

Mobile learning under martial law: the role of mobile applications in students' educational activities

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Abstract

This article examines the current state and key features of mobile learning among secondary school students in Ukraine under martial law. The aim of the study is to determine how mobile applications and smartphones are used for educational purposes, identify age-related patterns of use, and assess students' attitudes towards mobile learning. The research is based on a quantitative survey conducted in February 2025 with 962 students aged 10 to 18 from various regions of Ukraine. The results show that students actively use applications such as Google Classroom, Zoom, Duolingo, and ChatGPT for both formal and informal learning. For self-education, especially among high school students, apps are used to prepare for the national multi-subject test, while TikTok and YouTube are used for leisure. It was found that students prefer gamified and interactive applications. The results confirm the role of mobile learning as a flexible and accessible educational tool in times of crisis. At the same time, issues such as digital inequality, limited live interaction, and health risks are highlighted. The article contributes to the understanding of mobile learning as a distinct educational phenomenon and offers practical recommendations for its effective integration into the Ukrainian school system.

Keywords

general secondary education institution, mobile learning, ICT in education, mobile applications

1. Introduction

In the 21st century, mobile learning has become one of the key forms of transforming the educational environment, especially in times of crisis. Military conflicts, such as the full-scale invasion of Ukraine by the Russian Federation in 2022, have changed the forms and means of access to education, presenting certain challenges for students and teachers [1, 2]. In this context, mobile devices and applications appear not only as additional learning tools but as a critically important platform for ensuring a continuous educational process.

Under martial law, mobile learning has become the only means of receiving education for a significant part of the population that has been displaced or found itself in combat zones. Ukraine, as a country with a relatively high level of digitalization in education before the war, was able to mobilize digital resources at the national level, such as the "All-Ukrainian Online School" and the "Diia.Osvita" platform. Educational institutions intensified the educational process using Google Classroom, Microsoft Teams, Zoom, Google Meet, which made it possible to minimize learning losses. The role of mobile applications in this process is difficult to overestimate. They not only enable synchronous and asynchronous learning but also provide psychological support, motivation, and student autonomy.

Research on mobile learning conducted during martial law in Ukraine, particularly the work of Sippi et al. [3], proves that mobile education is a tool for increasing accessibility and equity in learning. Researchers confirm the important role of mobile learning in implementing the principle of equal access to education, especially during wartime.

Similar research results are reflected in the work of Onopriienko [4], which proves that mobile learning for students of general secondary education institutions during military operations contributes to the continuity of the learning process and helps avoid learning losses. Gamification of learning and

CTE 2024: 12th Workshop on Cloud Technologies in Education,
co-located with the 6th International Conference on History, Theory and Methodology of Learning (ICHTML 2025),
May 12, 2025, Kryvyi Rih, Ukraine

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visualization of educational material are advantages of mobile learning as opposed to purely distance learning [5, 6, 7].

In the work of Naveed et al. [8] a literature review on the organization of mobile learning showed that in formal education organized by an educational institution, mobile learning may not have all the advantages over traditional methods. However, under conditions of limited access to education, mobile learning promotes interactivity and makes the learning process personalized.

According to the reviewed studies on mobile learning organization, it can be noted that mobile technologies contribute to increasing students' motivation, developing critical thinking, and self-organization skills, which is especially important in conditions of instability. Moreover, due to their accessibility, mobile applications promote inclusion: they allow children from rural areas, internally displaced persons, and children with special educational needs to learn.

At the same time, the use of mobile technologies during wartime has its risks and limitations. Among them are the low level of digital literacy in certain population groups, as well as psychological stress associated with living under constant pressure. However, these challenges do not diminish the importance of mobile learning, but rather emphasize the need for the development of specialized strategies adapted to wartime conditions.

Thus, mobile applications serve not only as a technological but also as a socio-pedagogical phenomenon that ensures educational resilience. In wartime conditions, they become the main bridge between students and knowledge, between today's challenges and tomorrow's opportunities. This requires in-depth scientific analysis and the development of practical recommendations for educational policy, technological solutions, and pedagogical support.

2. Related work

The analysis of recent studies and publications has shown that mobile learning remains an effective form of organizing the learning process despite its relatively short history [9]. Mobile learning is often considered to originate from e-learning, which integrates mobile devices and technologies into the educational process [10]. Although the first experiments with the use of mobile devices in education began appearing in the early 2000s, the active implementation of mobile learning elements in educational institutions started around 2009 [11] and was initially reflected only in publications related to higher education institutions. Research and practice have demonstrated the effectiveness of mobile technologies in supporting and expanding traditional learning opportunities, particularly in providing access to educational materials, facilitating communication between students and teachers, completing assignments, and assessing learning outcomes.

A comprehensive analysis of the problem of organizing mobile learning in educational institutions, conducted by Crompton and Burke [12] covering the period from 2005 to 2016, revealed a significant positive impact on students' learning outcomes. Mobile learning proved especially effective in the field of foreign language acquisition. Since 2011, studies on mobile learning have confirmed the effectiveness of mobile devices not only for education but also for social interaction, work, and entertainment [13].

Between 2016 and 2018, the use of mobile learning in educational institutions allowed for the identification of its key advantages [14]: 1) the ability to access educational information, receive answers to questions, read e-books, and listen to podcasts; 2) access to learning tools, including educational programs, videos, educational games, and electronic libraries; 3) the transition from synchronous to asynchronous learning; 4) participation in virtual learning communities.

During this period, mobile learning also gained new significance as Apple and Google introduced their own augmented reality development kits for iOS and Android platforms, respectively. This became a significant push toward the organization of immersive mobile learning in educational institutions.

A report published by UNESCO in 2023 [15], identified mobile learning as one of the key factors in ensuring access to quality education in secondary schools, particularly in countries with medium and low incomes. Analysis conducted as part of mobile learning support initiatives in these countries indicates that mobile devices serve not only as tools for accessing educational materials but also as

platforms for communication, exchange of ideas, and discussion of complex issues with teachers and peers.

In Ukraine, the issue of using mobile phones in the learning process was first raised in early 2000s by Semerikov [16] who developed and successfully implemented a methodological system for teaching informatics disciplines, integrating elements of mobile learning. The research results confirmed the effectiveness of this approach for both university students and high school students in general secondary education institutions. However, despite its significant potential, mobile learning at the time did not become widely adopted as the sole form of education in Ukraine. Instead, it acted as a catalyst for changes in traditional learning, contributing to the emergence of a new, more flexible model – blended learning, which became widely used in secondary schools starting in April 2020 [17, 18].

Another important issue that can be addressed through the implementation of mobile learning is the organization of education for students who have become refugees from war-affected countries. Since 2013, the large number of forcibly displaced minor students from Syria, Afghanistan, and East Africa has led to discussions in the global community about the risks of a “lost generation” due to the inability to obtain quality secondary education [19]. A similar issue of educational losses has affected Ukrainian students following Russia’s full-scale invasion in February 2022, as evidenced by the PISA study [20]. Solving this problem requires a comprehensive approach, with one of the key elements being the use of mobile information and communication technologies to create a flexible and effective learning environment.

