



**E-LEARNING
INNOVATIONS
JOURNAL**

DOI: <https://doi.org/10.57125/ELIJ.2024.09.25.04>

How to cite: Kaminskyy, V. (2024). The Role of e-Learning During Martial Law: The Ukrainian Experience. *E-Learning Innovations Journal*, 2(2). 52-79. <https://doi.org/10.57125/ELIJ.2024.09.25.04>

The Role of e-Learning During Martial Law: The Ukrainian Experience

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Received: May 14, 2024 | **Accepted:** July 28, 2024 | **Available online:** September 25, 2024

Abstract: The research aim is to reveal the role of e-learning during Martial law by the example of Ukrainian experience. It focuses on the following objectives: to outline the advantages and challenges of e-learning; to describe the peculiarities of implementation of e-learning at the different levels of education; to analyse teaching methods used to integrate e-learning; and to develop the recommendations to implement e-learning. The systemic literature review was carried out to provide an objective summary of the current topic. All sources were published between March, 2022 and May, 2024. The literature focused on e-learning in Ukraine or similar conflict-affected areas. All articles were available in English or Ukrainian. To analyse the data, the



synthesis method was applied. The findings proved that e-learning became an important tool during emergencies, providing continuity in education. It was explained that e-learning is introduced at primary, secondary, and higher levels of education. It includes synchronous and asynchronous models. Certain teaching methods are used to implement e-learning effectively. They relate to interactive simulations, multimedia content, gamification, discussion forums, and personalized learning. These methods, combined, create a dynamic e-learning environment that enhances students' educational outcomes, particularly during emergencies. The implementation of e-learning in Ukraine during Martial law requires careful consideration of the recommendations: enhancement of digital infrastructure, adoption of flexible learning, formation of digital literacy, support of mental health, using interactive methods, increase of content quality, regular assessment, encouragement of positive teacher-student interaction, implementation of adaptive learning tools, and protection of students and educators' data. The research outcomes on the role of e-learning during Martial law can be used for the development of strategic plan of implementation of e-learning tools within the learning process in the regions affected by war or other emergencies. Also, the study can contribute to future educational practices, encouraging the development of more innovative learning solutions.

Keywords: virtual environment, learning process, teaching method, level of education, e-learning tools.

Introduction

E-learning, or electronic learning, uses digital technologies to deliver the educational content and facilitate the learning process through involvement of a wide range of methods, including online courses, virtual classrooms, interactive multimedia, and educational software (Yahiaoui et al., 2022). Currently, e-learning is applied to various contexts, from formal academic settings to professional development and formation of specific personal qualities. The importance of e-learning has increased in recent years significantly due to the rise of digital technologies which provide an access to educational resources for learners from anywhere in the world (Sherman et al., 2022).

Also, e-learning supports personalized learning paths and allows students to learn according to their individual needs and schedules. It also offers the possibilities for the educational institutions to reach a larger audience without the constraints of physical classroom environment. Moreover, e-learning has become increasingly important in times of disruption, such as during the COVID-19 pandemic, war, or natural disaster, highlighting its role in ensuring continuity of education when traditional methods are not accessible.

E-learning has emerged as a global phenomenon nowadays, removing geographic, economic, and cultural boundaries. It allows individuals from diverse backgrounds to engage with the educational content and opportunities that were previously impossible (Abdurrahmansyah et al., 2022; Rajib & Jahan, 2024). The proliferation of online learning platforms, such as Coursera,



edX, and Khan Academy, has facilitated this global expansion, offering a number of courses and programs in multiple languages and disciplines.

The global nature of e-learning is also evident in its integration into various sectors beyond traditional education. Many corporations and professional organizations increasingly rely on e-learning solutions for employees' training and development, reflecting its broad applicability across industries. The rise of (Massive Open Online Courses) MOOCs and online certification programs contributed to the creation of a flexible learning environment that accommodates the needs of a diverse audience. The rapid development of digital tools and platforms, such as Learning Management Systems (LMS), mobile applications, and interactive multimedia, enhanced the delivery and engagement of online education at the educational institutions (Moral & Villarente, 2024; Sherman et al., 2022).

Besides, lifelong education has become an important driver of e-learning, as it emphasizes the ongoing process of acquisition of knowledge and skills throughout an individual's life (Khrykov et al., 2023; Kobernyk et al., 2022). E-learning provides a flexible and accessible solution for adults seeking to upskill, reskill, or explore new fields outside the traditional classroom. This model supports self-directed learning and offers a wide range of courses and resources that cater to various interests and career goals.

The COVID-19 pandemic significantly accelerated the adoption of e-learning in Ukraine, as the educational institutions and organizations had to move rapidly to remote learning to comply with lockdowns and social distancing measures. By mid-2020, over 90% of Ukrainian higher education institutions transitioned to online learning platforms, according to the Ministry of Education and Science of Ukraine (2022; 2023a). This shift was driven by the need to maintain educational continuity during the peak of pandemic, which led to the widespread implementation of virtual classrooms, online assessments, and digital resources.

E-learning also saw an increase in the use of educational technologies, with a reported 60% rise in the use of e-learning platforms and tools among students and educators. The ongoing conflict in Ukraine has further intensified the reliance on e-learning, as it provides a necessary tool of education continuity during war. With the destruction of physical infrastructure and the displacement of populations, e-learning has become an essential alternative to the traditional classroom settings. According to a 2023 report by the Ukrainian Ministry of Education and Science (2023b), approximately 75% of schools and universities have adopted hybrid or fully online learning models to ensure that education continues despite the challenging circumstances. This adaptation has been supported by international aid and partnerships, which have provided technological resources and training to enhance the effectiveness of e-learning in conflict-affected areas.

Obviously, studying the role of e-learning in Ukraine during the war is important as it reveals how digital education solutions can sustain learning amidst severe disruptions. The conflict posed a number of significant challenges to traditional educational system and, therefore, the



examination of integration of e-learning in these circumstances can identify the effective strategies and tools to facilitate continued education under extreme conditions. This understanding not only presents the resilience and flexibility of digital learning but also provides valuable information for other regions or countries experiencing similar crises.

