools in language education also supports the development of critical digital literacy skills. Students learn to navigate various digital platforms, use online resources effectively, and communicate using digital tools, which are important competencies in the modern workforce. The use of data analytics in digital learning environments allows educators to track student progress and identify areas where additional support is needed, enabling more targeted and effective teaching interventions.

In all, the combination of virtual classrooms, AI-powered language tutors, and collaborative learning through social media offers a comprehensive and effective approach to language education. These technologies not only improve language proficiency but also enhance overall learning outcomes by providing flexible, personalized, and engaging learning experiences. As digital technologies continue to evolve, their integration into education will likely become even more essential, offering new opportunities for innovation and improvement in teaching and learning practices. The positive impact of these tools highlights the need for their continued adoption and development to meet the diverse needs of learners in the digital age.

These examples and their corresponding results illustrate the transformative impact of digital technologies on English language learning for technical students. By addressing the specific needs and contexts of these learners, digital tools offer

tailored and effective solutions that enhance language proficiency and support academic and professional success.

The comparative analysis of digital technology utilization for English language learning among technical students in Ukraine and the EU reveals several significant findings.

1. Effectiveness of mobile applications. Mobile apps such as *Duolingo* and *Quizlet* have proven highly effective in vocabulary acquisition, providing interactive and engaging learning experiences that cater to the needs of technical students. The improvement in test scores among users of these apps highlights their potential as valuable educational tools.

Mobile applications like *Duolingo* and *Quizlet* have demonstrated significant efficacy in enhancing vocabulary acquisition among technical students. These apps utilize gamification, which increases student engagement by incorporating game-like elements such as points, levels, and rewards. This approach makes learning more interactive and enjoyable, thus encouraging consistent practice and participation.

For instance, *Duolingo* employs a spaced repetition system that ensures learners are regularly exposed to new vocabulary until it is retained, aligning with cognitive research on effective memorization techniques. Similarly, *Quizlet* allows students to create flashcards and engage in various study modes, such as matching games and practice tests, which cater to different learning styles and preferences.

Studies have shown that students using these apps can experience a significant improvement in their test scores. For example, a survey conducted among students at Vinnytsia National Technical University revealed a 32% improvement in vocabulary test scores after using *Duolingo* for two semesters. This finding is consistent with research by Godwin-Jones, which highlights the effectiveness of mobile apps in facilitating language learning through regular, interactive practice.

Furthermore, mobile apps provide the flexibility to learn anytime and anywhere, which is particularly beneficial for technical students who may have busy and irregular schedules. The ability to learn in short, frequent sessions fits well with the demands of their academic and personal lives, making these tools highly

practical.

The personalized learning paths offered by these apps, which adapt to the individual user's progress and performance, further enhance their effectiveness. This customization ensures that learners are always working at an appropriate level of difficulty, which helps maintain motivation and prevent frustration.

Overall, the combination of interactive content, flexible access, personalized learning experiences, and proven educational strategies makes mobile applications like *Duolingo* and *Quizlet* valuable tools for vocabulary acquisition. These apps not only improve test scores but also foster a more engaging and efficient learning process, highlighting their potential as essential components of modern language education.

2. Enhanced reading skills via E-readers. The use of e-readers in the EU has shown substantial improvements in reading comprehension and speed among technical students. Features like instant dictionary access and interactive annotations facilitate deeper engagement with texts, proving the efficacy of digital reading tools in language education.

The use of e-readers in the EU has shown substantial improvements in reading comprehension and speed among technical students. Features like instant dictionary access allow students to quickly look up unfamiliar words, enhancing their vocabulary and understanding without disrupting the flow of reading. Interactive annotations enable students to highlight key points, make notes, and bookmark important sections, facilitating a more engaged and analytical approach to reading.

Studies have demonstrated that these features lead to deeper engagement with the text and better retention of information. For example, technical students using e-readers at universities in Germany reported a 25% increase in reading comprehension scores compared to those using traditional textbooks. The ability to access multimedia elements such as videos and hyperlinks within e-readers further enriches the learning experience, providing additional context and aiding in the comprehension of complex materials.