Despite programs implemented by the United Nations to address educational losses in war-affected countries through mobile technologies, the effectiveness of these efforts has not yet been sufficiently confirmed. Therefore, the key challenge for Ukrainian students in acquiring knowledge consciously is to create a personalized learning environment enriched with mobile information and communication technologies.

3. Problem statement

Despite the fact that mobile learning is a multifaceted educational process, an analysis of scientific publications has revealed several issues related to the use of mobile devices in general education institutions. Despite more than a decade of mobile learning development, it is impossible to unequivocally state that there are enough effective pedagogical strategies to integrate mobile devices into the educational process in a way that enhances its effectiveness. One of the key challenges is creating a balanced approach to using mobile devices both within and outside educational institutions. This approach should consider both psychological and pedagogical aspects of mobile technology use, as well as the development of appropriate methodologies and the selection of suitable tools.

Under martial law, when traditional forms of education face significant restrictions, mobile learning becomes a critically important tool for ensuring the continuity of the educational process in Ukraine. Mobile devices, particularly smartphones, play a crucial role as tools that allow students to access educational materials, communicate with teachers and classmates, and maintain a connection with their classroom, school, or specific subject teachers. The organization of psychological support for students studying under martial law conditions also cannot be overlooked. Mobile devices can serve as tools for providing psychological assistance and support.

The features of mobile learning listed above prove that under martial law in general secondary education institutions, ensuring the quality of mobile learning is an important issue. To develop effective pedagogical strategies and methodologies that contribute to achieving educational goals, it is necessary to conduct a thorough analysis of mobile device and application usage among students in Ukrainian general education institutions, as well as their individual approaches to organizing learning through mobile devices. This is crucial for achieving personalized learning and student autonomy.

Based on the obtained results, the issue of developing effective strategies and methodologies for using mobile devices in the educational process arises. Addressing these challenges is essential for ensuring the continuity and quality of education in Ukraine, as well as for supporting students’ psychological

well-being.

4. Methods of research

This study used a quantitative research analysis through an anonymous structured online survey to collect data on students' use of mobile devices and educational applications. The survey was conducted in February 2025 and involved 962 students in grades 5–11, aged 10 to 17, from general secondary education institutions across various regions of Ukraine (Kyiv, Odesa, Dnipro, Khmelnytskyi, Kryvyi Rih, Lysychansk). The authors' approach ensured regional representation and diversity in access to digital technologies. The tool used was a closed questionnaire developed by the authors and validated by experts in educational technology. It included single-choice questions and a Likert scale aimed at identifying: the types of mobile devices and operating systems used; the most frequently used educational and entertainment apps; the frequency and purpose of mobile app use; students' attitudes towards mobile learning and gamified educational tools; and self-assessments of academic and creative benefits of mobile learning. Descriptive statistics and focus group results were used to analyze the responses. The data were processed to identify age-related trends, usage patterns, and educational needs across different groups. The study adhered to ethical standards, ensuring the anonymity of participants and their voluntary consent.

The results of the study made it possible to identify trends in the use of mobile devices and applications by students under martial law, as well as to determine challenges and opportunities for implementing mobile learning in general secondary education institutions in Ukraine.

5. Research results

5.1. Theoretical foundations of mobile learning

Despite the widespread adoption of mobile learning in the educational community, scientific literature presents an ambiguous perception of the term “mobile learning”. The understanding of this concept ranges from the simple use of a mobile device for communication with a teacher or sending and receiving educational materials (e.g., via messaging apps) to a more profound interpretation – as a tool that creates conditions for the high-quality organization of a full-fledged learning process. The latter involves using mobile applications for education, creating interactive assignments, developing mobile learning courses and platforms, which allow for personalized learning and engaging students in educational activities.

The COVID-19 pandemic, in turn, not only facilitated the mass transition of educational institutions to mobile learning but also served as a powerful impetus for the development and refinement of various educational applications that are successfully used in educational processes worldwide.

Given the above, mobile learning can be considered one of the innovative forms of organizing the learning process, provided that:

- it is conducted using mobile devices with free access to educational materials, resources, and applications that facilitate the process of understanding and visualizing educational content;
- it allows free communication with other participants in the learning process;
- it provides unlimited access to Internet resources;
- it can take place anywhere and at any time. The organization of mobile learning enables the use of ready-made or the creation of unique educational materials delivered through mobile applications that promote collaborative project-based activities.

Among the advantages of mobile learning in general secondary education institutions, the following can be highlighted.

First. The flexibility and accessibility of the learning process gain particular importance in wartime conditions. Mobile technologies enable students to independently choose the time they can devote to learning, which is critically important when the regular learning schedule is disrupted. For students of

Ukrainian educational institutions, who are often forced to relocate, stay in shelters, or live abroad, the flexibility of the learning process helps maintain their motivation for education, as the pace and intensity of their learning depend on their physical and emotional state, access to a safe place, and the ability to connect to the Internet.

Another important factor in the accessibility of mobile learning is the ability for students to access various educational resources and platforms. Ukrainian students have the opportunity to study using platforms such as:

- “All-Ukrainian Online School” (<https://lms.e-school.net.ua/>) – an official free platform for distance and blended learning, developed by the Ministry of Education and Science of Ukraine during the 2020 pandemic. The purpose of creating this platform was to ensure equal access to quality education for all students from grades 5 to 11;
- ARBook (<https://arbook.info/>) – an innovative educational platform that combines traditional learning materials with augmented reality (AR) and virtual reality (VR) technologies [21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32]. This educational platform was launched as an educational project in July 2022 with the support of the Ministry of Education and Science of Ukraine to ensure an uninterrupted learning process in wartime conditions. Its task is to create interactive learning materials that make education more engaging and effective for students of different ages;
- MozaBook (<https://ua.mozaweb.com/uk>) – a comprehensive educational platform developed by Mozaik Education, offering interactive tools and materials for learning. This platform combines traditional teaching methods with modern digital technologies, enabling the organization of the learning process.

Using a mobile device for organizing the learning process allows students to download various educational applications and learning materials, which they can review at their own pace and revisit difficult topics; educational gaming applications that not only facilitate students’ knowledge acquisition but also motivate them to learn.

Speaking about the accessibility of mobile learning, attention should also be focused on the possibility of organizing inclusive education adapted for children with special educational needs.

Second. Personalization of the learning process. Mobile technologies allow students to shape their own educational trajectory by adapting the learning process to their individual needs. Through access to mobile platforms, students independently determine the complexity of the material based on their level of knowledge and self-learning skills and choose the most optimal learning format for themselves (text, video, illustrations, diagrams), taking into account their psychological characteristics.

The personalization of the learning process is a powerful motivational factor for students. If the learning process aligns with students’ interests and needs, they become more engaged in education and, consequently, more motivated. Receiving instant feedback while completing tasks also helps enhance learning motivation and effectiveness.

A particularly significant role in learning personalization is played by generative artificial intelligence (AI), which can serve as a personal assistant for students [33, 34, 35]. AI algorithms analyze the user’s progress, identify weaknesses in knowledge, and offer individually tailored tasks and materials to overcome difficulties [36].