Research Problem

E-learning has become an important tool during emergencies worldwide, providing continuity in education when traditional methods are disrupted (Abdurrahmansyah et al., 2022). During natural disasters, pandemics, or conflict situations, e-learning platforms enable students to continue their education despite physical barriers (Islam, Nur, & Talukder, 2021). For example, during the COVID-19 pandemic, e-learning facilitated remote instruction for millions of students globally, allowing them to access the educational materials, participate in virtual classrooms, and complete assignments from home (Stecula & Wolniak, 2022). This digital approach ensured that education continued even when schools were closed and social distancing measures were introduced, demonstrating e-learning's flexibility and resilience in crisis situations (Mukhtar et al., 2020).

A number of works revealed the role of e-learning during the COVID-19 pandemic, proving it appeared to be an invaluable resource for maintaining educational continuity across the globe. For example, in Italy, the sudden closure of schools prompted a rapid transition to online learning and the authorities swiftly implemented digital platforms and tools to facilitate remote education (Doz et al., 2023). Stańkowski (2021) described "La Scuola in Chiaro" initiative that allowed teachers to deliver lessons, conduct assessments, and engage with students virtually, helping to minimize educational disruptions and support continued learning during the height of the pandemic. In the United States, e-learning became an important component in managing the challenges posed by COVID-19 (Tosto et al., 2023).

American scholar outlined the peculiarities of shifting to remote instruction, using the platforms like Google Classroom and Zoom, and facilitating virtual classrooms. The special attention of Indian researchers was paid towards the distributing the educational content via mobile phones (Singh et al., 2021). This approach allowed millions of students, including those in rural and marginalized communities, to continue their education despite the school closures and significant infrastructural barriers.

In regions affected by natural disasters or environmental crises, e-learning offers a means to overcome the destruction of infrastructure and displacement of communities (Sakurai & Shaw, 2022). For instance, after hurricanes, earthquakes, or floods, schools and educational facilities are often damaged or become inaccessible. E-learning platforms can provide the educational resources enabling students to continue learning while the educational institutions are rebuilt. This adaptability not only supports ongoing education but also helps mitigate the educational issues that occur during recovery periods. Some findings showed the implementation of online



platforms and virtual classrooms following the 2011 earthquake and tsunami in Japan (Toyoda et al., 2021).

In the Philippines, which is frequently hit by typhoons and natural calamities, e-learning has been an essential tool for ensuring that education continues during and after such events (Lagmay & Rodrigo, 2022). The authors analysed the platforms like the “DepEd Commons” that provided online access to learning resources and lesson plans, helping students resume their education remotely. Some authors described the use of e-learning to facilitate communication between teachers and students (Cueto & Agaton, 2021). Also, some works of Canadian scholars are oriented towards using e-learning as a psychological tool to fosters a sense of stability and control among students during times of uncertainty or crisis (Nash, 2023).

The ongoing war in Ukraine demonstrated the role of e-learning in maintaining educational continuity despite the destruction of educational infrastructure and the displacement of participants of the learning process (Hedzyk et al., 2023). E-learning platforms allow for remote access to the educational content and interactions, ensuring that students continue their studies even during the conflict. This approach not only supports students’ academic progress but also provides a sense of normalcy and stability during emergencies emphasizing the importance of e-learning in sustaining education under the challenging conditions (Marynchenko et al., 2022).

In other countries e-learning has proven to be an important tool during wars and armed conflicts as well. For example, in Colombia, where decades of internal conflict have disrupted educational systems, e-learning has provided an alternative (Ariza & Saldarriaga, 2023). Some findings reveal the peculiarities of using e-learning in South Sudan and Libya (Mahgoub et al., 2023). It was discovered that mobile technology and online platforms offered students continued access to education despite the challenging conditions. Other examples included the experience of Yemen and Myanmar (Alawadhi, 2024).

Martial law in Ukraine, which was implemented in response to ongoing conflict and security threats, imposes significant restrictions on daily life, including limitations on movement, curfews, and disruptions to normal activities. These restrictions severely impact the education system, as schools may be closed due to safety concerns (Bondarenko, 2022; Kenworthy & Opatska, 2023). The imposition of Martial law often means that many students are displaced or living in areas where access to educational facilities is limited.

In this context, e-learning has emerged as an important instrument for sustaining educational activities during war. Digital platforms enable students to continue their education remotely, overcoming the physical barriers imposed by the conflict. In Ukraine, e-learning solutions such as online classes, virtual classrooms, and digital resources have been rapidly adopted to ensure that the learning process takes place despite restrictions (Semerikov et al., 2023). The incorporation of e-learning within the learning process stresses its role in maintaining educational continuity and supporting students during instability (Londar & Pietsch, 2023; Semerikov et al., 2023).



Research Focus

The investigation on the role of e-learning in Ukraine during war is important for understanding both its advantages and challenges in the conflict-affected context (Artyukhov et al., 2023). E-learning offers significant benefits, such as ensuring the continuity of education despite the physical destruction of schools and displacement of students. In Ukraine, e-learning platforms have facilitated access to the educational materials and virtual classrooms, enabling students to continue their studies from temporary shelters or remote locations.

However, the implementation of e-learning is characterized by the unique challenges, such as unequal access to technology, insufficient digital competence among both students and teachers, and the necessity to adapt teaching methods to the digital format (Khrykov et al., 2023). The pedagogical analysis of the problem demonstrates that the effectiveness of e-learning in Ukraine varies across educational levels (Bondarenko, 2022; Krymska et al., 2024). At the primary level, methods such as interactive educational games and digital storytelling are employed to engage young learners.

