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Innovation in Higher Education in Wartime: Using Modern Technologies

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Abstract

Amidst the backdrop of contemporary conflicts and hostilities unfolding across various regions globally, the landscape of higher education is confronted with a myriad of novel challenges and prospects. War initiates the need for rapid and effective innovations in education to ensure access to learning in times of crisis. The objective of this article is to assess and scrutinize the application of modern technologies in higher education amid periods of conflict, focusing specifically on their influence on educational accessibility and quality within nations grappling with wartime circumstances. To achieve this goal, an analysis of scientific literature and publications was conducted. The conducted research revealed that the utilization of modern technologies in higher education during the war contributes to increasing the availability and quality of education. These technologies make it possible to provide distance learning using remote forms of communication and learning. The conclusions show, that the utilization of modern technologies in education is a key factor in ensuring continuous learning during war and conflict. These technologies allow efficient use of resources and provide a high-quality educational environment for students in difficult conditions.

Keywords

Technological changes, educational technologies, distance learning, pedagogical innovations, wartime, digital platforms.

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Introduction

In times of conflict and turmoil, the resilience and adaptability of higher education institutions become paramount. Historically, periods of crisis, such as several conflicts in the Middle East, Israeli-Palestinian war or the ongoing Russian-Ukrainian War, have spurred innovation in various sectors, and higher education is no exception. The integration of modern technologies into educational practices during wartime not only addresses immediate challenges but also lays the groundwork for future advancements in pedagogy (Petrov, 2022). The relevance of innovation in higher education during wartime, exemplified by the Russian-Ukrainian War, cannot be overstated. Times of conflict often disrupt traditional modes of learning, presenting logistical challenges such as displacement, resource scarcity, and security concerns (Dobrovolska et al., 2023; Shpykuljak & Mazur, 2014). Moreover, the socio-economic impact of war can exacerbate existing disparities in access to education, particularly for marginalized communities. Embracing modern technologies offers a means to mitigate these challenges by enabling remote learning, fostering collaboration, and enhancing educational accessibility and quality. Modern studies have highlighted the transformative potential of modern technologies in higher education during wartime, drawing parallels with the innovative responses seen amidst the Russian-Ukrainian War (Dobrovolska et al., 2023; Habib, 2023). For instance, studies by Al Qaidani (2019) and Smith and Abouammoh (2013) demonstrated how virtual learning environments facilitated continuity in education amidst conflict-induced displacement. Similarly, Rajab (2018) explored the use of online platforms for disseminating educational resources in regions affected by conflict, emphasizing their role in reaching underserved populations. Also important for this research is the work by Kozlovskyi et al. (2024) that characterizes the influence of war on modern migration processes. This work demonstrates that war affects all social institutions. These studies underscore the importance of technological innovation in ensuring the resilience and inclusivity of higher education during periods of crisis. Despite these evident benefits, effective integration of modern technologies into higher education during wartime. These include infrastructural limitations, digital issues, pedagogical concerns, and cultural barriers to technology adoption. Addressing these challenges requires a nuanced understanding of the contextual factors influencing technology-mediated learning in conflict-affected settings.

The objective of this study is to examine the role of modern technologies in fostering innovation and resilience in higher education during wartime, drawing insights from experiences amidst conflicts. Specifically, it will examine the opportunities and challenges associated with the integration of technologies in educational practices within conflict-affected contexts. The study seeks to identify strategies for leveraging technology to enhance educational access, quality, and inclusivity in times of crisis. The overarching aim of this research is to aid in the formulation of evidence-based strategies for harnessing modern technologies in higher education during wartime, informed by lessons learned from conflicts. To pursue the objective, the following research questions will be addressed:

1. What insights and findings does existing scholarship provide on education during wartime?
2. How have educational institutions and initiatives successfully implemented technology-mediated learning in war-affected contexts?
3. What are the best practices and policy recommendations for maximizing the impact of technology on educational resilience and innovation in war-affected higher education settings?