Third. Interactivity is a key element of modern education, and mobile technologies create limitless opportunities for this. Mobile applications and platforms enable teachers to create or use ready-made interactive learning materials, such as video lessons with interactive elements, virtual laboratory work, online games, and quizzes. This contributes to a more engaging and exciting learning experience, as modern students, regardless of age, can be interested in the learning process through a system of accumulated points and rewards organized as a game.

At this stage of the education system’s development, interactivity and assessment can also be organized through the use of immersive technologies in the learning process. The use of such technologies allows students to take virtual tours, model events, conduct experiments, and visualize abstract concepts – all of which contribute to better assimilation of learning material and increased student motivation and can be done without teacher intervention [37, 38, 39, 40].

Fourth. The organization of microlearning is a modern and effective approach to organizing education, in which educational information is presented in small, logically complete didactic units. This division of material not only facilitates its processing and assimilation in a mobile format but also helps improve concentration, as students can focus on a small portion of educational material at a time. Microlearning also allows students to independently choose the pace of learning, revisit difficult topics, and repeat material at a convenient time. This format is especially beneficial for students with low concentration levels, as short and clear educational blocks help them maintain focus and avoid overload. Additionally, microlearning can be more interesting and engaging due to the use of various formats for presenting educational information: videos, infographics, interactive tasks, and tests.

All the listed advantages of mobile learning are interrelated components that make it possible to define the key principles of mobile learning in general secondary education institutions: flexibility and adaptability; accessibility and diversity; personalization and motivation; interactivity and immersiveness; autonomy and independence; safety and support.

5.2. The appropriateness of using mobile devices under martial law

As of the end of 2024, according to UNESCO, 79 education systems worldwide (around 40%) had implemented bans on smartphone use in schools. These measures aim to reduce distractions, improve student concentration, and address issues related to mental health and cyberbullying [41].

Here are some countries that have implemented such bans:

- *China.* Since 2021, students have been prohibited from bringing mobile phones to school without written parental permission. The goal is to protect eyesight, improve concentration, and prevent internet addiction [42].
- *Brazil.* In 2024, a federal law was adopted that prohibits smartphone use in schools, except in emergencies, for educational purposes, or for students with disabilities [43].
- *Denmark.* In 2025, the government announced a ban on mobile phones in schools and after-school programs for children aged 7 to 16–17, based on the recommendations of a child welfare commission [44].

These measures reflect a global trend toward limiting the use of mobile devices in educational institutions and raise the issue of developing a culture of using these devices for learning purposes.

Under martial law, mobile phones can serve as an important tool for ensuring learning continuity, maintaining communication between students, teachers, and parents, and providing access to educational materials and information. They can become a platform for interactive learning, knowledge exchange, and psychological support for students and teachers.

When comparing three forms of learning – distance, blended, and mobile learning – that can be implemented under martial law, we can conclude that mobile learning is the most flexible, adaptive, and viable one (table 1).

Unlike traditional models of distance learning, mobile learning relies not only on Wi-Fi availability but also on the ability to use mobile networks (3G, 4G, 5G). This significantly expands access to educational content even in emergency situations, particularly under martial law, when wired internet may be unavailable. In many cases, mobile connectivity remains the only stable communication channel, making mobile learning a realistic and viable alternative to traditional forms of educational activity.

While distance learning is entirely dependent on stable internet connections and specialized equipment, and blended learning requires periodic physical presence in educational institutions – which can be dangerous or impossible under certain conditions – mobile learning offers a more flexible and adaptive model. It leverages the advantages of learners' existing personal devices and enables learning to take place anytime and anywhere. Even under limited or unstable connectivity, learners can access study materials, communicate with teachers and peers, and complete assignments with a high degree of autonomy. These very characteristics make mobile learning particularly relevant in crisis situations and for ensuring the continuity of the educational process.

Table 1

Comparative table of three learning formats: distance, blended, and mobile learning.

Criterion	Distance learning	Blended learning	Mobile learning
Place of learning	Online (remotely)	Combination of online and in-person learning	Anywhere (via mobile devices)
Time of learning	Fixed schedule or asynchronous	Mixed: partly scheduled, partly flexible	Mostly asynchronous, at a convenient time
Learning device	PC, laptop	PC, laptop, sometimes tablet	Smartphone, tablet
Use of mobile devices	Partially (apps, messaging)	Interactive elements during sessions	Main learning tool
Content formats	Video lectures, tests, forums	Face-to-face and online activities, group work	Micro-content, podcasts, interactive applications
Role of the instructor	Facilitator, coordinator	Mentor, organizer of content and activities	Mentor offering micro-learning
Accessibility	Requires a stable internet connection	Depends on the stage (online/offline)	High (if smartphone and internet access are available)
Student motivation	Depends on self-discipline	Supported through interaction	Increases through flexibility and gamification

The concept of mobile learning is broader than that of blended learning, as it encompasses the process of acquiring knowledge through mobile devices in a user-friendly mode. It can be organized within the framework of formal education as well as self-directed learning, providing high mobility and flexibility in the learning process. In contrast, blended learning combines traditional in-person formats with elements of online education, aiming to merge the advantages of both approaches.

The key differences between these forms lie in the tools and formats used to organize learning. Mobile learning is predominantly conducted via smartphones or tablets, whereas blended learning uses both digital (computers, interactive platforms) and traditional (printed materials, chalkboards) tools. Mobile learning emphasizes mostly asynchronous online interaction, granting learners greater freedom and personalization. Blended learning, on the other hand, integrates digital communication with face-to-face interaction and is usually based on a synchronous schedule.

Thus, mobile learning emerges as a means of individualized, flexible, and accessible education – especially relevant during crises – while blended learning remains an effective model for structured integration of diverse educational formats.

5.3. Challenges of using mobile learning in the educational process

Mobile learning, as an important part of the modern educational process, provides students and teachers with new opportunities for learning and development. However, along with undeniable advantages, it also presents challenges that require careful analysis and a balanced approach to their resolution within the general secondary education system of Ukraine:

- *limited access to Internet resources remains a problem for some students in Ukraine* – this applies to students from rural areas, where mobile Internet coverage may be insufficient or of poor quality, as well as to students in cities experiencing damaged infrastructure and power outages. The cost of mobile Internet should also not be overlooked, as it may be too high for some families. While the issue of providing students with mobile devices has been partially resolved through government programs, other important aspects still require attention and funding. These include the development of high-quality educational materials adapted for mobile devices, accessibility of educational mobile applications, teacher training on the use of mobile technologies in education, and the provision of technical support for students and teachers;
- *lack of live communication* – live communication is an important factor for speech development, communication skills, and the social adaptation of children. A lack of face-to-face interaction may lead to difficulties in constructing complex sentences, inaccurate word usage, problems

understanding abstract concepts, and other aspects of speech development. This drawback of mobile learning can be easily addressed by organizing communication and interaction between students even during video conferences, online forums, and collaborative projects. It is important for teachers to effectively use these tools to develop students' speech and communication competence. Another important factor in this issue is the psychological support of students, which is easier and more effective in face-to-face communication. Personal communication between a teacher or psychologist and a student allows for a quicker response to changes in their behavior;

- *insufficient development of independent learning skills among students, especially younger and middle school students* – a low level of self-organization and self-control can make learning through mobile devices more difficult. Constant air raid alerts provoke a stressful state in students, which in turn reduces their concentration and self-discipline;
- *deterioration of health* – prolonged use of mobile devices can lead to eye strain and nervous system fatigue, make students more irritable, and reduce their physical activity. However, these risks can be minimized by organizing the educational process according to the blended learning model – a combination of traditional education with mobile information and communication technologies.

