“Digital transformation of relocated higher education institutions in Ukraine under martial law”

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SPECIAL ISSUE "UKRAINIAN UNIVERSITIES IN NEW REALITIES: 10 YEARS OF WAR"

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DIGITAL TRANSFORMATION OF RELOCATED HIGHER EDUCATION INSTITUTIONS IN UKRAINE UNDER MARTIAL LAW

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Abstract

The ongoing Russia-Ukraine war has profoundly disrupted the higher education landscape, compelling numerous institutions to adapt to unprecedented challenges. This study investigates the resilience and adaptive strategies of relocated higher education institutions under martial law, focusing on Berdyansk State Pedagogical University. The analysis emphasizes the critical role of digital transformation in sustaining academic operations amidst displacement. Methodologically, the study integrates qualitative interviews and quantitative analysis, exploring how cloud technologies, learning management systems, and AI-driven chatbots contributed to continuity in education. The results reveal that digital platforms ensured accessibility to educational resources, increased student engagement, and enhanced institutional resilience. Over 85% of surveyed participants identified learning management systems' platforms as pivotal in maintaining educational quality, while AI chatbots were instrumental during crises, offering real-time communication and support even during power outages. Additionally, cloud-based solutions enabled the preservation of critical data and ensured uninterrupted access to academic resources, facilitating smooth transitions for both faculty and students. The findings underline that digital transformation not only mitigates immediate disruptions but also fosters long-term innovation in higher education institutions operating in war zones. This study offers valuable insights into how relocated institutions can leverage digital tools to build resilience, sustain educational quality, and adapt to evolving challenges in war-affected regions.

Keywords resilience, digital transformation, AI chatbots, martial law, educational continuity, war zones

JEL Classification I23, I21, O33

INTRODUCTION

The full-scale Russian invasion of Ukraine in 2022 has posed unprecedented challenges to the nation's higher education system. Universities and colleges in regions such as Luhansk, Donetsk, Kharkiv, and Zaporizhzhia have faced severe disruptions, including the destruction of infrastructure, occupation of territories, and threats to the safety and autonomy of their academic communities. These conditions have necessitated the relocation of higher education institutions (HEIs) to safer areas, a process involving not only physical movement but also profound transformations in educational delivery and support systems (Davies, 2004). The relocation of HEIs has been a critical response to ensure the continuity of education and safeguard academic freedom amidst the turmoil.

The relocation process, however, brings a host of challenges. Institutions must contend with the loss of physical infrastructure, the displacement of faculty and students, and the urgent need to transition to digital and remote learning. Martial law and the intensifying war actions

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further complicate these efforts, demanding ongoing resilience and adaptation from all stakeholders (European Commission, 2024; INEE, 2022). These disruptions necessitate innovative solutions to sustain academic operations and preserve the core educational mission of these institutions.

In this complex and rapidly changing environment, information technology (IT) has emerged as an essential tool for enabling universities to overcome these challenges. IT solutions provide critical support for maintaining communication, ensuring access to educational resources, and facilitating remote learning. The deployment of cloud technologies, virtual classrooms, and learning management systems (LMS) has proven instrumental in mitigating the challenges posed by displacement. Additionally, the integration of AI-driven chatbots has provided real-time support, enabling students and staff to navigate crises such as power outages and communication disruptions.

The relocation of HEIs also highlights the significant role of international collaborations in building resilience. Partnerships with global technology leaders such as Microsoft, Google, and Amazon Web Services (AWS) have facilitated the rapid deployment of digital tools and platforms. These collaborations have ensured not only the continuity of academic operations but also the security of sensitive data, which is crucial in a war-affected region. Despite these efforts, a pressing need remains to address gaps in understanding the long-term implications of these adaptive measures and their scalability in similar crises globally.

The role of IT in fostering resilience and adaptability among relocated HEIs provides a critical perspective on sustaining educational continuity. Case studies, including that of Berdyansk State Pedagogical University (BSPU), illustrate how digital transformation supports academic operations and resilience. These insights contribute to a broader understanding of strategies required to sustain higher education in regions experiencing prolonged war actions. Additionally, further analysis emphasizes the necessity of innovative approaches to enhance the adaptability of HEIs while addressing the unique challenges posed by displacement and martial law.