Secondary education often uses a combination of asynchronous methods, like pre-recorded lectures and online discussion forums, alongside synchronous tools like video conferencing to maintain real-time interaction. Higher education institutions in Ukraine apply advanced tools like online research databases, virtual labs, and collaborative platforms to support the learning process. Therefore, the study of the peculiarities of implementation of e-learning in Ukraine during Martial law and description of its role for the participants of the learning process can enhance the efficiency of education system and allow for its continuity during instability. Definitely, the special attention must be drawn to the development of practical recommendations to use e-learning efficiently in the Ukrainian context.

Research Aim and Research Questions

The research aim is to reveal the role of e-learning during Martial law by the example of Ukrainian experience.

The following research questions are to be answered:

RQ1: What are the advantages and challenges of e-learning in the Ukrainian context?

RQ2: What are the peculiarities of implementation of e-learning at the different levels of education: primary, secondary and higher?

RQ3: What teaching methods and instruments are used to integrate e-learning within the learning process?

RQ4: What are the recommendations to implement e-learning in Ukraine during ongoing war?



Literature Review

The scholars interpret e-learning as the using of digital technologies and online platforms to deliver the educational content (Yahiaoui et al., 2022). Also, e-learning is defined as a method of education where students and teachers interact through the Internet (Hruzevskyi, 2023). This form of learning relates to various forms such as online courses, webinars, and digital simulations, enabling students to access the educational materials, participate in discussions, and complete assignments from any location. Banyoi, Kharkivska, Shkurko, and Yatskiv (2023) state that e-learning is a system of delivering education through virtual environments that use digital tools and platforms. The findings show that e-learning is characterized by flexibility since it adopts different learning styles and schedules, enabling learners to study at their own pace (Levchuk et al., 2022).

Bondarenko (2022) and Velykodna, Mishaka, Miroshnyk, and Deputatov (2023) describe that e-learning is acceptable to employ different teaching methods tailored to the content and learners' needs, such as gamification for engagement, multimedia for enhanced content delivery, and virtual labs for practical experiences. Importantly, the effectiveness of e-learning is closely connected with the availability and use of technology. Successful e-learning is technology-dependent and requires reliable Internet access, appropriate hardware (computers, tablets, smartphones), and software tools such as LMS, personalization technologies, and authoring tools (Londar & Pietsch, 2023).

Presently, e-learning integrated artificial intelligence (AI) and Virtual Reality (VR) extensively. A number of Ukrainian authors studied the use of AI and VR tools in e-learning to enhance both engagement and personalization (Volos et al., 2023). AI algorithms are able to tailor learning experiences to individual students, analyze their performance data, and predicting their learning needs. This helps to build adaptive learning trajectories that address diverse learning styles and paces. At the same time, the scholars investigating the incorporation of VR into e-learning state that the technology facilitates the creation of immersive educational environment where students can interact with 3D simulations and conduct virtual experiments (Kravchenko et al., 2024). The findings show that the combination of AI and VR improves the online learning process and provide a number of opportunities for learners to practice their skills in the controlled setting.

E-learning can be synchronous and asynchronous e-learning, each playing a critical role in the educational environment (Artyukhov et al., 2023; Sherman et al., 2022). For instance, synchronous e-learning, involving real-time interactions through platforms like Zoom or Google Meet, facilitates immediate feedback and live discussions. However, it requires stable internet access and fixed scheduling, which can be challenging in areas affected by conflict or infrastructure limitations. On the other hand, asynchronous e-learning provides greater flexibility by allowing students to access materials and complete assignments on their own schedule (Levchuk et al., 2022). This format is particularly useful for reaching students in remote or war-affected regions of Ukraine where synchronous sessions are difficult to coordinate. The



combination of both approaches helps to address the diverse needs of learners and adapt to the challenges posed by the current situation in Ukraine (Denyshchych et al., 2024).

Many works are devoted to teaching methods used in e-learning (Kondratiuk et al., 2022; Marchenko, 2023). Firstly, interactive simulations are described and it was found that they offer learners the opportunity to engage with digital scenarios that replicate real-world situations (Tsilmak et al., 2023). This method is particularly useful in fields like science and engineering, where simulations can provide practical experience. Secondly, multimedia content uses various forms of media, including videos, infographics, and audio recordings, to present information in an engaging manner (Sherman et al., 2022). This method adjusts to different learning styles by combining visual, auditory, and textual elements.

Thirdly, gamification was considered as a significant method since it, incorporating game-like into the learning process, motivates learners and makes the learning process more interesting (Matviienko, Kuzmina, & Yanishevskaya, 2023). Fourthly, discussion forums are differentiated. They facilitate asynchronous communication, allowing students to participate in discussions, ask questions, and collaborate with peers at their own pace (Artyukhov et al., 2023). This method encourages critical thinking and peer-to-peer learning. Fifthly, it is worth mentioning that personalized learning is a topic of many scientific and pedagogical works on the peculiarities of e-learning. According to Honcharuk, Bugaenko, Shevchuk, Liubchenko, and Bezlatnia (2024), it uses adaptive learning technologies to tailor the educational content to individual students' needs, preferences, and performance levels. Personalized learning enables to analyze the data on students' progress as well. The findings prove that these methods, combined, create a dynamic and effective e-learning environment that enhances students' educational outcomes, particularly during emergencies (Lytvynova & Soroko, 2023).

In addition, the recent studies define digital literacy of both teachers and students as an important component of e-learning (Bhinder, 2020; Ligonenko et al., 2022; Stoika, 2023). They show that using e-learning tools requires a high level of digital skills to make the learning process effective. For teachers, digital literacy means the ability to navigate and use various e-learning platforms, create and manage online content, and apply digital communication tools effectively. In Ukraine, where many educators had to adapt to online teaching due to ongoing conflict, possessing these skills is essential for delivering quality education.

Teachers must be proficient at using LMS, creating multimedia content, and facilitating online discussions. For students, digital literacy ensures that they can fully engage with e-learning tools and access the educational resources effectively. Students need to be proficient in using online platforms and tools, participate in virtual classes, and complete assignments. Developing these skills helps students overcome barriers to learning and adapt to the changing educational environment shaped by conflict and displacement.