Despite the mentioned challenges, mobile learning remains a relevant form of organizing the educational process under martial law.

5.4. The state of mobile application usage among 5th-11th grade students under martial law

Modern digital technologies play a key role in transforming the educational process. In particular, mobile devices have become an integral part of learning, providing access to educational resources, interactive tasks, and communication platforms. The use of smartphones among students generates both positive expectations related to expanded opportunities for independent learning and concerns regarding their role in distracting from the educational process.

The development of mobile technologies creates unique opportunities for personalized learning [45], gamification of educational processes [46, 47], and enhanced communication efficiency among participants in the educational environment. However, despite the wide range of digital services that can contribute to improved learning, their usage level among students remains uneven. Research on the use of mobile services in the educational process is relevant, as it provides insight into which digital tools are most frequently used by students, for what purposes, and what challenges educators face in this context.

In February 2025, researchers from the Institute of Educational Digitalization of the National Academy of Educational Sciences of Ukraine conducted a survey of 962 students in grades 5-11 regarding their use of mobile phones for learning, self-education, and entertainment. The survey provided a variety of perspectives and experiences, covering students from different regions of Ukraine, namely: Dnipro, Dnipropetrovsk region – 19.23%, Kyiv – 37.17%, Odesa, Odesa region – 16.53%, Khmelnytskyi, Khmelnytskyi region – 9.46%, Kryvyi Rih, Dnipropetrovsk region – 14.97%, Lysychansk, Luhansk region – 2.6%.

Students aged 10 to 18 participated in the study, allowing for an analysis of mobile phone usage across different age groups. The most active participants were students aged 14-15, which may be associated with a period of active social life and education (figure 1).

The mobile phones used by students run the following operating systems: Android – 58%, iOS – 39%, Windows Phone – 3%.

Among the most popular educational applications, students mentioned Google Classroom, Zoom, Teams, Quizlet, Duolingo, and Photomath. Most students use these apps for completing homework, preparing for tests, and learning foreign languages. Some students also use applications for reading books, scanning documents, and taking notes (figure 2).

The selection of these applications is based on the fact that students installed them on their mobile phones for specific purposes, including:

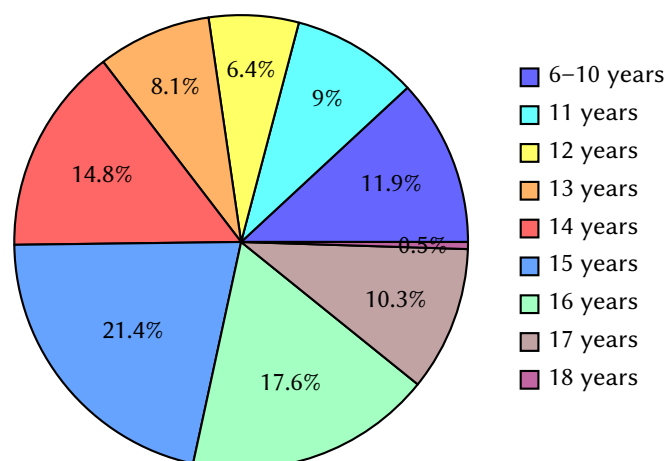


Figure 1: Distribution of students by age group.

- Google Classroom – for organizing learning, completing assignments, and communicating with teachers;
- Zoom / Google Meet – for online lessons, video conferences, and group discussions;
- Yedyna Shkola / Moia Shkola – access to learning materials, schedules, grades, homework, and teacher communication;
- Teams – for project collaboration, messaging, and video conferencing;
- Novi Znannia – a digital diary with distance learning features;
- Photomath – for solving math problems and explaining solutions;
- Duolingo – for learning foreign languages in a gamified format;
- ChatGPT – for getting answers to questions, assistance with learning, and completing tasks;
- Quizlet – for creating and using flashcards, quizzes for memorizing educational information, key concepts, and formulas;
- Viber – for communicating with classmates, messaging, and calls;
- Canva – for creating presentations, infographics, and project designs;
- Proste ZNO – for preparing for external independent testing (ZNO);
- Outlook – an email service for communication with teachers and classmates.

These applications help students organize their studies, gain new knowledge, and communicate effectively.

Analyzing mobile applications across different age groups, we found that: ages 10-11 – younger students who are just beginning to use digital tools in learning, with the most common apps being Google Classroom, Zoom, Duolingo, and Yedyna Shkola; ages 12-14 – middle school students who actively use various applications for learning and communication, including Teams, Canva, Photomath, and Quizlet; ages 15-17 – high school students preparing for exams and university entrance, favoring more specialized educational apps such as Google Meet, ChatGPT, Novi Znannia, and Proste ZNO.

We identified certain trends in app usage: younger students more often use simple and intuitive applications; middle school students actively use applications for communication and collaboration; high school students prefer applications that help them prepare for exams. During the analysis of responses, it was found that students most frequently mentioned foreign languages and mathematics as subjects they study using mobile applications. This data helps us better understand how students of different age groups use mobile applications for learning.

Among the most popular applications for self-education and entertainment, students named TikTok, Instagram, YouTube, Roblox, Brawl Stars, and Minecraft. Most students use these applications for socializing with friends, watching videos, and playing games. Some students also use applications for listening to music and reading books.