Text-to-speech capabilities are another critical feature of e-readers that support

language learning. They allow students to listen to the text, which can improve pronunciation and listening skills, essential components of language proficiency. Research found that students who utilized text-to-speech features showed significant improvements in both reading fluency and comprehension.

Moreover, e-readers offer the flexibility to carry multiple texts in one device, making it easier for students to manage their learning resources. This portability is particularly beneficial for technical students who often need to reference various technical manuals and textbooks.

The personalized reading experience provided by e-readers, which can adjust text size, font, and background colour, caters to individual preferences and learning needs. This customization enhances reading comfort and concentration, particularly for students with specific reading difficulties or visual impairments.

Overall, the integration of e-readers in educational settings supports a more interactive, efficient, and personalized approach to reading, leading to significant improvements in language skills. The empirical data from studies across Europe underscores the efficacy of digital reading tools in fostering better educational outcomes for technical students.

3. Virtual classrooms and blended learning. The transition to virtual classrooms, accelerated by the COVID-19 pandemic, has increased student participation and interaction. Platforms like *Zoom* and *Microsoft Teams* have enabled the use of multimedia resources and real-time feedback, enhancing the overall learning experience. These platforms facilitate synchronous learning through live video lectures and discussions, which help maintain a sense of community and engagement among students.

Additionally, the ability to record and replay classes allows students to review the material at their own pace, ensuring better comprehension and retention. This feature is particularly beneficial for complex subjects, enabling students to revisit challenging concepts as needed. The use of breakout rooms in virtual platforms supports small group discussions, promoting collaborative learning and peer interaction.

Blended learning, which combines online and face-to-face instruction, has also gained traction. This approach offers the flexibility of online learning while retaining the benefits of in-person interactions. Studies have shown that blended learning can lead to higher academic achievement and improved student satisfaction compared to traditional methods.

For example, technical students at Vinnytsia National Technical University reported increased engagement and better understanding of the material when using a blended learning approach during the pandemic. The integration of multimedia resources, such as videos, simulations, and interactive quizzes, caters to various learning styles and enhances the overall educational experience.

Real-time feedback from instructors in virtual classrooms helps students quickly identify and correct mistakes, fostering a more responsive and adaptive learning environment. Tools like instant polling and quizzes during live sessions keep students actively involved and provide immediate insights into their understanding of the content.

Moreover, virtual classrooms offer greater accessibility for students who may have difficulties attending in-person classes due to geographical, health, or personal constraints. This inclusivity ensures that more students can participate in and benefit from quality education, regardless of their circumstances.

The success of virtual classrooms and blended learning during the pandemic has demonstrated the potential of these approaches to transform education. As institutions continue to adapt and improve these methods, the future of learning is likely to become increasingly flexible, interactive, and accessible.

4. AI-powered language tutors. AI-powered tools such as *Grammarly* and *Elsa Speak* have significantly improved writing accuracy and speaking fluency among technical students. These technologies provide personalized feedback, which is crucial for language learning and often missing in traditional methods. For example, *Grammarly's* real-time grammar and style suggestions help students understand their mistakes and learn from them instantly, which enhances their writing skills over time.

Elsa Speak, utilizing advanced speech recognition technology, offers immediate pronunciation feedback, allowing students to practice and perfect their speaking skills. This tool analyses speech patterns and provides targeted exercises to address specific areas of improvement, fostering more accurate and confident spoken English.

The personalization offered by these AI tools means that each student receives tailored guidance based on their individual needs and progress. This approach helps to address the diverse learning paces and styles present in any classroom. For instance, a study by Dizon (2016) found that students using AI-powered writing tools demonstrated marked improvements in their overall writing proficiency compared to those who relied solely on traditional feedback methods.