Taking this into consideration, the research requires the special attention to describe the advantages and challenges of e-learning in the Ukrainian context and to outline the peculiarities



of implementation of e-learning at the different levels of education on the basis of scientific works and legal acts. Besides, since the literature review proves the importance of selection of efficient teaching methods, it is necessary to investigate the strengths and weaknesses of teaching methods used in the Ukrainian context.

Materials and Methods

To answer the research questions, the systemic literature review was carried out which aimed at comprehensive and methodical gathering, evaluation, and synthesizing the existing research on the topic of implementation of e-learning in the Ukrainian context during Martial law to provide an objective and evidence-based summary of current knowledge. The methodology helped to identify and analyze the patterns, gaps, and trends within the literature, ensuring that the review encompasses a wide range of relevant studies. Further, the systematic literature review contributed to the development of future research directions and design of optimal model of introduction of e-learning in various educational institutions during instability.

Conducting the review involved several principles to ensure the comprehensiveness of research: (1) systematically searching throughout multiple databases and sources to capture all relevant studies; (2) clear inclusion and exclusion criteria; (3) transparent methods for data extraction and synthesis to minimize bias; (4) evaluating the quality and reliability of included studies; and (5) synthesis to organize and integrate the findings in order to provide the recommendations to implement e-learning in Ukraine during ongoing war. These principles collectively produce an objective review that accurately reflects the state of knowledge related to the problems of using e-learning in the Ukrainian context, particularly during Martial law.

Data Collection

The data collection process for the systematic literature review on the role of e-learning in Ukraine during martial law began with a comprehensive search strategy. This involves identifying relevant databases, such as Google Scholar, JSTOR, Scopus, Web of Science, and Ukrainian academic repositories, to gather a broad range of literature. Keywords and phrases such as "e-learning in Ukraine," "online education during Martial law," and "digital learning in conflict zones" are used to organize the search. Boolean operators (AND, OR, NOT) helped to combine terms effectively. The search strategy also includes grey literature, such as reports from government agencies, particularly Ministry of Education and Science of Ukraine, non-governmental organizations, and educational institutions, to ensure a comprehensive collection of relevant data.

To ensure the relevance and quality of the literature, specific inclusion and exclusion criteria are established. The literature was included on the basis of: (1) period of publication; (2) focusing of research; (3) language of publication; (4) attention towards the impact of Martial law on education; and (5) type of research. According to the first inclusion criterion, all sources were published between March, 2022 and May, 2024.



Besides, the literature focused on e-learning in Ukraine or similar conflict-affected areas. All articles were available in English or Ukrainian to overcome language barrier. The studies analyzed the peculiarities of imposing Martial law in Ukraine and its impact upon the education system at different levels (primary, secondary, and higher). In addition, the research included empirical data or case studies on the implementation of e-learning in the Ukrainian context. At the same time, 5 exclusion criteria were introduced.

They included the following: (1) Studies not related to e-learning or Ukraine; (2) Articles published before March, 2022 to avoid outdated information; (3) Publications in languages other than English or Ukrainian; (4) Studies lacking empirical evidence or case studies; and (5) Research focusing on e-learning in contexts unrelated to conflict or Martial law. The collected literature was screened based on the inclusion and exclusion criteria. This involved reviewing titles and abstracts to determine relevance and then conducting a full-text review for studies that met the criteria.

Data Analysis

To analyse the data, the synthesis method was applied. This involved organizing the extracted data from each study into categories based on key themes and patterns. Using thematic analysis, researchers identified common themes such as the effectiveness of e-learning and its advantages within the educational process; challenges faced during martial law; implementation of e-learning at primary, secondary, and higher level of education; and teaching methods used to implement e-learning at the Ukrainian educational institutions. Finally, the data analysis was aimed at integrating and interpreting the synthesized findings in the context of the role of e-learning during Martial law in Ukraine. Researchers compare and contrast the results across different studies to draw objective conclusions about the effectiveness, challenges, and best practices of e-learning in the Ukrainian context. The analysis also enabled to highlight the research gaps in the literature and suggest the areas for future research.

Results

RQ1: What are the advantages and challenges of e-learning in the Ukrainian context?

In Ukraine, during Martial law, e-learning is regulated by the Laws "On Education" (Verkhovna Rada, 2024) and "On Higher Education" (Verkhovna Rada, 2023) defining the rights and responsibilities of participants in the learning process when e-learning is introduced. The resolutions of the Cabinet of Ministers of Ukraine regulate the functioning of the education system during Martial law since they address specific requirements for organizing e-learning, particularly through the unified state web-portal of digital education "Diia. Digital Education" (Cabinet of Ministers of Ukraine. (2022).

Besides, the educational institutions apply the orders and recommendations the Ministry of Education and Science of Ukraine regarding the implementation, organization, and control of e-learning (Ministry of Education and Science of Ukraine, 2023c). The Ministry issued the



recommendations and methodological materials related to the organization of e-learning during Martial law (Ministry of Education and Science of Ukraine, 2020; 2023b). These materials include specific advice on using online platforms, ensuring the quality of education, and supporting students. These documents form the legal framework for e-learning in Ukraine during Martial law. At the same time, the Ministry of Education and Science regularly prepares the reports in the peculiarities of implementation of e-learning within the learning process of educational institutions (Ministry of Education and Science of Ukraine, 2023a). These reports enable to outline advantages and disadvantages of e-learning during Martial law.

Here, it is mentioned that e-learning ensures the continuation of the learning process even in conditions of armed conflict and partial infrastructure destruction. According to official documents from the Ministry of Education and Science of Ukraine (Ministry of Education and Science of Ukraine, 2023a), online platforms allow students to continue their studies despite the physical inaccessibility of educational institutions. This helps maintain academic progress and avoid significant interruptions in the educational process. Other advantages include: flexibility or the opportunity to study from any location and at any time; reducing risks and ensuring safety due to avoidance of physical travel; access to educational resources and materials; innovations in teaching and learning and stimulating of pedagogical innovation; supporting psychological well-being by providing stability in students' educational lives.