1. LITERATURE REVIEW

Armed conflicts have a huge impact on higher education (Greshta et al., 2023; Omoeva et al., 2018). Conflicts disrupt not only the physical infrastructure of educational institutions but also the social and academic lives of students and faculty (Paradies, 2023). Studies have shown that educational institutions often face challenges such as the destruction of buildings, displacement of academic communities, and disruptions to the continuity of education in war zones (Davies, 2004; Smith & Vaux, 2003). Military conflicts permeate all components of the academic environment, leading to the displacement of researchers and students (UIS, 2010), the disruption of curriculum coherence, the slowdown or impossibility of conducting research and innovation, and the weakening of international academic cooperation (Kayyali, 2024).

In the context of Ukraine, the situation is particularly dire due to the intensity and protracted nature of the war. Reports indicate that several universities have been completely destroyed or severely damaged in the heavily affected regions of Luhansk, Donetsk, Kharkiv, and Zaporizhzhia (INEE, 2022). The destruction of Kharkiv Karazin University, one of the oldest institutions in the country, a major educational hub, and an alma mater to three Nobel laureates (Karazin University, n.d.), underscores the extent of the impact on the country's educational infrastructure. Russian attacks on Kharkiv National University not only destroyed the university's infrastructure but also caused environmental damage, which, according to estimates by the Kharkiv State Environmental Inspectorate, reached 2.3 billion UAH or $62 million as of early 2023 (Fram, 2023).

As a result of these severe disruptions, students and faculty have been displaced, and many institutions have lost access to their physical campuses and essential resources (CIVICA, 2023; Spivakovsky et al., 2023). However, despite these daunting chal-

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lenges, the integration of IT has played a crucial role in enabling universities to maintain educational continuity (Symons & Cole, 2021; Staiger & Proudman, 2022). The rapid deployment of IT and tools has allowed these institutions to transition swiftly to digital platforms, ensuring that education continues despite the severe disruptions caused by the war.

The relocation of higher education institutions due to armed conflict is a relatively recent phenomenon in academic discussions, though it shares parallels with historical instances of universities moving during periods of war (Sherman et al., 2022) or political upheaval (Avery & Said, 2017; Peregudova, 2023). For example, during World War II, several universities in Europe were relocated or operated in exile (Usher, 2020). These historical events highlight the resilience of educational institutions in continuing their mission despite significant adversity (Orzhel et al., 2023).

In countries such as Turkey, Germany, Jordan, and Lebanon, the integration of refugees into higher education systems has presented a variety of strategies and challenges. These experiences demonstrate the difficulties faced by institutions in ensuring education access for displaced populations, particularly Syrian refugees. Such efforts emphasize the importance of developing adaptive policies to support education in times of crisis, which may offer valuable insights for other countries experiencing similar circumstances (de Wit & Altbach, 2016; A. Erdoğan & M. Erdoğan, 2020; Ergin & de Wit, 2020).

The war in Ukraine has had a devastating impact on the country's educational sector, notably higher education. According to the Ministry of Education and Science of Ukraine, over 2,000 educational facilities have been damaged, and more than 220 have been destroyed (Sobenko, 2023). As a result, approximately 24,000 students have been unable to resume their studies since February 24, 2022 (Trade Union of Education and Science Workers of Ukraine, 2022). Furthermore, a report by the Ukrainian Helsinki Union for Human Rights highlights that tens of thousands of students have faced significant challenges in continuing their education, including those related to displacement and limited access to infrastructure. Official statistics indicate that over 80,000 students in Ukraine are classified as internally displaced (Zakon i Biznes, 2023), emphasizing the immense challenges faced by the education system (Figure 1).

Between 2022 and 2024, the number of internally displaced students in Ukraine fluctuated significantly. In 2022, following the outbreak of the full-scale Russian invasion, approximately 80,000 students were classified as internally displaced persons. By 2023, this number decreased slightly to around 70,000, reflecting some stabilization due to the adaptation of higher education institutions and the implementation of digital technologies. However, in 2024, the number of displaced students rose again to 75,000 due to an escalation of war actions in certain regions. These figures highlight the severe challenges the educational system faces while underscoring the critical role of digital tools in ensuring access to education amidst the military crises.

In Ukraine, the relocation of universities has been both a response to immediate threats and a strategic movement to preserve the continuity of education (Ivanenko, 2024) while also further restoring the national identity of Ukrainians in occupied territories (Greenfield, 2024). Universities also play an influential role in peace-building in conflict-affected societies (Kester et al., 2022). According to recent reports, as of late 2023, 43 universities have been displaced from occupied territories, impacting hundreds of thousands of students and scholars (INEE, 2022). These relocations have involved significant logistical challenges, including the transfer of academic records, relocation of faculty and students, and the establishment of new administrative operations (Porkuian et al., 2023). This requires universities to allocate limited resources optimally and use them effectively (Bezzubko & Ponomarova, 2023; Nosok, 2024) to maintain educational continuity and support students and faculty during these trying times for Ukraine.