Literature review

In the face of war and upheaval, incorporating modern technologies into higher education becomes essential to ensure continuity and resilience. Modern researchers have analyzed various problems of technology integration in education during the war. Their research demonstrates that the use of modern innovative solutions is important when organizing training during wartime (Vovchenko et al., 2022; Yemelyanova et al. 2023). Akimov et al. (2023) conducted a methodical review examining the education 4.0 within open innovation competence frameworks. Their findings contribute important insights into the higher education, emphasizing the importance of open innovation in fostering adaptability and responsiveness, particularly in times of crisis. Boklan et al. (2023) centered on the implementation of distance learning through Google Meet in contemporary settings. This study provides practical insights into leveraging digital platforms for remote education delivery, highlighting the potential of technology-mediated learning to overcome barriers posed by wartime disruptions. Filipova et al. (2021) investigated a transhumanist legal perspective as a reaction to temporal challenges.

Although not directly focused on wartime education, this study offers a theoretical framework for understanding the evolving role of technology in shaping legal and ethical norms, which is pertinent to discussions on the integration of modern technologies in higher education during conflict. Hladoshchuk et al. (2023) examined the activities and development of open universities in European states. While not explicitly addressing wartime contexts, this study underscores the importance of open and inclusive educational practices, which can be particularly relevant for ensuring accessibility and equity in higher education during periods of conflict. Iskakova (2023) focused on digital technologies to support learning for education seekers with special needs. Modern studies also highlights the potential of technology to cater to diverse learning needs and promote inclusivity, offering insights into strategies for addressing the educational challenges faced by vulnerable populations during wartime (Vasiutiak et al., 2021; Zhylin et al., 2022). Moreover, Krymets (2022) engaged in philosophical reflections on the future of education. While not directly related to wartime education, this study underscores the importance of preparing students for dynamic and challenging environments, which is particularly relevant in the context of integrating modern technologies to enhance educational resilience during conflict. The study by Salnyk et al. (2023) offers practical insights into leveraging immersive technologies to enhance the educational experience, which can be valuable for mitigating the disruptions caused by wartime conditions and enabling innovative approaches to teaching and learning. Savchenko et al. (2020) centered/focused on the administration of the progression of prospective educators in institutions of higher education. Tsekhmister (2023) performed a meta-analysis on the efficacy of blended learning in the field of medical sphere. While not specific to wartime education, this study offers empirical evidence supporting the efficacy of blended learning models, which can be applicable in designing resilient educational strategies that combine traditional and technology-mediated approaches during periods of conflict. In summary, the reviewed literature provides a multifaceted understanding of the intersection between innovation, modern technologies, and higher education in wartime contexts. These studies offer theoretical insights, practical strategies, and empirical evidence that can inform the development of innovative approaches to higher education delivery, thereby enhancing resilience and adaptability in times of crisis. However, these studies are mainly focused on local practices, the authors of this study aim to comprehensively approach this problem and identify the main innovations in education during the war period on the example of modern wars and conflicts.

Methodology

General Background

The methodology employed in this study seeks to explore the application and efficacy of contemporary technologies in higher education amid wartime scenarios. Given the multifaceted nature of the topic, a qualitative approach will be employed to gather comprehensive data and insights. The study will focus on regions affected by conflict, such as Ukraine, Syria, Yemen, and Nigeria, where the integration of modern technologies in higher education is particularly pertinent due to the challenges posed by ongoing conflicts (See Table 1).

Table 1: *General Scheme of the Research*

Period	Stage	Description
Month 1-2	Literature Review	1. Initial searches were conducted in databases like PubMed, Google Scholar, and pertinent scholarly journals using keywords related to innovation, higher education, technology, and conflict. 2. A comprehensive list of relevant studies, reports, and articles was compiled. 3. The identified literature was reviewed and screened to ensure relevance and applicability to the research topic. 4. Thematic analysis of selected literature was initiated to identify key themes and insights related to the use of modern technologies education during wartime.
Month 3-4	Data Analysis and Synthesis	1. Thematic analysis of the literature was continued, with a focus on identifying recurring themes, patterns, and implications. 2. Findings from the thematic analysis were synthesized to create an understanding of the role of modern technologies in innovation and resilience in higher education during wartime. 3. Any gaps or inconsistencies in the literature were identified, and avenues for further research or exploration were proposed. 4. Preliminary findings and conclusions were drafted based on the synthesized data analysis.
Month 5-6	Refinement and Writing	1. Preliminary findings and conclusions were refined based on feedback from peers, advisors, or colleagues. 2. The final research report was written, incorporating the synthesized findings, analysis, and conclusions. 3. Proper citation and acknowledgment of sources were ensured to uphold academic integrity.