Also, the reports of the Ministry of Education and Science of Ukraine pay the attention to challenges facing e-learning (Ministry of Education and Science of Ukraine, 2022; 2023a). There was stated that many students in Ukraine face challenges with accessing stable Internet and necessary equipment, which complicates participation in e-learning. During Martial law, this issue is increased as the infrastructure often becomes damaged due to combat activities and missile attacks. Besides, in Ukraine, there is a significant gap between urban and rural areas concerning the access to modern technologies. Also, the following challenges were differentiated: insufficient teachers' training in the field of using e-learning; technical maintenance issues, such as instability in power supply and technical problems; decreased motivation among students, especially in the context of stress and uncertainty associated with war; and limited access to psychological support via online tools.

Similar advantages are described in the works of Ukrainian scholars. For example, O. Levchuk, K. Levchuk, Husak and Havryliuk (2022) admit that e-learning provides high flexibility in planning the educational process. In the conditions of Martial law, the ability to study at any time and from any location becomes especially important. Londar and Pietsch (2023) indicate that e-learning provides an access to education, when traditional educational institutions may be inaccessible or destroyed. A number of works stress that e-learning helps to ensure the continuity of the learning process at the Ukrainian educational institutions (Londar & Pietsch, 2023; Semerikov et al., 2023). Besides, e-learning contributes to the development of digital skills among the participants of learning process (Ligonenko et al., 2022), psychological support (Kot &



Lytvynchenko, 2022), and implementation of innovative technologies resulted in improvement of learning process (Kravchenko et al., 2024).

Concerning the disadvantages, researchers note that combat actions and infrastructure destruction significantly complicate the access to the Internet and modern technologies (Galynska & Bilous, 2022). Other authors described the impact of war upon psychological state of students (Kot & Lytvynchenko, 2022). They say that stress and anxiety caused by the conflict reduce concentration and motivation for learning, complicating the adaptation to e-learning. Other challenges include inequality in access to resources; necessity to form digital literacy among teachers; and difficulties in assessment (Krymska et al., 2024; Sibruk et al., 2023). Table 1 analyses the advantages and challenges of e-learning in the Ukrainian context.

Table 1

Advantages and challenges of e-learning in the Ukrainian context

Advantages	Challenges
<i>According to the reports of the Ministry of Education and Science of Ukraine:</i>	
Continuity of the learning process	Limited access to the Internet and technology
Flexibility	Inequality in access to digital resources
Reducing risks and ensuring safety	Insufficient teachers' training
Extending access to educational resources and materials	Technical maintenance issues
Innovations in teaching and learning	Decreased motivation
Supporting psychological well-being	Limited access to psychological support via online tools
<i>According to the findings in the scientific literature:</i>	
Flexibility	Irregular access to infrastructure
Increased access to education	Psychological pressure and stress
Continuity of learning process	Inequality in access to the educational resources
Development of digital skills	Necessity to form digital literacy among teachers
Psychological support during emergencies	Difficulties in assessment
Improvement of the learning process through implementation of innovative technologies	

Source: Author's development.



Some works are devoted to the formation of specific skills among students by means of e-learning. Table 2 suggests the analysis of these skills and their description on the basis of literature sources.

Table 2

Skills formed due to e-learning

Skills	Description
Digital literacy (Ligonenko et al., 2022; Londar & Pietsch, 2023; Stoika, 2023)	Students learn to use various digital platforms and tools, work with software, create content, and become aware of data protection.
Self-directed learning (Londar & Pietsch, 2023; Nikolenko et al., 2023)	Students improve self-organization, planning, and effective time management when they work independently.
Critical thinking (Levchuk et al., 2022)	E-learning involves working with various sources of information and requires the ability to assess their quality and reliability.
Communication skills (Nikolenko et al., 2023; Rybchynska, 2023; Westerlund et al., 2023)	Students use different communication methods in an online environment, such as forums, chats, and video conferences.
Problem-solving skills (Matviichuk, Ferilli, & Hnedko, 2022; Semerikov et al., 2023)	E-learning often requires students to find solutions independently.

Source: Author's development.

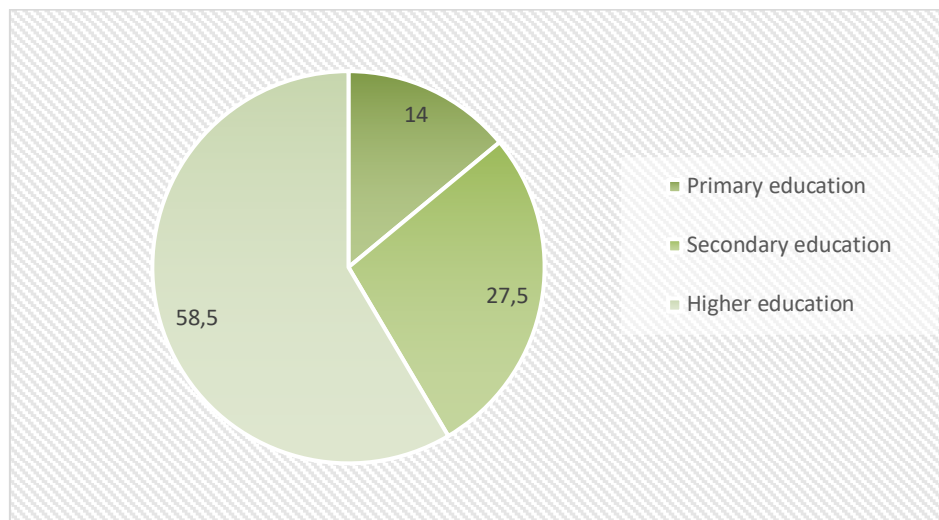
RQ2: What are the peculiarities of implementation of e-learning at the different levels of education: primary, secondary and higher?