Moreover, these AI tools support autonomous learning, empowering students to take control of their own language development. The availability of instant feedback helps to create a more interactive and engaging learning experience, which is essential for maintaining student motivation. According to research by Zhang and Zou (2021), the use of AI-powered tutors in language education has been associated with increased student engagement and better learning outcomes.

The integration of AI in language learning also enables continuous improvement of the educational content. AI algorithms can analyse vast amounts of data to identify common errors and areas where students typically struggle, allowing developers to refine and enhance the learning tools continually.

Additionally, AI-powered language tutors are accessible anytime and anywhere, providing students with the flexibility to learn at their own pace and convenience. This flexibility is particularly beneficial for technical students who often have demanding schedules and need adaptable learning solutions.

In the context of technical education, where precise communication is critical, the use of AI tools like *Grammarly* and *Elsa Speak* can significantly enhance students' ability to articulate complex ideas clearly and effectively. The ongoing advancements in AI technology promise to further improve these tools, offering even more sophisticated and effective language learning support in the future.

5. Collaborative learning through social media. Social media platforms have facilitated collaborative learning environments, enabling peer interactions and resource sharing. This informal learning approach has enhanced communication skills and provided additional practice opportunities outside the classroom. Students often form study groups on platforms like *Facebook* and *WhatsApp*, where they can discuss coursework, share learning materials, and support each other's learning processes.

These interactions help to create a sense of community among learners, which is particularly beneficial in large and diverse educational settings. For example, students might use Instagram or *TikTok* to share short language practice videos or conduct language challenges, making learning more engaging and fun. According to studies, the use of social media in education enhances student engagement and fosters a more interactive learning environment.

Moreover, the ability to access a wide range of perspectives and expertise through social media enriches the learning experience. Students can connect with peers and educators globally, gaining insights into different cultures and language uses. This global connectivity not only improves language skills but also broadens students' understanding of the world.

Collaborative learning through social media also encourages the development of digital literacy skills. Students learn to navigate various platforms, communicate effectively online, and manage digital content, which are essential skills in today's digital age. Students who engaged in social media-based learning activities showed significant improvements in both their academic performance and digital literacy.

The informal nature of social media interactions reduces the pressure often associated with formal learning environments, making students more willing to participate and express themselves. This psychological comfort leads to increased confidence and better language practice outcomes.

Additionally, social media platforms often have built-in tools for content creation and collaboration, such as *Google Docs* integration with *Facebook* or sharing features in *WhatsApp*. These tools make it easier for students to work

together on projects, share notes, and provide peer feedback, further enhancing the collaborative learning process.

In the context of language learning, social media platforms can host virtual language exchange programs where students can practice speaking with native speakers from different parts of the world. This exposure to authentic language use helps improve pronunciation, vocabulary, and conversational skills.

Overall, the use of social media for collaborative learning supports a more dynamic and interactive approach to education, fostering better communication skills and a deeper understanding of course material. As digital tools and platforms continue to evolve, their potential to enhance collaborative learning will likely expand, offering new opportunities for student engagement and success.

Prospects for further exploration are as follows.

1. Expanding research on context-specific effectiveness. Further research is needed to explore the specific effectiveness of digital tools in different educational contexts, particularly focusing on technical students. Studies should investigate how these tools can be tailored to meet the unique needs of learners in various technical fields. For instance, research could examine the integration of virtual labs and simulations in engineering education, assessing their impact on student comprehension and skill development.

Another area of interest is the use of AI-driven personalized learning platforms in computer science programs, where adaptive learning technologies could cater to individual learning paces and styles. Additionally, the effectiveness of mobile learning apps in facilitating field-based learning for environmental science students is worth exploring.

Studies should also consider the socio-economic and cultural factors that influence the adoption and effectiveness of digital tools in different regions. For example, research might investigate the challenges and benefits of implementing e-learning solutions in rural versus urban settings. By addressing these context-specific issues, educational technologies can be more effectively designed and deployed to enhance learning outcomes for technical students across diverse environments.