Souce: Author's development.

Data Collection

Literature Collection

A review of pertinent academic literature will be conducted to gather insights into existing research on innovation in higher education during wartime, with a specific focus on the use of modern technologies. Databases such as PubMed, Google Scholar, and academic journals in the fields of education, technology, and conflict studies will be searched to identify significant studies. The literature search was focused mainly on recent years, in order to take into account the current relevant information about the impact of the war on education.

The inclusion of literature was based on the following criteria:

1. Actual coverage of the problem
2. The research has a clear research methodology
3. The work describes specific case studies
4. The study characterizes the problem of the implementation of education in countries where there was or is a war.

Case Studies.

Selected conflict-affected countries will undergo in-depth case studies. These case studies will provide rich qualitative data on the implementation, challenges, and impact of modern technologies in higher education settings amidst wartime conditions. The selection of case study sites will be guided by the severity of conflict, the availability of technological infrastructure, and the diversity of educational contexts.

Data Analysis

Thematic analysis was utilized to examine the data of the literature review. The identified literature was carefully examined to identify recurring themes, patterns, and insights related to the issue of utilization of technologies in higher education during war. Themes included challenges faced by institutions, innovative technological solutions implemented, the impact on teaching and the overall effectiveness of technology-mediated education in conflict settings. The findings from the thematic analysis were synthesized to create an understanding of the role of modern technologies in innovation and resilience in higher education during wartime. Connections between themes and sub-

themes were explored to identify overarching trends and key implications. Additionally, any gaps or inconsistencies in the literature were highlighted, providing opportunities for further research and exploration.

By conducting a qualitative analysis of existing literature, this study aims to contribute valuable insights into the complex dynamics of innovation in higher education within wartime contexts.

Results

Innovative technologies in education system of countries affected by war general case study

In countries affected by war, higher education institutions face unique challenges in maintaining educational continuity and quality amidst conflict-related disruptions. To address these challenges, innovative technologies are increasingly being employed to facilitate learning, enhance accessibility, and foster resilience. Some of the innovative technologies used in higher education in conflict-affected countries include online learning programs, mobile learning, open educational resources, virtual Reality or augmented reality, peer-to-peer learning platforms, artificial Intelligence (AI) and machine learning (Makhachashvili & Semenist, 2022; Li et al., 2024). In response to the Yemeni crisis, Saudi Arabian universities have implemented remote learning technologies such as video conferencing and online course platforms to ensure continuity of education for Yemeni students who have been displaced or affected by the conflict. Universities in Saudi Arabia have collaborated with international organizations to provide online courses and resources tailored to the needs of Yemeni students (Rajab, 2018). Moreover, Israeli universities have developed advanced e-learning platforms and virtual classrooms to accommodate students from conflict-affected areas, such as Gaza and the West Bank. These platforms offer interactive lectures, virtual labs, and collaborative tools, enabling students to participate in classes and access educational materials remotely, despite the challenges posed by the ongoing conflict. In regions affected by the Boko Haram insurgency, Nigerian universities have adopted mobile learning technologies to deliver educational content to students in remote and insecure areas. Mobile apps and SMS-based learning platforms have been used to disseminate lectures, quizzes, and course materials, allowing students to engage in self-directed learning and stay connected with their academic institutions despite security challenges (Al Qaidani,

2019). Yemeni universities have leveraged virtual reality (VR) and augmented reality (AR) technologies to create immersive educational experiences for students amid the ongoing conflict. For example, virtual laboratories have been developed to simulate scientific experiments and practical training sessions, enabling students to gain hands-on experience in fields such as engineering, medicine, and environmental science, even when access to physical laboratories is limited due to the conflict. These examples demonstrate how innovative technologies have been employed in higher education contexts within countries affected by war to overcome barriers to learning and ensure educational continuity for students facing displacement, insecurity, and other challenges associated with armed conflict (Makhachashvili & Semenist, 2023). Through the strategic integration of modern technologies, universities in these countries have been able to adapt to the evolving needs of students and maintain the quality and accessibility of education, despite the disruptive effects of war. (See Table 2).