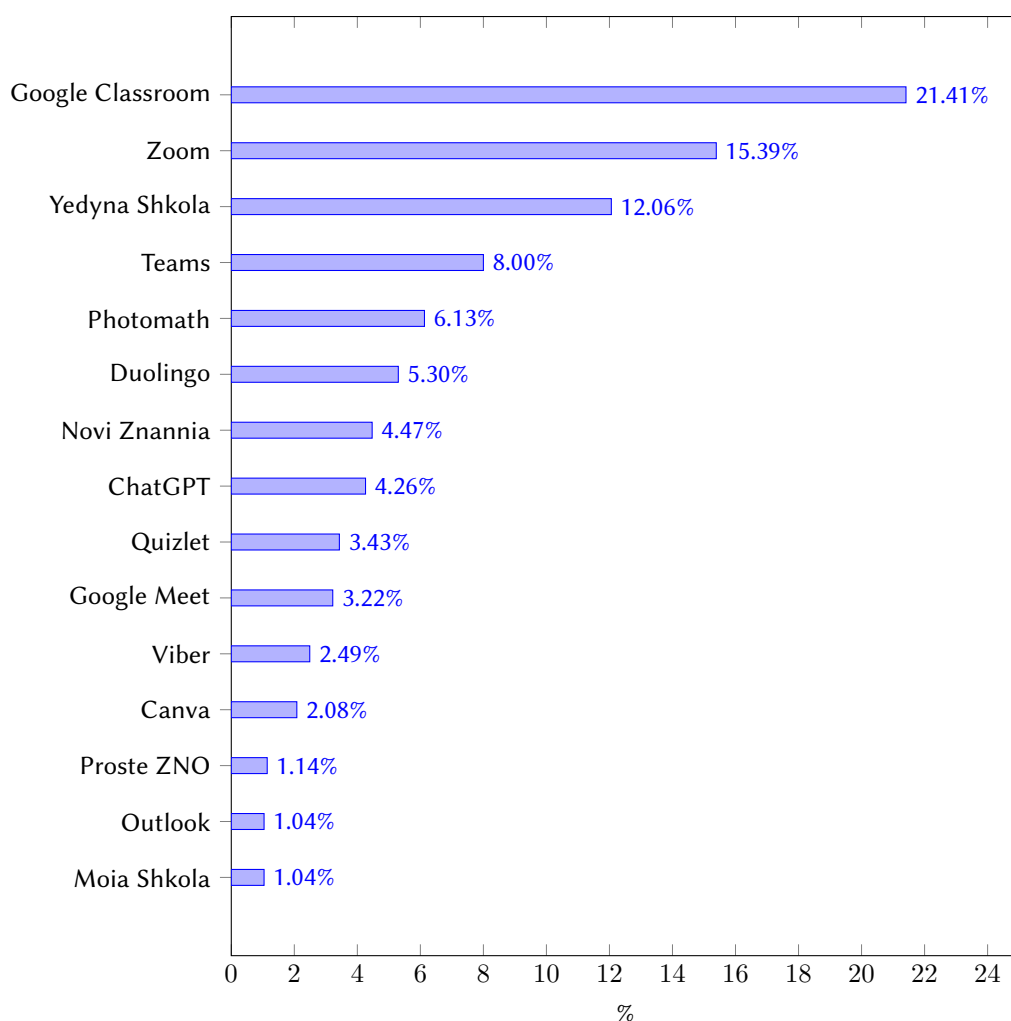


Figure 2: Most common educational apps installed on students' mobile phones.

Most students expressed interest in using educational applications in a game-like format. They believe this could make learning more engaging and enjoyable. Some students even mentioned that they would be willing to use such applications for studying mathematics, physics, chemistry, biology, and foreign languages.

As shown in figure 3, students actively use mobile applications for various purposes, including entertainment, creativity, and communication.

An important factor in the effectiveness of mobile applications is students' attitudes (perceptions) toward gamified content: 70% of students respond positively to the use of mobile applications in the learning process, 20% are neutral, and 10% respond negatively. This indicates the need to consider students' concerns and beliefs when developing and implementing mobile educational solutions.

As established, most students use simulators and interactive tasks to prepare for lessons and assessments. They believe these tools help them better understand the material and improve their knowledge. 60% of students regularly use mobile applications, 30% use them as needed, and only 10% do not use them at all. The most common subjects for which students use simulators are mathematics, foreign languages, and history.

Some of the most popular social networks and messengers among students are Telegram – 90%, Viber – 80%, TikTok – 75%, Instagram – 65%. Most students use them for communicating with friends, exchanging messages, and sharing photos. Some students also use them for learning and sharing educational materials. For example, a student from Khmelnytskyi Lyceum No. 10 uses Telegram to communicate with classmates, while a student from Odesa Lyceum No. 7 uses Viber to exchange

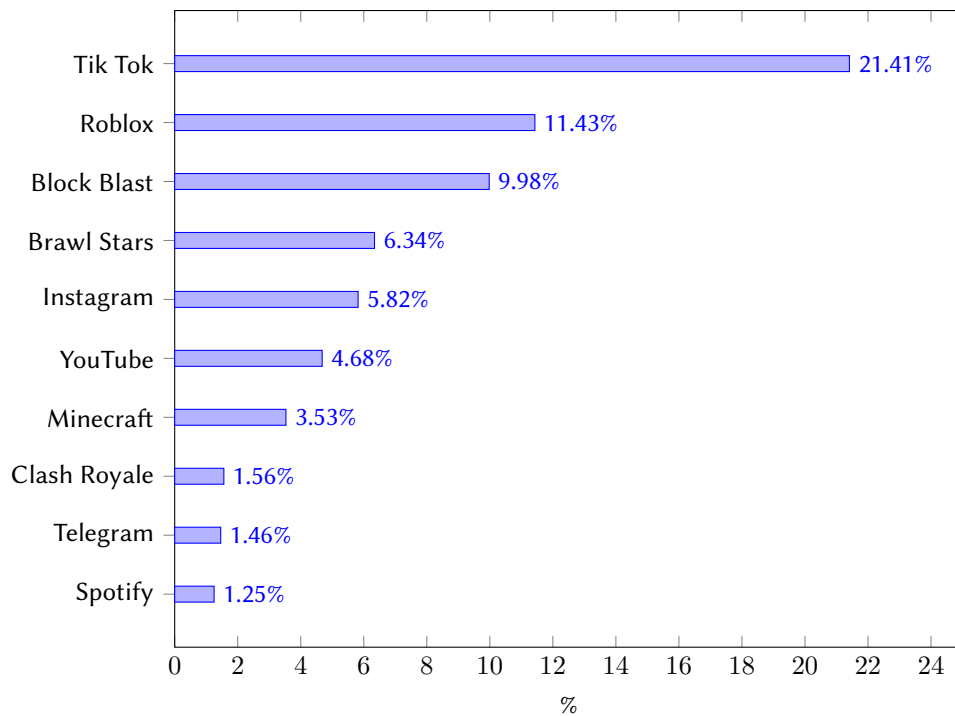


Figure 3: Mobile applications used by students for self-education and entertainment.

messages with friends.

Additionally, the survey found that 95% of students use mobile phones for completing homework, 80% of students believe that mobile phones help them learn better, 70% of students would like to use more educational applications in school, and 60% of students believe that mobile phones help them develop creative abilities (figure 4).