According to the Strategy for the Development of Higher Education in Ukraine for 2021–2031, priorities have been identified to promote the innovative development of educational institutions, which are essential for adaptation to contemporary challenges (Ministry of Education and

Science of Ukraine, 2000). Kibenko and Popadych (2024) highlight the challenges faced by educational institutions during the war and provide recommendations on adaptive strategies to maintain educational standards and ensure the continuity of learning.

This has necessitated the study of the management of relocated universities under heightened uncertainty. In this context, it is also important to highlight the findings of Denysova and Hruntkovska (2022), who emphasize the implementation of distance learning technologies in the educational process of vocational (professional-technical) education institutions during martial law.

Recent studies provide valuable insights into the challenges faced by higher education in Ukraine during the ongoing war and propose strategies to address these issues. These analyses emphasize the crucial role of digital platforms in maintaining the continuity of education under adverse circumstances. For instance, Popova et al. (2023) examined the implementation of distance and blended learning in Ukrainian universities during both peacetime and wartime. Their results highlight the adaptability of educational institutions in leveraging digital tools to ensure uninterrupted learning. Similarly, Blayone et al. (2018) explored the digital readiness of higher education students in Ukraine and Georgia, focusing on their preparedness for transformative online learning. This study underscores the importance of equipping students with the necessary digital competencies to thrive in challenging environments.

Together, these studies illustrate how digital platforms and technological readiness have become indispensable for sustaining education in Ukraine amidst the disruptions caused by war. They also underscore the potential for digital transformation to address immediate challenges and lay the groundwork for more resilient and inclusive higher education systems in the future. According to Lopatina et al. (2023), in order to remain competitive and address contemporary challenges, universities must integrate cutting-edge technologies such as artificial intelligence, big data analytics, robotics, and the Internet of Things into their educational programs and research projects. They argue that these technologies are essential for maintaining high educational standards and fostering innovation in complex and unpredictable environments. By adopting flexible and adaptive teaching methods, universities can effectively support students and faculty in navigating these challenges.

Digital tools such as learning management systems (LMS), video conferencing platforms, and online collaboration tools have become central to the functioning of these institutions (Tsybuliak et al., 2023; Suchikova & Tsybuliak, 2024). According to the regulatory documents of higher education institutions, the effective use of these technologies is a necessary condition for ensuring the quality of the educational process in remote learning settings. For example, the use of Moodle as an LMS has enabled Ukrainian universities to facilitate online learning and maintain communication between students and faculty, even when geographically dispersed (Falko & Zhukov, 2023).

Moreover, the integration of cloud storage solutions, digital libraries, and virtual laboratories has enabled these institutions to maintain access to academic resources and conduct research activities despite disruptions. These technological solutions have become especially critical in the context of full-scale war, as noted by Varnavska and Chepok (2024), emphasizing that the effectiveness of distance education largely depends on the availability of interactive learning tools.

Building on these technological advancements, information technologies have not only alleviated the logistical challenges of relocation but also provided a robust foundation for sustaining academic operations. Universities that were temporarily displaced successfully adapted to the new conditions, transforming into "universities without walls." As noted by Lopatina et al. (2023), universities functioning without physical boundaries have been able to ensure continuity of education by leveraging innovative technologies. For instance, Berdyansk State Pedagogical University continuously implements numerous initiatives that promote the development of distance learning and adaptation to new normal. Tools such as Microsoft Teams for virtual classrooms, Azure for cloud storage, and other digital platforms have played a crucial role in supporting these institu-

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tions, helping them overcome physical barriers. Through these technologies, universities are actively adopting remote solutions, developing and implementing digital platforms that ensure continuity in the learning process, and create virtual spaces for academic activities.

Moreover, artificial intelligence-based solutions, such as chatbots, offer innovative support to students and faculty, providing real-time information and access to educational content even during power outages or bombings. He et al. (2019) explored the impact of students' use of online support services on their engagement in the learning process. They demonstrated that active use of such services enhances engagement and can indicate students' learning status. Essel et al. (2022) show that undergraduate students who interacted with a chatbot as a virtual teaching assistant achieved better academic results compared to those who interacted with a human instructor. This is a significant contribution to the literature on AI chatbots in the context of improving student learning. In this regard, the implementation of innovative technologies such as chatbots is important for increasing student motivation and providing essential support for their learning.