Table 2: *Basic Electronic Technologies and their Description Used in Education During the War Period*

No	Technologies	Description
1	Online learning platforms	Virtual learning environments, exemplified by learning management systems (e.g., Moodle, Blackboard), facilitate the remote delivery of courses and educational resources by institutions.
2	Mobile learning	Mobile technologies, including smartphones and tablets, play a crucial role in extending educational access to students in conflict-affected areas with limited infrastructure. Mobile learning applications and platforms offer interactive and personalized learning experiences, leveraging the ubiquity of mobile devices to reach learners in remote and marginalized communities.
3	Open educational resources (OER)	OER initiatives provide freely accessible educational materials, including textbooks, videos, and interactive simulations, which can be particularly valuable in resource-constrained environments. By leveraging digital technologies and open licensing, OER initiatives enable educators to adapt and localize content to meet the diverse needs of students in conflict-affected contexts.
4	Virtual reality (VR) and augmented reality (AR)	Immersive technologies such as VR and AR offer innovative ways to enhance experiential learning and simulate real-world environments in higher education. In conflict areas, VR and AR applications can facilitate hands-on training in fields such as healthcare, engineering, and cultural heritage preservation, enabling students to gain practical skills and experiences despite physical limitations.
5	Peer-to-peer platforms	Collaborative learning platforms and peer-to-peer networks enable students to connect, share knowledge, and support each other's learning journeys. These platforms foster a sense of community and collaboration among students, promoting active engagement and

		mutual support in challenging environments characterized by displacement and insecurity.
6	Artificial intelligence (AI) or machine education	AI educational tools and adaptive learning platforms can personalize instruction, assess student progress, and provide targeted interventions based on individual learning needs. In conflict-affected contexts, AI technologies can help address the diverse educational backgrounds and learning challenges faced by students, thereby enhancing educational equity and inclusivity.
7	Remote proctoring and assessment technologies	Remote proctoring solutions enable institutions to conduct secure and reliable assessments in online and hybrid learning environments. These technologies use AI algorithms and biometric authentication to monitor student behavior and prevent academic dishonesty, ensuring the integrity of assessments despite the absence of traditional in-person proctoring.
8	Blockchain technology	Blockchain-based credentials and digital certificates offer a secure and tamper-proof way to verify academic achievements and credentials, facilitating recognition of learning outcomes and mobility of students in conflict-affected regions. Blockchain technology enhances trust and transparency in credentialing processes, mitigating the risks of credential fraud and exploitation.

Source: Authors' development.

By leveraging these innovative technologies, higher education institutions in conflict-affected countries can overcome logistical, infrastructural, and socio-economic barriers to education, empowering students to access quality learning experiences and pursue academic and professional opportunities despite the challenges of war.

Another important trend is the introduction of e-learning, which has been actively implemented in Israel, Yemen and Saudi Arabia. E-learning provides students with unparalleled flexibility, enabling access to course content anytime and anywhere (Chakhaia & Bregvadze, 2018). This accessibility is particularly advantageous for students who face constraints in attending face-to-face classes or prefer alternative learning modalities. Moreover, e-learning facilitates the cost-effective distribution of learning materials, eliminating the need for expensive printed textbooks and supplementary resources. The adoption of e-learning holds immense potential for transformative change, particularly in developing countries (Rajab, 2018). For students, teachers, and the broader economy and society in these regions, the incorporation of e-learning promises substantial improvements.

Studies conducted in Saudi Arabia underscore the pivotal role of e-learning in expanding educational opportunities, particularly for marginalized groups such as women and individuals in remote areas (Rajab, 2018). Given the gender-segregated educational

system mandated by Islamic tradition, e-learning provides a viable solution by offering parallel versions of courses tailored to each gender, thereby minimizing costs and ensuring quality control through consistent instructor delivery. Moreover, e-learning emerges as a crucial avenue for reaching underserved populations residing in remote regions, where access to traditional educational institutions is limited (Rajab, 2018). Furthermore, the versatility of e-learning renders it a viable alternative model for education delivery in crisis and disaster areas. In such contexts, where conventional educational infrastructure may be compromised, e-learning offers a resilient solution that can be swiftly deployed to ensure continuity of learning. By transcending geographical barriers and physical limitations, e-learning holds the potential to mitigate the adverse impacts of crises on educational access and attainment, thereby promoting resilience and recovery in affected communities.