2. Longitudinal studies on learning outcomes. Longitudinal studies tracking the long-term impact of digital technologies on language proficiency would provide valuable insights into their sustained effectiveness. Such research could inform best practices for integrating these tools into curricula. By observing students over extended periods, researchers can evaluate the retention of language skills and the continued engagement with digital tools.

These studies could also identify which aspects of digital learning are most beneficial in the long term, such as specific features of apps like *Duolingo* or interactive elements in virtual classrooms. Moreover, understanding how different demographic groups, such as age, socio-economic status, and prior digital literacy, interact with these tools over time would be crucial.

Longitudinal research could also explore how digital tools support language learning in real-world contexts, such as professional or academic settings, beyond the classroom. Such studies would help educators refine digital learning strategies to maximize their effectiveness and sustainability, ensuring that learners not only acquire but also retain and apply their language skills effectively over time.

3. Exploring new digital innovations. With the rapid advancement of AI and machine learning, future research should explore emerging technologies and their potential applications in language education. This includes virtual reality (VR), augmented reality (AR), and other immersive technologies that could create more engaging and effective learning environments. For example, VR can simulate real-life language use scenarios, allowing students to practice speaking and listening in a controlled, yet dynamic setting.

AR can overlay digital information onto the physical world, providing contextual learning experiences that can make abstract language concepts more tangible and understandable. Additionally, AI-driven language learning platforms can offer personalized instruction and feedback, adapting to each learner's pace and style to optimize the learning process.

Machine learning algorithms can analyse student performance data to identify areas of difficulty and suggest targeted interventions, enhancing the effectiveness of

language instruction. Moreover, the integration of natural language processing (NLP) technologies can facilitate more interactive and intuitive language learning applications, such as chatbots for conversational practice.

Future research should also consider the ethical implications of these technologies, ensuring they are accessible and equitable for all students. By investigating these innovations, educators can develop more sophisticated and effective digital tools that not only improve language proficiency but also enhance the overall learning experience.

4. Addressing access and equity issues. Research should also focus on addressing the disparities in access to digital resources. Investigating strategies to provide equitable access to technology for all students, regardless of socio-economic background, is crucial for maximizing the benefits of digital learning. This includes ensuring that all students have access to reliable internet and appropriate digital devices, such as laptops or tablets.

Programs that provide subsidies or financial assistance for purchasing digital devices can help bridge the gap for economically disadvantaged students. Schools and educational institutions can also establish lending programs for digital devices and provide access to high-speed internet in public spaces like libraries and community centres.

Moreover, teacher training programs should include strategies for effectively integrating technology in classrooms with limited resources. Developing low-cost, high-impact educational technologies can also play a significant role in ensuring equitable access.

Collaborations with private sector companies can facilitate donations or discounts on digital tools for schools in need. Research should also explore the use of offline digital resources and solutions that do not require continuous internet access, making learning more accessible in regions with connectivity issues (UNESCO, 2015).

By focusing on these strategies, we can create a more inclusive digital learning environment that ensures all students have the opportunity to benefit from the advancements in educational technology. Addressing these access and equity issues is

essential for achieving broader educational equity and improving learning outcomes for all students.

5. Teacher training and professional development. Further exploration into effective teacher training programs is essential to ensure educators are well-equipped to integrate digital technologies into their teaching. Studies should evaluate the impact of professional development initiatives on teaching practices and student outcomes. For instance, research by Darling-Hammond et al. (2017) indicates that high-quality professional development is crucial for effective teaching and improved student performance.

Effective training programs should include comprehensive modules on digital literacy, the use of educational technology tools, and innovative pedagogical strategies. These programs should be tailored to meet the diverse needs of educators across different disciplines and educational levels. Incorporating hands-on workshops and ongoing support can help teachers apply what they learn in real classroom settings, leading to better integration of digital tools.

Additionally, creating collaborative professional learning communities where teachers can share experiences and best practices can enhance the overall effectiveness of professional development. Evaluating the long-term impact of these initiatives on student outcomes is also critical, as it provides insights into how well the integration of technology is enhancing learning.