Studying the peculiarities of implementation of e-learning at the different levels of education, it was found that only 14 % of sources relate to primary education (Budnyk & Sajdak-Burska, 2023; Velykodna et al., 2023). At the same time, 27,5 % of investigations describe the implementation of e-learning in secondary school (Kenworthy & Opatska, 2023; Lordos et al., 2024; Melnyk, 2023). The authors revealed the use of teaching strategies, organization of positive student-teacher interaction in virtual learning environment, and improvement of assessment of students' learning outcomes. The largest number of works (58,5 %) are oriented towards-learning within the system of higher education in Ukraine. They concern the analysis of potentials and challenges of e-learning (Semerikov et al., 2023), maintaining effective communication and collaboration between students and teachers (Danylchenko-Cherniak, 2023), and the use of teaching methods to enhance the learning process (Krymska et al., 2024). Figure 1 shows the levels of education represented in scientific literature.



Figure 1

The levels of education represented in scientific literature



Source: Author's development.

The implementation of e-learning in primary education in Ukraine during the war presents unique challenges since it requires more interactive activities educational experiences (Velykodna et al., 2023). Additionally, primary education needs significant parental involvement and support, which can be difficult to maintain under wartime conditions (Usova, 2024). Teachers face difficulties in adapting age-appropriate content to digital formats and ensuring that online platforms are user-friendly for young children. The recent findings suggest the following teaching methods to organize effective e-learning in primary education: games, live sessions, interactive e-books, and educational apps (Bondarenko, 2022; Velykodna et al., 2023).

In secondary education, e-learning involves a blend of interactive and independent learning methods to stay engaged and motivated (Melnyk, 2023). Teachers pay the great attention to adapt their methods to adjust to diverse learning styles of students (Ovcharuk, 2023). Additionally, secondary students face the added pressure of preparing for critical exams and future educational or career opportunities. Holovko, Zhuk, and Naumenko (2023) describe the importance of timely feedback as it addresses the mental health during war affecting students' concentration and learning performance (Kot & Lytvynchenko, 2022). The scholars reveal the using of blended learning, project-based learning, online collaboration, VR-based exercises, gamification, and online assessment in secondary education (Lytvynova & Soroko, 2023).

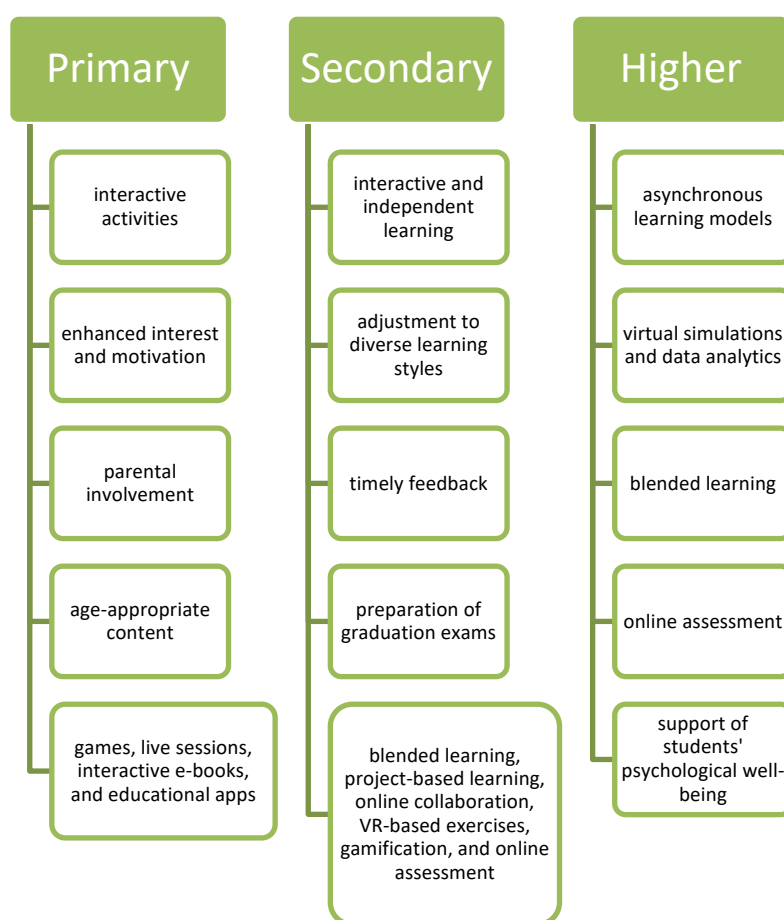
The researches devoted to using e-learning in higher education in Ukraine show the adaptation of teaching methods to suit the virtual environment (Banyoi et al., 2023). Higher educational institutions increasingly use asynchronous learning models, such as pre-recorded lectures and online discussion forums, to accommodate the diverse schedules and connectivity issues (Artyukhov et al., 2023). The special attention is paid towards the description of incorporation of virtual simulations or data analytics to facilitate the educational environment (Kondratiuk et al., 2022).



Besides, some papers investigated the adoption of flexible and blended learning approaches by Ukrainian universities (Marchenko, 2023). The focus has also shifted towards supporting students' psychological well-being, incorporating methods that provide emotional support in the face of the ongoing crisis. These findings reflect the resilience and creativity of Ukrainian higher education institutions in overcoming the complexities of e-learning during wartime. Figure 2 summarizes the peculiarities of implementation of e-learning at the different levels of education.

Figure 2

Peculiarities of implementation of e-learning at the different levels of education



Source: Author's development.

RQ3: What teaching methods and instruments are used to integrate e-learning within the learning process?