Higher education of wartime: case study of Ukraine

In late February 2022, the Russian Federation launched a full-scale invasion into the territory of independent Ukraine, marking a new stage in the eight-year war against country, has led to destabilization in virtually all spheres of public life. The war has brought significant comprehensive changes, including the destruction of infrastructure, rising inflation, population migration to other regions of the country and beyond its borders, and a reduction in the working-age population, among others (Boiko, 2023; Budnyk, 2022; Kryshtanovych et al., 2023). The higher education system was not exempt, as no higher education institution in Ukraine could be prepared for functioning, and in many cases even for "existence," in wartime conditions.

Prior to the commencement of the full-scale war, particularly since 2020, the higher education system, along with the entire education sector in Ukraine, had experienced significant disruptions due to the restrictions imposed by the COVID-19 pandemic. (Westerlund et al., 2023). During the pandemic, the primary tasks were to create a safe educational environment and implement distance learning.

The experience gained by Ukrainian educational institutions, including higher education institutions, in organizing distance learning in 2020–2021 allowed for a quicker adaptation to conducting educational activities in wartime conditions (Westerlund et al., 2023). However, more stringent obstacles arose, such as the impossibility of using distance learning technologies in uncontrolled territories and territories where

(unfortunately, and currently) hostilities are taking place due to the lack of internet access, as well as the destruction.

Ukrainian higher education institutions have successfully developed internal policies and effective solutions for stabilization and functioning amidst the armed invasion of Russia, thanks to the unity of the educational community and international support (Mereniuk & Parshyn, 2024; Velykodna et al., 2023). The further evolution of the higher education system involves the development of institutions that take into account the ramifications of the war. According to experts' forecasts, Ukraine's state educational policy in the near future will focus on overcoming the infrastructure destruction of higher education institutions; creating favorable conditions for transforming their network and designing an innovative educational environment that would ensure the effectiveness of institutions' innovative activities to enhance the quality of education (Order of the Cabinet, 2022). The Development Strategy for Higher Education in Ukraine clearly outlines the strategic and operational goals and objectives for the advancement of higher education in Ukraine in the coming decade (Order of the Cabinet, 2022). Specifically, goals regarding conducting fundamental and applied scientific research as the basis for quality higher education and popularizing science (Boiko, 2023; Mandanici et al., 2023). Conducting fundamental and applied scientific research involves identifying priority areas and developing innovative projects for implementing the results (products) of scientific activities into practice, thus updating the content of higher education (developing and accrediting new educational programs for training specialists).

The introduction of new forms of educational programs based on computer technologies remains relevant even in the complex conditions of war (Kolesnykova, 2023). This includes various models of distance learning that provide quality platforms. Distance learning platforms are tools that can have many advantages when integrated with higher and postgraduate education programs (Iskakova, 2023; Rossikhin et al., 2020). Therefore, e-learning platforms can facilitate individual or group learning processes and grant users access a variety of resources and discussions on pertinent educational subjects. Importantly, within these distance platforms, the educational process can be internationalized, allowing for quick and efficient exchange of experience in mastering various teaching methods in any field of expertise (Rajab, 2018). The extensive reach of global audiences via distance learning platforms allows for the rapid and efficient experimentation with diverse teaching methodologies. To make the