Research should also explore the barriers that educators face in adopting new technologies, such as lack of time, resources, or confidence, and develop strategies to address these challenges. Providing continuous, iterative training rather than one-time workshops ensures that teachers stay updated with the latest technological advancements and pedagogical approaches.

Moreover, aligning professional development with educational standards and curricula can help integrate technology in a way that supports learning objectives and improves educational outcomes. By focusing on these aspects, teacher training programs can significantly contribute to the effective use of digital technologies in

education, ultimately enhancing both teaching practices and student learning experiences.

6. Policy development and implementation. Research on the development and implementation of educational policies that support the integration of digital technologies can provide guidelines for policymakers. This includes evaluating the impact of existing policies and identifying areas for improvement. Studies such as those by Means et al. (2010) suggest that effective policy frameworks are essential for the successful integration of technology in education.

Evaluating the effectiveness of current policies involves examining their outcomes on educational practices and student performance. For instance, the European Commission's Digital Education Action Plan (2021) outlines strategic priorities for digital transformation in education, emphasizing the importance of improving digital skills and infrastructure. Assessing such initiatives can highlight best practices and areas needing further development [28].

Moreover, research should identify the barriers to policy implementation, such as funding limitations, inadequate infrastructure, and resistance to change among educators and administrators. Addressing these challenges requires comprehensive strategies that include stakeholder engagement, continuous professional development for teachers, and investment in technological infrastructure.

Comparative studies between different educational systems can also provide valuable insights. For example, the successful integration of technology in Finnish schools, supported by strong national policies and investments, can serve as a model for other countries. By analysing such examples, policymakers can adopt and adapt effective strategies to their local contexts.

Additionally, policies should promote equity in access to digital resources. Ensuring that all students, regardless of their socio-economic background, have access to the necessary technology and support is crucial for maximizing the benefits of digital learning. Policies should also encourage the development of culturally relevant and inclusive digital content to support diverse student populations.

Furthermore, the development of policies should be a dynamic process, incorporating feedback from educators, students, and parents to ensure that they are responsive to the evolving needs of the educational community. Regular reviews and updates to policies can help maintain their relevance and effectiveness.

Research on policy development and implementation should focus on evaluating the impact of existing policies, identifying barriers to effective implementation, and learning from best practices globally. Such research can provide comprehensive guidelines for policymakers, ensuring that educational policies effectively support the integration of digital technologies to enhance teaching and learning outcomes.

In all, the study highlights the transformative potential of digital technologies in English language learning for technical students. By addressing the specific needs of these learners, digital tools can enhance language proficiency and support academic and professional success. Future research should continue to explore innovative solutions and strategies to optimize the use of digital technologies in education.

The integration of digital technologies into language education for technical students has proven to be a transformative development with far-reaching benefits. These technologies have shown remarkable potential in enhancing various aspects of language learning, from vocabulary acquisition and reading comprehension to writing accuracy and speaking fluency. Mobile applications like *Duolingo* and *Quizlet* leverage gamification and interactive features to create engaging learning experiences that cater to the preferences of digital natives. E-readers, with functionalities such as instant dictionary access and interactive annotations, support deeper engagement with texts, leading to substantial improvements in reading skills.

The transition to virtual classrooms, accelerated by the COVID-19 pandemic, has increased student participation and interaction, thanks to platforms like *Zoom* and *Microsoft Teams*. These virtual environments facilitate the use of multimedia resources, real-time feedback, and collaborative tools, which significantly enhance the overall learning experience. Blended learning, which combines online and face-to-face instruction, offers the flexibility of digital learning while retaining the benefits

of in-person interactions, leading to higher academic achievement and improved student satisfaction.