This comprehensive approach illustrates a harmonious combination of project-based and network models, with an emphasis on flexibility, openness, and innovation in managing educational and scientific processes. However, despite the substantial body of research, the issue of displaced higher education institutions remains underexplored. Specifically, the integration of digital platforms and the long-term impact of such technologies on displaced universities require more detailed analysis.

This study aims to explore how digital platforms, such as learning management systems (LMS), cloud storage, virtual classrooms, and AI-based solutions, are utilized by relocated universities in Ukraine to ensure the continuity of education, overcome logistical and operational barriers, and maintain academic quality during the ongoing Russia-Ukraine war, while also assessing their long-term impact on the resilience and adaptability of higher education institutions.

2. METHODOLOGY

The study utilized quantitative and qualitative methods to analyze the role of IT solutions in addressing the challenges faced by relocated higher education institutions in wartime Ukraine. Key quality indicators were identified to assess the effectiveness of technological interventions, including:

- Accessibility of the information environment: The ability of students and faculty to access online platforms and resources.
- Student involvement: Engagement in online and hybrid courses supported by IT tools.
- Satisfaction with organization: Perceptions of how well IT systems supported communication and administrative processes.

Qualitative data were collected through semi-structured surveys with administrators, faculty, and students, focusing on IT-specific challenges such as transitioning to cloud platforms, implementing LMS, and integrating AI-based tools. Surveys addressed logistical barriers during relocation, psychological impacts, and the role of external IT support.

The thematic analysis highlighted the critical role of digital technologies. Cloud services ensured uninterrupted access to educational resources, LMS platforms facilitated remote teaching and learning, and AI chatbots provided real-time support. These tools proved essential in maintaining operational stability at Berdyansk State Pedagogical University, enabling the institution to adapt swiftly to the new conditions.

The study underscores how IT infrastructure and digital tools are central to the resilience of relocated universities, demonstrating their importance in overcoming logistical and operational disruptions caused by relocation.

Quantitative data were gathered through an online survey administered to students and faculty members of Berdyansk State Pedagogical University. The survey sought to measure the frequency and effectiveness of digital tools (such as LMS, video

conferencing platforms, and virtual labs), satisfaction with the support provided during relocation, academic performance metrics before and after relocation, and perceptions of educational quality in the new conditions.

The study included participants from Berdyansk State Pedagogical University in three annual surveys conducted during the summers of 2022, 2023, and 2024. Each survey captured a diverse group of respondents to provide a comprehensive understanding of the impact of relocation and digital transformation.

In total, 654 responses were collected in 2022, 889 in 2023, and 887 in 2024, comprising students, faculty members, and administrative staff. The distribution was as follows:

- Students represented approximately 70% of the respondents across all years. Most student participants were in their third or fourth year of study, reflecting the lower enrollment numbers for first-year students during the Russian full-scale invasion.
- Faculty members accounted for around 25% of respondents. Faculty participants were drawn from a range of departments and reflected the university's multidisciplinary profile.
- Administrative staff made up approximately 5% of respondents, offering insights into the logistical and operational challenges faced during the relocation.

A notable aspect of the respondent demographics was the predominance of women, as many men were serving on the front lines. This gender imbalance was especially evident among students and faculty, highlighting the broader societal impacts of the war. The surveys also captured additional demographic details, such as academic roles and years of experience, providing a nuanced profile of participants. These insights enhanced the reliability and applicability of the study's conclusions.

The survey was distributed to a broad audience via university email lists, social media platforms, and internal communication channels.

In addition to the survey, technical data on user activity within educational support systems such as Moodle, Zoom, and DSpace were collected. These data provided insights into how students and faculty interacted with the digital tools, including the frequency and nature of activities conducted on these platforms.

Quantitative data were analyzed using SPSS software. Descriptive statistics were used to summarize the survey responses, while inferential statistics were applied to examine relationships between key variables, such as the effectiveness of digital tools and perceived educational quality. The analysis also looked at how chatbots affected students' satisfaction and their involvement in the learning process.

Ethical approval for the study was obtained from the Institutional Review Board of Berdyansk State Pedagogical University. All participants, including those who completed the survey, were provided with an informed consent form that outlined the purpose, procedures, risks, and benefits of the study. Participation was voluntary, and participants were assured of their right to withdraw from the study at any time without consequences. Confidentiality was maintained by anonymizing all transcripts and survey responses.