educational process in a distance format as useful as possible, Ukrainian HEI teachers mainly work on platforms such as Zoom, Microsoft Teams, Webex Meetings, Google Meet, Skype, Cisco, Classtime. Also, online courses like Prometheus, VUMonline, Khan Academy, lessons on YouTube channels, the online learning studio EdEra, and the WiseCow video lecture hall have proven to be effective (Boklan et al., 2023; Salnyk et al., 2023). It's important to highlight that during the state of war in Ukraine, the adoption of "e-learning" stands as the sole viable solution to uphold the continuity of higher education. This transition in higher education represents a necessary measure to sustain the learning process and surmount challenges. Efforts directed towards the teaching staff focus on enhancing competency and acquiring essential practical experience in utilizing innovative digital technologies and programs (Barvinok & Pudło, 2023). The vast majority of Ukrainian HEIs are creating a new educational environment in which students have accesses to information resources at any time and place, using electronic and mobile educational technologies, making the learning process more attractive, democratic, and convenient, and encouraging students to self-education and lifelong learning. For example, the electronic learning environment for students can be any resource where educational materials are presented: the educational institution's website, faculty website, social pages of teachers and lecturers, repository, file-sharing platforms, various distance learning platforms, and services (Iskakova, 2023). Usually, HEIs provide the educational process with the following platforms and communication tools: Moodle, Google Classroom, the Zoom video conferencing service, Google Meet, and other Google services (Google Drive, email), the Viber internet application, Telegram (Boklan et al., 2023; Salnyk et al., 2023). However, despite the obvious high demand for online learning among students of Ukrainian HEIs, there are components of education that seem unsuitable for online learning. For example, medical students need direct contact with patients to develop clinical skills. To achieve this, educators use interactive and active learning methods: business games (“diagnosis, additional examination methods, and treatment”, “diagnosis and provision of emergency medical care”), case method, working in small groups with situation analysis (Tsekhmister et al., 2023; Parshyn, 2024). Teachers also create various clinical and situational case studies, problem tasks necessary for modeling clinical situations close to those in practical medicine.

The innovative activity of higher education institutions involves not only creating new (innovative) products based on fundamental and applied research, preparing future professionals to apply acquired knowledge and skills in their professional and personal

lives (including the development and application of innovations), but also shaping an innovative culture grounded in values (Kaminskyy & Viesova, 2022; Kubiv et al., 2020). In education, universal and national values are the foundation and condition for shaping individuals as active and responsible members of civil society. By limiting itself to the goal of creating new technologies, humanity risks turning into a generation of professional manipulators and fraudsters, which not only contradicts the purpose of education but inevitably leads to a gap. The values-based aspect underlying the innovative activity of HEIs is a prerequisite for integration into the European and global educational space, including the cultivation of values such as democracy, dignity, tolerance, national orientation, intercultural education, etc. The innovative educational activity of HEIs aims at developing and implementing educational innovations, its level is determined by the content and scale of changes in educational objects as a result of using the proposed educational innovation (Kostikova et al., 2023; Bobro, 2024). The key goal of developing and applying innovations in Ukrainian higher education is the modernization (restructuring) of HEIs and their integration into the context of the Bologna Process to join the global educational space and ensure the competitiveness of Ukrainian HEIs.

Discussion

The results of the article demonstrate important changes taking place in the educational systems of war-torn countries. The use of innovative technologies under such circumstances becomes difficult, as the general transformations of society do not contribute to sustainable development. At the same time, the war opens opportunities for the active use of distance learning and Internet platforms, thanks to which it is possible to establish an effective educational process using all the possibilities of modern digital technologies (Habib, 2023; Rajab, 2018; Lysenko et al., 2024; Milicevic, 2015). The proposed conclusions expand the existing scientific ideas that the introduction and active use of innovations are possible in times of military operations. The positive aspect of this, as illustrated by the case of Ukraine, lies in the experience gained from mitigating the repercussions of the COVID-19 pandemic (Zhylin et al., 2022). Education during quarantine restrictions relied on the utilization of innovative technologies. As a result, the outcomes of distance learning have been largely favorable. The results of the proposed article confirm the views of scientists on the real positive possibilities of innovative

technologies (Kamusella, 2018; Salnyk et al., 2023; Kozlovskyi et al., 2022). Obviously, the need for their use will only grow in the future.

The proposed results support the conclusions of Boiko (2023) that Ukraine should urgently incorporate its science and education into the European social space, especially given the ongoing war that started on February 24, 2022. The researcher also highlighted the role of innovative educational activities in identifying and addressing challenges related to developing students' social and personal competencies. These challenges encompass delineating the value and substantive content of education, as well as navigating risks linked to informational, political, and military confrontation. In light of these complexities, educators in Ukraine must analyze the broader social, political, economic, and cultural context to effectively represent the national space and promote unity among Ukrainians. On the other hand, the lack of funding does not allow to fully realizing the potential of using VR and AR technologies in Ukraine. This was emphasized by Ivanchenko et al. (2023) and Kuzheliev et al. (2023). Hence, their conclusions are hard to deny.