The selection of effective teaching methods is important for e-learning because it directly impacts students' engagement, comprehension, and learning outcomes. In the virtual environment, where traditional face-to-face interactions are limited, choosing teaching methods – such as virtual simulations, video lectures, gamification – can significantly enhance the learning process. The literature analysis demonstrated that at the Ukrainian educational institutions the following teaching methods are actively incorporated: pre-recorded video lectures; live online



classes conducted through platforms like Zoom or Microsoft Teams; online discussions; virtual labs and simulations; group work conducted via online tools such as Google Docs; flipped classroom.

Some works mention the use of adaptive learning platforms, gamifications, and online quizzes. Sometimes guest lectures are applied allowing students to gain professional experience from experts outside their immediate educational environment. Other methods include resource sharing and instruction delivery through LMS. Table 3 analyses teaching methods used to deliver e-learning at the Ukrainian educational institutions.

Table 3

Teaching methods used to deliver e-learning in the Ukrainian context

E-learning tools	Sherman et al., 2022	Banyo et al., 2023	Sikra, 2023	Londar & Pietsch, 2023	Matviichuk et al., 2022	Honcharuk et al., 2024	Kenworthy & Opatska, 2023
Asynchronous video lectures	+	+	+	+	+	-	+
Live online classes	+	+	+	+	+	+	+
Online discussions	+	+	+	+	+	+	+
Virtual labs and simulations	+	+	-	+	+	-	+
Group work	+	+	-	+	-	+	+
Flipped classroom	+	+	+	-	+	+	+
Adaptive learning platforms	+	+	+	-	+	+	+
Gamification	-	+	+	+	+	+	+
Online quizzes	-	+	+	-	+	-	-
Guest lectures	+	-	+	-	-	-	-



Resource sharing	+	+	+	-	-	-	+
LMS	+	+	-	+	+	+	-

Source: Author's development.

RQ4: What are the recommendations to implement e-learning in Ukraine during ongoing war?

A number of works (Banyoi et al., 2023; Londar & Pietsch, 2023) and official documents issued by the Ministry of Education and Science of Ukraine (2023a; 2023b) present the recommendations for implementing e-learning in Ukraine during the ongoing war. The conflict has disrupted traditional learning environments, making it imperative to adopt and optimize digital solutions that can minimize the challenges of war. Effective e-learning strategies not only facilitate continued learning process and skill development but also offer a means of stability and resilience for students facing uncertainty. The findings show that the implementation of e-learning in Ukraine during Martial law requires careful consideration of both technological and socio-emotional factors and is oriented towards the accomplishment of the following recommendations:

1) Enhancement of digital infrastructure through improving Internet access and connectivity, especially in conflict-affected areas (Ministry of Education and Science of Ukraine, 2023a; 2023b).

2) Adoption of flexible learning models based on the blend of asynchronous and synchronous learning methods (Hruzevskyi, 2023; Levchuk et al., 2022);

3) Providing technical training and formation of digital literacy among students and teachers (Bhinder, 2020; Ligonenko et al., 2022; Londar & Pietsch, 2023; Stoika, 2023);

4) Support of mental health and well-being, create of the supportive online environment (Kot & Lytvynchenko, 2022);

5) Using interactive teaching methods, such as virtual simulations, collaborative projects, and gamification, to keep students engaged and motivated despite physical distance (Bondarenko, 2022; Velykodna et al., 2023);

6) Enhancement of content quality (Banyoi et al., 2023; Marynchenko et al., 2022; Sherman et al., 2022);

7) Application of regular assessment on the basis of e-learning strategies (Krymska et al., 2024; Sibrak et al., 2023);

8) Encouragement of teacher-student interaction and maintenance of regular communication between teachers and students through virtual office, email, or messaging apps (Kalachova et al., 2023; Tverdokhliebova & Yevtushenko, 2023);



9) Implementation of adaptive learning tools that tailor the educational content and assessments to individual students' needs as well as building the individual educational trajectories (Hedzyk et al., 2023; Kalachova et al., 2023);

10) Protection of students and educators' personal information and academic data (Ministry of Education and Science of Ukraine, 2023a; 2023b).

Therefore, the findings on the role of e-learning during Martial law is important in today's context as it shows the resilience and adaptability of educational systems to emergencies. The data gained from the examination of e-learning during war can contribute to the development of teaching strategies to ensure educational continuity and accessibility when traditional methods are disrupted. Also, the study provides the valuable recommendations for enhancing digital educational environment that can improve the educational practices in the countries facing uncertainties or armed conflicts.

Discussion

The research outlined the importance of the role of e-learning in Ukraine during Martial law. The findings showed the positive role of e-learning through a number of advantages. It was revealed that e-learning ensures the continuation of the learning process (Ministry of Education and Science of Ukraine, 2023a; Semerikov et al., 2023), provides high flexibility in planning the educational process (Londar & Pietsch, 2023). Also, e-learning is responsible for the development of digital skills among both students and teachers (Ligonenko et al., 2022). Importantly, online education plays an important role in proving the psychological support to the participants of learning process (Kot & Lytvynchenko, 2022). Other findings demonstrated its contribution to enhancement the efficiency of learning process through the implementation of innovative technologies (Kravchenko et al., 2024). This shows that e-learning was an objective requirement of Ukrainian educational system and it enables educational institutions to continue education in crisis.

The literature analysis proved that e-learning is introduced differently at primary, secondary, and higher levels of education in the Ukrainian content. Unfortunately, there is a small number of works devoted to the investigation of the peculiarities of e-learning at the primary level. It was found that it, first of all, requires more interactive activities to increase motivation and interest of young learners (Velykodna et al., 2023). The scholars pay the special attention towards the explanation of parental involvement in education during emergency.

For example, Usova (2024) focused on the school selection and organization of independent learning among pupils. In primary education teachers widely use interactive activities such as games or live session. Also, interactive apps are found to be effective (Bondarenko, 2022). Secondary education used blended learning since this model increase students' motivation significantly (Melnyk, 2023). In addition, project-based learning, online collaboration, VR-based exercises, and gamification demonstrated their efficiency in e-learning in the Ukrainian context (Lytvynova & Soroko, 2023).