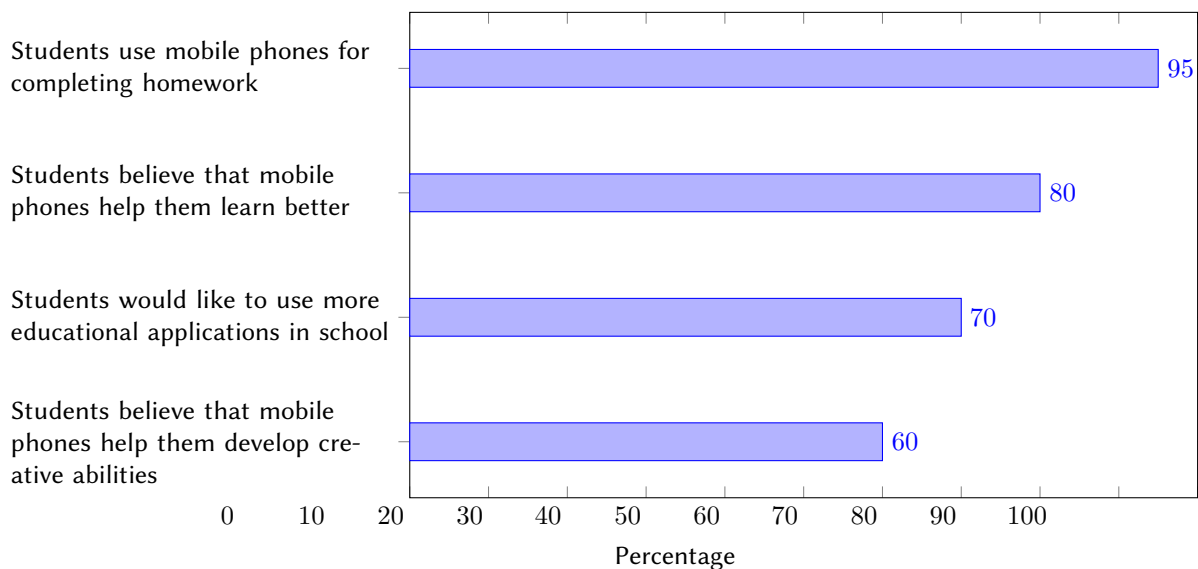


Figure 4: Students' opinion on the use of mobile applications for learning.

Interestingly, 749 students — almost 80% — use the calendar application, highlighting its widespread use for organizing the learning process.

6. Conclusion

Mobile learning is becoming increasingly popular due to the convenience and accessibility of mobile devices. In the context of digitalized education, the use of mobile applications has become an essential element of the learning process, as it allows students to study anytime and anywhere. Our survey, conducted among students, revealed that most of them actively use mobile applications for educational purposes.

Mobile learning has several key features that determine its effectiveness. First, mobile applications integrate elements of gamification and interaction, increasing students' engagement in the learning process. Many students noted that the convenience of mobile platforms helps them better organize their time and effectively manage their studies. Second, mobile learning provides a personalized educational experience. The use of different applications allows students to tailor their learning to their individual needs and proficiency levels. Specifically, they can choose programs for independent study, take tests to assess their knowledge, or interact with classmates through specialized platforms.

One of the most important aspects is access to educational materials at any time. Mobile applications significantly simplify access to courses or textbooks, enabling students to learn regardless of their location. This is particularly valuable during remote or hybrid learning.

Thus, mobile learning is becoming an effective tool for ensuring access to education, overcoming learning losses, and improving the quality of education. Considering the survey results, it can be stated that its potential in Ukrainian schools remains largely untapped. However, with the introduction of new technologies and applications, this process will only continue to gain momentum.

Declaration on Generative AI

The authors have employed ChatGPT 4.5 to assist with writer's block, translate text from Ukrainian into English, and polish sentences.

References

- [1] M. Velykodna, V. Deputatov, L. Kolisnyk, O. Shestopalova, O. Shylo, Psychological Service for Ukrainian School Students during the Russian Invasion: Experience of School Psychologists from Kryvyi Rih, *International Journal of Child Health and Nutrition* 12 (2023) 11–22. doi:10.6000/1929-4247.2023.12.01.2.
- [2] O. Lushchak, M. Velykodna, S. Bolman, O. Strilbytska, V. Berezovskyi, K. B. Storey, Prevalence of stress, anxiety, and symptoms of post-traumatic stress disorder among Ukrainians after the first year of Russian invasion: a nationwide cross-sectional study, *The Lancet Regional Health - Europe* 36 (2024) 100773. doi:10.1016/j.lanepe.2023.100773.
- [3] V. V. Sippii, V. V. Khrenova, B. V. Paska, Mobile education as a tool for enhancing accessibility and equality in education: analysis of current status and perspectives, 2024. doi:10.52058/2786-6165-2024-4(22)-1415-1432.
- [4] O. Onopriienko, A mobile application as an actual educational means under the conditions of the martial law, *New Inception* 3-4 (2022) 13–21. doi:10.58407/NI.22.3-4.1.
- [5] D. Y. Bobyliev, E. V. Vihrova, Problems and prospects of distance learning in teaching fundamental subjects to future Mathematics teachers, *Journal of Physics: Conference Series* 1840 (2021) 012002. doi:10.1088/1742-6596/1840/1/012002.
- [6] M. J. Syvyi, O. B. Mazbayev, O. M. Varakuta, N. B. Panteleeva, O. V. Bondarenko, Distance learning as innovation technology of school geographical education, in: O. Y. Burov, A. E. Kiv (Eds.), *Proceedings of the 3rd International Workshop on Augmented Reality in Education*, Kryvyi Rih, Ukraine, May 13, 2020, volume 2731 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2020, pp. 369–382. URL: <https://ceur-ws.org/Vol-2731/paper22.pdf>.