On the other hand, it is possible to partially support Lucić's (2020) conclusions about the peculiarities of education during the war. Lucić (2020) examined educational practices that emerged during the Bosnian War in Sarajevo under siege. He juxtaposed analyses of interviews conducted with teachers and students alongside archival documentation to elucidate the nature of educational activities and curriculum structures. By investigating how the siege's constraints influenced perceptions of space and time, the evolution of educational infrastructures throughout the besieged city is chronologically traced. The obtained results generally confirm his conclusions about the psychological features of work during the war. At the same time, it is worth emphasizing the importance of the development of the latest technologies. Obviously, in the 1990s, the use of radio was an innovative teaching method. In modern times, turning to Internet platforms and using innovative teaching methods has much more positive effects.

The study findings underscored the significant role of digital technologies in facilitating learning for individuals impacted by war. However, contrary to the perspective posited by Iskakova (2023) and Iatsyshyn et al. (2024) suggesting that electronic technologies foster personalized learning for individuals with special needs, it is contended that specific electronic platforms require enhancements to accommodate the diverse needs of this demographic. Consequently, the results partially highlight the significance of technology, aligning with Iskakova's (2023) study, yet it is evident that

these technologies do not consistently promote the establishment of an inclusive environment. Further research is warranted to explore strategies for optimizing electronic platforms to ensure equitable access and support for individuals with special needs in educational settings affected by conflict.

Hence, the scientific novelty of the research resides in the constructive analysis of the impact of modern technologies on the educational process within a military conflict context. The proposed methodology for data collection and analysis is thorough.

Limitations of the research

However, there are several limitations to acknowledge. Primarily, the literature review may be susceptible to publication bias, as studies with favorable outcomes are more inclined to be published. This potential bias could influence the findings towards more positive perspectives on the utilization of modern technologies in higher education during wartime. Moreover, the findings from in-depth case studies in selected countries may not be generalizable to other conflict-affected regions or educational settings. The selection criteria for case study sites could also introduce bias. At third, focusing mainly on recent years for the literature review may overlook valuable insights from earlier studies. Therefore, these limitations do not affect the validity of the results, but only demonstrate future promising directions for research that should be considered.

Conclusions

In conclusion, the innovative utilization of technologies in higher education within conflict-affected regions emerges as a critical strategy to ensure the continuity and quality of education. A diverse array of technologies, including online learning platforms, mobile learning, open educational resources, virtual reality, and artificial intelligence, has been effectively deployed to surmount the barriers to learning imposed by war. These technologies have been particularly instrumental in countries such as Saudi Arabia, Israel, and Nigeria, where they have facilitated remote education delivery, facilitated interactive learning experiences, and simulated practical training sessions. Overall, the integration of modern technologies has empowered universities in conflict zones to effectively navigate the challenges of war, thereby safeguarding the accessibility and quality of education for students confronted with displacement and insecurity.

The Russian invasion of Ukraine in 2022 has profoundly affected all aspects of Ukrainian society, including higher education. The war has caused destruction of infrastructure, inflation, population displacement, and a decrease in the working-age population. Even before the war, the education sector had been impacted by the COVID-19 pandemic, leading to a focus on creating a safe educational environment and implementing distance learning.

Despite the challenges, Ukrainian higher education institutions have adapted to wartime conditions, thanks to the unity of the educational community and international support. The Development Strategy for Higher Education in Ukraine for 2022-2032 outlines goals for infrastructure restoration, creating innovative educational environments, and integrating into the European Research Area. The introduction of new educational programs using computer technologies, including distance learning, has been crucial. Platforms like Zoom, Google Meet, and others have been instrumental in maintaining educational continuity. However, certain aspects of education, such as clinical skills training for medical students, remain challenging to deliver online.

Overall, Ukrainian higher education is undergoing significant transformation to adapt to the challenges of war and integrate into the global educational landscape, emphasizing the importance of innovation and values-based education.

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