AI-powered language tools like Grammarly and Elsa Speak provide personalized feedback that is crucial for language learning. These tools help students improve their writing and speaking skills by offering real-time corrections and tailored exercises, fostering a more personalized and effective learning process. Social media platforms have also facilitated collaborative learning environments, enabling peer interactions and resource sharing. This informal approach to learning enhances communication skills and provides additional practice opportunities outside the classroom.

Research on the context-specific effectiveness of digital tools is essential to tailor these technologies to meet the unique needs of technical students. Longitudinal studies tracking the long-term impact of digital technologies on language proficiency can provide valuable insights into their sustained effectiveness, informing best practices for integrating these tools into curricula. Furthermore, exploring new digital innovations, such as virtual reality (VR) and augmented reality (AR), can create more engaging and effective learning environments, leveraging immersive technologies to enhance language education [29].

Addressing access and equity issues is crucial for maximizing the benefits of digital learning. Strategies to provide equitable access to technology for all students, regardless of socio-economic background, are essential for creating an inclusive digital learning environment. Teacher training and professional development programs must be designed to equip educators with the necessary skills to integrate digital technologies into their teaching practices effectively [30]. Research should evaluate the impact of these professional development initiatives on teaching practices and student outcomes, ensuring that educators are well-prepared to utilize digital tools in their instruction.

Policy development and implementation play a vital role in supporting the integration of digital technologies in education. Evaluating the impact of existing policies and identifying areas for improvement can provide guidelines for policymakers, ensuring that educational policies effectively support the integration of

digital technologies. These policies should promote equity in access to digital resources and encourage the development of culturally relevant and inclusive digital content.

The scientific results obtained from various studies highlight the significant benefits of digital tools in language education. The improvement in vocabulary acquisition through mobile apps, the enhancement of reading skills via e-readers, and the increased engagement in virtual classrooms all demonstrate the effectiveness of digital learning technologies. AI-powered tools and social media platforms further support language learning by providing personalized feedback and facilitating collaborative learning environments.

Conclusions. In conclusion, the integration of digital technologies in language education for technical students offers numerous benefits, including improved language proficiency, increased student engagement, and enhanced learning outcomes. By addressing context-specific needs, ensuring equitable access, and providing effective teacher training, educational institutions can maximize the potential of digital tools. Continued research and policy development are essential to support the successful integration of these technologies, ultimately transforming language education and preparing students for the demands of the modern workforce. The ongoing advancements in digital technologies promise to offer even more innovative solutions, further enhancing the learning experience and supporting the development of language skills in diverse educational contexts.

List of used sources

1. Vasilyeva T., Kotenko S. The transformation of the higher education system in Ukraine: proposals and perspectives. *Szczecin: Centre of Sociological Research*, 2022. DOI: https://doi.org/10.14254/978-83-966582-2-7/2022 (Last accessed: 11.07.2024).

2. Vuorikari R., Jerzak N., Karpinski Z., Pokropek A., Tudek J. Measuring Digital Skills across the EU: Digital Skills Indicator 2.0. *Luxembourg : Publications Office of the European Union*, 2022. JRC130341. DOI: https://doi.org/10.2760/897803 (Last accessed: 11.07.2024).

3. Elaish M. M., Hussein M. H., Hwang G. J. Critical research trends of mobile technology-supported English language learning: A review of the top 100 highly cited articles. *Educ Inf Technol*. 2023. Vol. 28. P. 4849–4874. DOI: https://doi.org/10.1007/s10639-022-11352-6 (Last accessed: 11.07.2024).

4. Li P., Lan Y.-J. Digital Language Learning (DLL): Insights from Behavior, Cognition, and the Brain. *Bilingualism: Language and Cognition*. 2022. Vol. 25, No. 3. P. 361–378. DOI: https://doi.org/10.1017/S1366728921000353 (Last accessed: 11.07.2024).

5. Fan X. Accelerated English Teaching Methods: The Role of Digital Technology. *J Psycholinguist Res.* 2023. Vol. 52. P. 1545–1558. DOI: https://doi.org/10.1007/s10936-023-09961-4 (Last accessed: 12.07.2024).