- [7] O. V. Korotun, T. A. Vakaliuk, A. M. Makhno, Tools for Teaching the R Programming Language to Bachelors of Computer Science in the Period of Distance Learning, in: E. Smyrnova-Trybulska, N.-S. Chen, P. Kommers, N. Morze (Eds.), *E-Learning and Enhancing Soft Skills: Contemporary Models of Education in the Era of Artificial Intelligence*, Springer Nature Switzerland, Cham, 2025, pp. 309–330. doi:10.1007/978-3-031-82243-8_18.
- [8] Q. N. Naveed, H. Choudhary, N. Ahmad, J. Alqahtani, Q. A. Ibrahim, A. I. Qahmash, Mobile Learning in Higher Education: A Systematic Literature Review, *Sustainability* 15 (2023) 13566. doi:10.3390/su151813566.
- [9] M. A. Kyslova, S. O. Semerikov, K. I. Slovak, Mobile learning evolution: a decade of developments (2014-2023), *Educational Technology Quarterly* 2025 (2025) 186–208. doi:10.55056/etq.25.
- [10] N. S. Alzaza, A. R. Yaakub, Students' Awareness and Requirements of Mobile Learning Services in the Higher Education Environment, *American Journal of Economics and Business Administration* 3 (2011) 95–100. URL: <https://thescipub.com/pdf/ajebasp.2011.95.100.pdf>.
- [11] D. Castellanos-Reyes, E. Romero-Hall, L. Vasconcelos, B. García, Mobile Learning for Emergency Situations: Four Design Cases from Latin America, in: V. Dennen, C. Dickson-Deane, X. Ge, D. Ifenthaler, S. Murthy, J. C. Richardson (Eds.), *Global Perspectives on Educational Innovations for Emergency Situations*, Springer International Publishing, Cham, 2022, pp. 89–98. doi:10.1007/978-3-030-99634-5_9.
- [12] H. Crompton, D. Burke, The use of mobile learning in higher education: A systematic review, *Computers & Education* 123 (2018) 53–64. doi:10.1016/j.compedu.2018.04.007.
- [13] A. Kukulska-Hulme, J. Pettit, L. Bradley, A. Carvalho, A. Herrington, D. Kennedy, A. Walker, Mature Students Using Mobile Devices in Life and Learning, *International Journal of Mobile and Blended Learning* 3 (2011) 18–52. doi:10.4018/jmb1.2011010102.
- [14] S. Criollo-C., S. Luján-Mora, A SWOT analysis of bring your own devices in mobile learning, in: *International Conference on Mobile Learning*, 2018, pp. 148–152. URL: <https://files.eric.ed.gov/fulltext/ED590363.pdf>.
- [15] Global Education Monitoring Report Team, *Technology in education: A tool on whose terms?*, Technical Report, UNESCO, 2023. doi:10.54676/UZQV8501.
- [16] S. O. Semerikov, *Theoretical and Methodological Foundations of Fundamentalization of Informatics Education in Higher Educational Institutions*, Doctoral dissertation in pedagogical sciences: 13.00.02, Kyiv, 2009.
- [17] S. L. Kucher, R. M. Horbatiuk, M. M. Ozhha, N. M. Hryniaieva, Use of information and communication technologies in the organization of blended learning of future vocational education professionals, in: S. Papadakis (Ed.), *Proceedings of the 11th Workshop on Cloud Technologies in Education (CTE 2023)*, Kryvyi Rih, Ukraine, December 22, 2023, volume 3679 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2023, pp. 54–66. URL: <https://ceur-ws.org/Vol-3679/paper39.pdf>.
- [18] I. S. Mintii, Blended learning: definition, concept and relevance to education for sustainability, in: S. O. Semerikov, A. M. Striuk, M. V. Marienko, O. P. Pinchuk (Eds.), *Proceedings of the 7th International Workshop on Augmented Reality in Education (AREdu 2024)*, Kryvyi Rih, Ukraine, May 14, 2024, volume 3918 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2024, pp. 260–281. URL: <https://ceur-ws.org/Vol-3918/paper303.pdf>.
- [19] M. Drolia, S. Papadakis, E. Sifaki, M. Kalogiannakis, Mobile Learning Applications for Refugees: A Systematic Literature Review, *Education Sciences* 12 (2022) 96. doi:10.3390/educsci12020096.
- [20] H. Bichko, V. Tereshchenko, *Learning losses: Essence, causes, consequences, and ways to overcome*, Technical Report, Ukrainian Center for Educational Quality Assessment, 2023. URL: https://testportal.gov.ua/wp-content/uploads/2023/04/Learning-losses_Ukraine.pdf.
- [21] S. O. Zelinska, A. A. Azaryan, V. A. Azaryan, Investigation of Opportunities of the Practical Application of the Augmented Reality Technologies in the Information and Educative Environment for Mining Engineers Training in the Higher Education Establishment, in: A. E. Kiv, V. N. Soloviev (Eds.), *Proceedings of the 1st International Workshop on Augmented Reality in Education*, Kryvyi Rih, Ukraine, October 2, 2018, volume 2257 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2018, pp. 204–214. URL: <https://ceur-ws.org/Vol-2257/paper20.pdf>.

- [22] I. S. Mintii, V. N. Soloviev, Augmented Reality: Ukrainian Present Business and Future Education, in: A. E. Kiv, V. N. Soloviev (Eds.), Proceedings of the 1st International Workshop on Augmented Reality in Education, Kryvyi Rih, Ukraine, October 2, 2018, volume 2257 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2018, pp. 227–231. URL: <https://ceur-ws.org/Vol-2257/paper22.pdf>.
- [23] N. V. Rashevskaya, V. N. Soloviev, Augmented Reality and the Prospects for Applying Its in the Training of Future Engineers, in: A. E. Kiv, V. N. Soloviev (Eds.), Proceedings of the 1st International Workshop on Augmented Reality in Education, Kryvyi Rih, Ukraine, October 2, 2018, volume 2257 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2018, pp. 192–197. URL: <https://ceur-ws.org/Vol-2257/paper18.pdf>.
- [24] T. H. Kolomoiets, D. A. Kassim, Using the Augmented Reality to Teach of Global Reading of Preschoolers with Autism Spectrum Disorders, in: A. E. Kiv, V. N. Soloviev (Eds.), Proceedings of the 1st International Workshop on Augmented Reality in Education, Kryvyi Rih, Ukraine, October 2, 2018, volume 2257 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2018, pp. 237–246. URL: <https://ceur-ws.org/Vol-2257/paper24.pdf>.
- [25] T. A. Vakaliuk, S. I. Pochtoviuk, Analysis of tools for the development of augmented reality technologies, in: S. H. Lytvynova, S. O. Semerikov (Eds.), Proceedings of the 4th International Workshop on Augmented Reality in Education (AREdu 2021), Kryvyi Rih, Ukraine, May 11, 2021, volume 2898 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2021, pp. 119–130. URL: <https://ceur-ws.org/Vol-2898/paper06.pdf>.
- [26] N. O. Zinonos, E. V. Vihrova, A. V. Pikilnyak, Prospects of Using the Augmented Reality for Training Foreign Students at the Preparatory Departments of Universities in Ukraine, in: A. E. Kiv, V. N. Soloviev (Eds.), Proceedings of the 1st International Workshop on Augmented Reality in Education, Kryvyi Rih, Ukraine, October 2, 2018, volume 2257 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2018, pp. 87–92. URL: <https://ceur-ws.org/Vol-2257/paper10.pdf>.
- [27] O. O. Lavrentieva, I. O. Arkhypov, O. P. Krupski, D. O. Velykodnyi, S. V. Filatov, Methodology of using mobile apps with augmented reality in students' vocational preparation process for transport industry, in: O. Y. Burov, A. E. Kiv (Eds.), Proceedings of the 3rd International Workshop on Augmented Reality in Education, Kryvyi Rih, Ukraine, May 13, 2020, volume 2731 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2020, pp. 143–162. URL: <https://ceur-ws.org/Vol-2731/paper07.pdf>.
- [28] O. B. Petrovych, A. P. Vinnichuk, V. P. Krupka, I. A. Zelenenka, A. V. Voznyak, The usage of augmented reality technologies in professional training of future teachers of Ukrainian language and literature, in: S. H. Lytvynova, S. O. Semerikov (Eds.), Proceedings of the 4th International Workshop on Augmented Reality in Education (AREdu 2021), Kryvyi Rih, Ukraine, May 11, 2021, volume 2898 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2021, pp. 315–333. URL: <https://ceur-ws.org/Vol-2898/paper17.pdf>.
- [29] V. V. Babkin, V. V. Sharavara, V. V. Sharavara, V. V. Bilous, A. V. Voznyak, S. Y. Kharchenko, Using augmented reality in university education for future IT specialists: educational process and student research work, in: S. H. Lytvynova, S. O. Semerikov (Eds.), Proceedings of the 4th International Workshop on Augmented Reality in Education (AREdu 2021), Kryvyi Rih, Ukraine, May 11, 2021, volume 2898 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2021, pp. 255–268. URL: <https://ceur-ws.org/Vol-2898/paper14.pdf>.
- [30] S. P. Palamar, G. V. Bieliienka, T. O. Ponomarenko, L. V. Kozak, L. L. Nezhyva, A. V. Voznyak, Formation of readiness of future teachers to use augmented reality in the educational process of preschool and primary education, in: S. H. Lytvynova, S. O. Semerikov (Eds.), Proceedings of the 4th International Workshop on Augmented Reality in Education (AREdu 2021), Kryvyi Rih, Ukraine, May 11, 2021, volume 2898 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2021, pp. 334–350. URL: <https://ceur-ws.org/Vol-2898/paper18.pdf>.
- [31] D. A. Karnishyna, T. V. Selivanova, P. P. Nechypurenko, T. V. Starova, V. G. Stoliarenko, The use of augmented reality in chemistry lessons in the study of “Oxygen-containing organic compounds” using the mobile application Blippar, *Journal of Physics: Conference Series* 2288 (2022) 012018. doi:10.1088/1742-6596/2288/1/012018.
- [32] T. H. Kramarenko, O. S. Pylypenko, M. V. Moiseienko, Enhancing mathematics education with