The special attention of Ukrainian pedagogues is focused on using e-learning in higher education in Ukraine. The problems studied include: adaptation of teaching methods and the creation of virtual environment (Banyoi et al., 2023); use of interactive teaching methods to maintain students' engagement (Artyukhov et al., 2023; Volos et al., 2023). In higher education advanced technologies are widely used, particularly VR-driven activities, AI tools, simulation-based activities (Kravchenko et al., 2024). This supports the idea that virtual learning environment contributes to the building of real-life scenarios resulted in formation of professional competencies among students. Some authors described the potential of e-learning to provide emotional support (Kot & Lytvynchenko, 2022).

Obviously, the research proves that e-learning can be organized at all the levels of education and it maintains the continuity education and students' involvement in the learning process through different tools and learning models. At the same time, e-learning, being a flexible technology, ensures the adaptation to rapid changes of the educational environment and establishes the stability in the education system.

The study is devoted to the selection of effective teaching methods as well. It was found that in the virtual environment traditional techniques are limited, and teachers are obliged to search for innovative solutions. The recent findings enabled to distinguish the following teaching methods in e-learning: pre-recorded video lectures (Banyoi et al., 2023); live online classes conducted (Matviichuk et al., 2022); online discussions (Sherman et al., 2022). Londar and Pietsch (2023) pay the special attention to the implementation of virtual labs and simulations. Besides, flipped classroom is efficient since it enables students to perform preliminary activities (Honcharuk et al., 2024). Some findings concern the use of adaptive learning platforms (Kravchenko et al., 2024), gamification (Kenworthy & Opatska, 2023), and online quizzes (Matviichuk et al., 2022).

At the same time, it is worth stating that combining diverse teaching methods is important for optimizing students' engagement and learning outcomes. Different methods are adjusted to various learning styles and preferences resulted in enhancing the learning process, even in times of crisis. Integrating different approaches, teachers can create a more dynamic educational environment that addresses the needs of all students, promotes deeper understanding, and encourages continuous engagement.

Conclusions and Implications

E-learning has become an important tool during emergencies worldwide, providing continuity in education when traditional methods are disrupted. It appeared to be invaluable tool during the times of pandemics, natural disasters and armed conflicts. The ongoing war in Ukraine demonstrated the role of e-learning in providing a remote access to the educational content and interactions, ensuring that students continue their studies even during the conflict. This approach not only supports students' academic progress but also provides a sense of normalcy and stability during emergencies emphasizing the importance of e-learning in sustaining education under the



challenging conditions. Martial law in Ukraine, which was implemented in response to ongoing conflict and security threats, imposes significant restrictions on daily life, including limitations on movement, curfews, and disruptions to normal activities. These restrictions severely impact the education system, as schools may be closed due to safety concerns.

E-learning is introduced differently at primary, secondary, and higher levels of education in the Ukrainian content. It can be synchronous and asynchronous e-learning, each playing a critical role in the educational environment. It was found that synchronous e-learning involves real-time interactions and facilitates live discussions. Asynchronous e-learning provides greater flexibility by allowing students to access materials and complete assignments on their own schedule. This format is particularly useful for reaching students in remote or war-affected regions of Ukraine. In the Ukrainian context, a number of teaching methods are used to implement e-learning effectively. They relate to interactive simulations, multimedia content, gamification, discussion forums, and personalized learning. The findings prove that these methods, combined, create a dynamic e-learning environment that enhances students' educational outcomes, particularly during emergencies.

The conflict has disrupted traditional learning environments, making it imperative to adopt and optimize digital solutions that can minimize the challenges of war. The findings show that the implementation of e-learning in Ukraine during Martial law requires careful consideration of the following recommendations: enhancement of digital infrastructure, adoption of flexible learning models, formation of digital literacy, support of mental health and well-being, using interactive teaching methods, increase of content quality, regular assessment, encouragement of positive teacher-student interaction, implementation of adaptive learning tools, and protection of students and educators' personal information and academic data.

The research outcomes on the role of e-learning during Martial law reveal several significant implications for the improvements of education system. First, the increased reliance on e-learning platforms suggests a need for the development of evidence-based interventions to overcome the challenges of e-learning and ensure the equal opportunities for all learners. Therefore, the study results can be used for the development of strategic plan of implementation of e-learning tools within the learning process in the regions affected by war or other emergencies. Second, the research indicates that e-learning has become an important mechanism for maintaining educational progress and providing stability during Martial law.

The integration of online learning platforms allows educators to continue delivering instruction and work with students, when the traditional classroom is disrupted. And the findings can be useful for the development of unified e-learning methodology based on its advantages and strengths. This research enables to select effective teaching methods and create the efficient educational environment, in the Ukrainian context. And third, the findings demonstrate the transformative potential of e-learning in shaping the future of education in Ukraine. The experience gained from this period can contribute to future educational practices, encouraging the development of more innovative and flexible learning solutions.



Suggestions for Future Research

Future research should focus on assessing the long-term impacts of e-learning on students' outcomes and educational environment at different levels – primary, secondary, and higher. This research could help identify best teaching and learning practices for enhancing digital education and ensuring that all students have the opportunity to benefit from e-learning. Another important aspect for further research is the exploration of pedagogical strategies and technological tools that appeared to be the most effective in the context of e-learning in Ukrainian during Martial law. Analyzing these teaching methods, platforms, and resources can facilitate the building of efficient virtual educational environment at the Ukrainian educational institutions.

Also, these studies will contribute to future e-learning implementations, both in emergencies and in regular educational landscape. Additionally, it is important to conduct a perception-based analysis on the role of e-learning in Ukraine during Martial law to gain a comprehensive understanding of its impact and effectiveness from the perspectives of both students and educators. Such an analysis will provide valuable information how individuals experience and perceive e-learning amid the challenges of Martial law, including its benefits and challenges.

Acknowledgements

None.

Conflict of Interest

None.

Funding

The Author received no funding for this research.

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