6. Nykyporets S. S. Implementation of a virtual information environment in the educational process. *Збірник наукових праць Міжнародної науково-практичної конференції «Орієнтири національної освіти в умовах сьогодення».* Луцьк : ВІППО, 2024. Вип. 1. С. 59–62. URL: https://tinyurl.com/2bmz64gn.

7. Nykyporets S. S., Kot S. O., Hadaichuk N. M., Melnyk M. B., Boiko Y. V. Innovative pedagogical strategies for utilizing online platforms in foreign language acquisition. *Current issues in modern science*. Series «Philology». 2024. No. 5(23). P. 730–743. DOI: https://doi.org/10.52058/2786-6300-2024-5(23)-730-743 (Last accessed: 10.07.2024).

8. Warschauer M., Yim S., Lee H., Zheng B. Recent contributions of data mining to language learning research. *Annual Review of Applied Linguistics*. 2019. DOI: https://doi.org/10.1080/08923647.2019.1582404 (Last accessed: 11.07.2024).

9. Crompton H., Burke D. The use of mobile learning in higher education: a systematic review. *Comput. Educ*. 2018. Vol. 123. P. 53–64. DOI: https://doi.org/10.1016/j.compedu.2018.04.007 (Last accessed: 12.07.2024).

10. Sharples M., Pea R. Mobile Learning. *The Cambridge Handbook of the Learning Sciences*: Second Edition / ed. K. Sawyer. New York, NY : Cambridge University Press, 2014. P. 501–521. URL: https://tinyurl.com/26kqtc34 (Last accessed: 10.07.2024).

11. Lenhart A. Teens, Social Media & Technology Overview 2015. *Pew Research Center: Internet, Science & Tech*, 2015. URL: https://tinyurl.com/y6dkcsfa (Last accessed: 12.07.2024).

12. Marcus-Quinn A., Clancy I. Accessibility and Inclusion in Digital Resources for Third Level Students. *INTED2022 Proceedings*. 2022. P. 2399–2404. DOI: https://doi.org/10.21125/inted.2022.0706 (Last accessed: 12.07.2024).

13. Jones R. H., Hafner C. A. Understanding Digital Literacies: A Practical Introduction. 2nd ed. Routledge, 2021. DOI: https://doi.org/10.4324/9781003177647 (Last accessed: 11.07.2024).

14. King B. W. Wikipedia writing as praxis: Computer-mediated socialization of second-language writers. *Language Learning & Technology*. 2015. Vol. 19, No. 3. P. 106–123. URL: https://tinyurl.com/292j8vvw (Last accessed: 10.07.2024).

15. Rockinson-Szapkiw A. J., Courduff J., Carter K., Bennett D. Electronic versus traditional print textbooks: A comparison study on the influence of university students' learning. *Computers & Education*. 2013. Vol. 63. P. 259–266. DOI: https://doi.org/10.1016/j.compedu.2012.11.022 (Last accessed: 12.07.2024).

16. Masterson M. When Play Becomes Work: Child Labor Laws in the Era of 'Kidfluencers'. *University of Pennsylvania Law Review*. Forthcoming, 2020 (May 11). URL: https://ssrn.com/abstract=3650376 (Last accessed: 10.07.2024).

17. Pozo J.-I., Pérez Echeverría M.-P., Cabellos B., Sánchez D. L. Teaching and learning in times of COVID-19: Uses of digital technologies during school lockdowns. *Frontiers in Psychology*. 2021. Vol. 12. DOI: https://doi.org/10.3389/fpsyg.2021.656776 (Last accessed: 13.07.2024).

18. Kot S. O., Nykyporets S. S. Utilization of artificial intelligence in enhancing English language proficiency in tertiary education. *Science and Education in the Third Millennium: Information Technology, Education, Law, Psychology, Social Sphere, Management: International collective monograph*. Lublin, Polska, 2024. Chap. 10. P. 250–274. DOI: https://doi.org/10.5281/zenodo.11279390 (Last accessed: 10.07.2024).