- geogebra and augmented reality, in: S. O. Semerikov, A. M. Striuk (Eds.), *Proceedings of the 6th International Workshop on Augmented Reality in Education (AREdu 2023)*, Kryvyi Rih, Ukraine, May 17, 2023, volume 3844 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2023, pp. 117–126. URL: <https://ceur-ws.org/Vol-3844/paper03.pdf>.
- [33] A. O. Kolhatin, Generative artificial intelligence in teacher training: a narrative scoping review, *CTE Workshop Proceedings* 12 (2025) 1–18. doi:10.55056/cte.920.
- [34] V. A. Hamaniuk, S. O. Semerikov, Y. V. Shramko, GenAI as scholarly ally: patterns, pedagogy, and policies in graduate writing research, *Educational Technology Quarterly* 2025 (2025) 234–252. doi:10.55056/etq.965.
- [35] S. S. Shanto, Z. Ahmed, A. I. Jony, A proposed framework for achieving higher levels of outcome-based learning using generative AI in education, *Educational Technology Quarterly* 2025 (2025) 1–15. doi:10.55056/etq.788.
- [36] S. Lytvynova, N. Rashevskaya, S. Proskura, The use of artificial intelligence in teaching students programming languages, in: S. Papadakis (Ed.), *Proceedings of the IX International Workshop on Professional Retraining and Life-Long Learning using ICT: Person-oriented Approach (3L-Person 2024)* co-located with 19th International Conference on ICT in Education, Research, and Industrial Applications (ICTERI 2024), Lviv, Ukraine, September 23, 2024, volume 3781 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2024, pp. 10–29. URL: <https://ceur-ws.org/Vol-3781/paper01.pdf>.
- [37] S. L. Malchenko, D. V. Mykoliuk, A. E. Kiv, Using interactive technologies to study the evolution of stars in astronomy classes, in: A. E. Kiv, M. P. Shyshkina (Eds.), *Proceedings of the 2nd International Workshop on Augmented Reality in Education*, Kryvyi Rih, Ukraine, March 22, 2019, volume 2547 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2019, pp. 145–155. URL: <https://ceur-ws.org/Vol-2547/paper11.pdf>.
- [38] S. L. Malchenko, V. S. Poliarenko, Y. O. Prykhozha, Interactive technology use during the study of the Universe, *Journal of Physics: Conference Series* 2611 (2023) 012013. doi:10.1088/1742-6596/2611/1/012013.
- [39] Y. Okopna, N. Morska, O. Stakhova, L. Voinalovych, O. Protas, O. Kravchenko, Analogy of tasks of traditional and interactive approaches to students' education in higher education institutions, *Systematic Reviews in Pharmacy* 11 (2020) 287–289. doi:10.31838/srp.2020.8.43.
- [40] A. Zhdaniuk, O. Tarasova, M. Moiseienko, A. Stepanyuk, An interactive online trainer for primary school computer science education: Design, implementation, and theoretical foundations, in: S. O. Semerikov, A. M. Striuk (Eds.), *Proceedings of the 7th Workshop for Young Scientists in Computer Science & Software Engineering (CS&SE@SW 2024)*, Virtual Event, Kryvyi Rih, Ukraine, December 27, 2024, volume 3917 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2024, pp. 139–151. URL: <https://ceur-ws.org/Vol-3917/paper33.pdf>.
- [41] UNESCO, To ban or not to ban?, UNESCO, 2023. URL: <https://web.archive.org/web/20250830114930/https://www.unesco.org/en/articles/smartphones-school-only-when-they-clearly-support-learning>.
- [42] J. Wakefield, China bans children from using mobile phones at school, BBC News, 2021. URL: <https://www.bbc.com/news/technology-55902778>.
- [43] M. Savarese, D. Rodrigues, New Brazil law restricts use of smartphones in elementary and high schools, AP News, 2025. URL: <https://apnews.com/article/smartphones-brazil-restrictions-children-bab6fd0ac6a277441bbaab235f9bbad2>.
- [44] M. Bryant, Denmark to ban mobile phones in schools and after-school clubs, *The Guardian*, 2025. URL: <https://www.theguardian.com/world/2025/feb/25/denmark-to-ban-mobile-phones-in-schools-and-after-school-clubs>.
- [45] S. V. Shokaliuk, A. O. Kavetskyi, Design and evaluation of a personalized digital mathematics tutor for grade 6 learners, in: S. O. Semerikov, A. M. Striuk (Eds.), *Proceedings of the 7th Workshop for Young Scientists in Computer Science & Software Engineering (CS&SE@SW 2024)*, Virtual Event, Kryvyi Rih, Ukraine, December 27, 2024, volume 3917 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2024, pp. 58–65. URL: <https://ceur-ws.org/Vol-3917/paper25.pdf>.
- [46] E. G. Fedorenko, N. V. Kaidan, V. Y. Velychko, V. N. Soloviev, Gamification when studying logical

- operators on the Minecraft EDU platform, in: S. H. Lytvynova, S. O. Semerikov (Eds.), *Proceedings of the 4th International Workshop on Augmented Reality in Education (AREdu 2021)*, Kryvyi Rih, Ukraine, May 11, 2021, volume 2898 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2021, pp. 107–118. URL: <https://ceur-ws.org/Vol-2898/paper05.pdf>.
- [47] A. V. Riabko, T. A. Vakaliuk, O. V. Zaika, R. P. Kukharchuk, I. V. Novitska, Gamification method using Minecraft for training future teachers of computer science, in: T. A. Vakaliuk, V. V. Osadchyi, O. P. Pinchuk (Eds.), *Proceedings of the 3rd Workshop on Digital Transformation of Education (DigiTransfEd 2024)* co-located with 19th International Conference on ICT in Education, Research and Industrial Applications (ICTERI 2024), Lviv, Ukraine, September 23-27, 2024, volume 3771 of *CEUR Workshop Proceedings*, CEUR-WS.org, 2024, pp. 22–35. URL: <https://ceur-ws.org/Vol-3771/paper26.pdf>.