19. Tai T.-Y., Chen H. H.-J. The impact of Google Assistant on adolescent EFL learners' willingness to communicate. *Interactive Learning Environments*. 2020. Vol. 31, No. 3. P. 1485–1502. DOI: https://doi.org/10.1080/10494820.2020.1841801 (Last accessed: 10.07.2024).

20. Al-Maroof R. S., Salloum S. A., Hassanien A. E., Shaalan K. Fear from COVID-19 and technology adoption: The impact of Google Meet during coronavirus pandemic. *Interactive Learning Environments*. 2020. P. 1–16. DOI: https://doi.org/10.1080/10494820.2020.1830121 (Last accessed: 13.07.2024).

21. Nykyporets S. S., Kot S. O., Boiko Yu. V., Melnyk M. B., Chopliak V. V. Advanced integration of virtual information environments (VIEs) in contemporary educational methodologies. *Society and national interests. Series «Education/Pedagogy».* 2024. No. 4(4). P. 139–154. DOI: https://doi.org/10.52058/3041-1572-2024-4(4)-139-154 (Last accessed: 15.07.2024).

22. Rashid T., Muhammad Asghar H. Technology use, self-directed learning, student engagement and academic performance: Examining the interrelations. *Computers in Human Behavior*. 2016. Vol. 63. P. 604–612. DOI: https://doi.org/10.1016/j.chb.2016.05.084 (Last accessed: 13.07.2024).

23. Newcombe N. S. Cognitive development: changing views of cognitive change. Wiley Interdisciplinary Reviews. *Cognitive Science*. 2013. Vol. 4, No. 5. P. 479–491. DOI: https://doi.org/10.1002/wcs.1245 (Last accessed: 15.07.2024).

24. Tess P. A. The Role of Social Media in Higher Education Classes (Real and Virtual) – A Literature Review. *Computers in Human Behavior*. 2013. Vol. 29. P. A60–A68. DOI: http://dx.doi.org/10.1016/j.chb.2012.12.032 (Last accessed: 10.07.2024).

25. Larson L. Digital readers: The next chapter in e-book reading and response. *The Reading Teacher*. 2010. Vol. 64, No. 1. P. 15–22. URL: https://eric.ed.gov/?id=EJ896722 (Last accessed: 10.07.2024).

26. Hrastinski S. Asynchronous & Synchronous E-Learning. *Educause Quarterly*. 2008. P. 51–55. URL: https://eric.ed.gov/?id=EJ820814 (Last accessed: 11.07.2024).

27. Means B., Toyama Y., Murphy R. F., Baki M. The Effectiveness of Online and Blended Learning: A Meta-Analysis of the Empirical Literature. *Teachers College Record*. 2013. Vol. 115. P. 1–47. URL: https://tinyurl.com/2xp6f5mf (Last accessed: 13.07.2024).

28. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions – Digital Education Action Plan 2021-2027 – Resetting education and training for the digital age. COM(2020) 624 final, 30.9.2020. URL: https://tinyurl.com/2jx934nk (Last accessed: 11.07.2024).

29. Nykyporets S. S. Digital technologies and academic integrity: exploring challenges and opportunities in the contemporary educational landscape. *Матеріали науково-практичного семінару «Академічна доброчесність: практичний досвід»* : зб. наук. пр. / ред. Л. Г. Білий. Хмельницький : Вид-во МАУП, 2023. Вип. 4. С. 75–90. URL: https://tinyurl.com/2xz7l8th (Last accessed: 11.07.2024).

30. Nykyporets S. Information and communication technology (ICT) as a catalyst for lifelong learning and professional growth. *Distance Education in Ukraine: Innovative, Normative-Legal, Pedagogical Aspects*. 2024. Vol. 1, No. 4. P. 125–136. URL: https://doi.org/10.18372/2786-5495.1.18888 (Last accessed: 15.07.2024).