3. RESULTS

Berdyansk State Pedagogical University, originally located in an occupied territory of Ukraine, faced severe challenges following the full-scale Russian invasion on February 24, 2022. The occupation of Berdyansk on February 27 posed a significant threat to the university's material and information resources, including critical data on students, staff, and academic programs. To protect these assets, the university quickly developed and implemented an action plan, transferring servers and databases to secure cloud platforms in late March 2022 (Bohdanov, 2022; Censor.net, 2023).

By May 2022, the university successfully relocated to Zaporizhzhia, resuming educational and administrative operations with the help of Ukrainian IT companies. These efforts included the establishment of new server capacities and the adop-

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tion of cloud technologies like Microsoft Azure to replace lost physical infrastructure. Additionally, enhanced security protocols were introduced to protect data from potential cyber threats. This digital transformation not only ensured uninterrupted access to resources for students, faculty, and staff but also highlighted the resilience of the university in overcoming the challenges of war and relocation (Pershyi Zaporizkyi, 2023).

Information technologies have been vital for relocated higher education institutions like Berdyansk State Pedagogical University, helping to address challenges such as loss of physical infrastructure, disrupted administration, and maintaining educational continuity during the war. Key technologies employed include cloud services, LMS platforms, communication tools, and AI-driven solutions, enabling both educational and administrative activities to continue remotely.

Cloud services like AWS and Microsoft Azure have been critical, allowing universities to securely store and access data from anywhere, thus safeguarding academic and administrative resources. For Berdyansk State Pedagogical University, transitioning to cloud storage ensured uninterrupted access to documents, research data, and educational materials despite relocation.

LMS platforms such as Moodle and communication tools like Microsoft Teams and Zoom provided virtual environments for course delivery, faculty meetings, and administrative tasks, ensuring continuity in teaching and community cohesion. Additionally, AI chatbots offered real-time support during emergencies, bridging communication gaps during power outages or infrastructure damage.

Global tech companies, including Microsoft, Google, and AWS, played a crucial role by providing platforms such as Teams, Google Classroom, and cloud infrastructure, which supported uninterrupted academic operations. These efforts highlight the resilience of Ukrainian HEIs and provide a model for institutions in war zones. The integration of these technologies has accelerated the digital transformation of higher education in Ukraine, underscoring the need for further optimization to enhance accessibility, engagement, and educational quality in hostile environments.

The relocation process required substantial administrative coordination, which was greatly facilitated by IT tools. Microsoft Teams and other digital platforms enabled continuous communication among administrative staff, ensuring that critical functions like registration and academic advising could be maintained during the transition. These technologies allowed universities to recreate their administrative operations in a virtual environment, ensuring that the relocation did not interrupt essential services.

The rapid adoption of digital platforms, particularly Microsoft Teams and LMS like Moodle, has been pivotal in maintaining educational continuity (Kester et al., 2022). These tools have provided a structured environment for online learning, enabling faculty to deliver lectures, distribute materials, and interact with students despite the physical dislocation. The survey data indicate that the use of Microsoft Teams has been incredibly effective, with over 85% of respondents noting its critical role in facilitating synchronous classes.

The survey conducted as part of the study played a complementary role, providing context to the broader examination of digital transformation in relocated higher education institutions. It focused on user engagement with IT tools, including LMS, cloud platforms, and AI-driven chatbots, offering a snapshot of their practical application. These findings were intended to illustrate how digital technologies supported the continuity of education during the relocation process.

The complete survey text[1], along with its detailed results and analysis, and dynamic trends, is publicly available on the official website of the university[2]. This ensures transparency and accessibility for stakeholders interested in the data, contextualizing the implementation and impact of digital tools within the university's operational framework. In addition to Microsoft Teams, other col-

1 https://bdpu.org.ua/en/sektor-iakosti-osvity/questionnaire/

2 https://bdpu.org.ua/en/sektor-iakosti-osvity/results-monitoring-quality-education/

laboration tools such as OneDrive and SharePoint have enabled seamless sharing and collaboration on academic projects. These tools have been essential in maintaining the integrity of academic programs, allowing students and faculty to work together in real time, regardless of their physical location. Moreover, the integration of AI-driven chatbots into these platforms offers a promising avenue to provide continuous support during emergencies, ensuring that students have access to critical information even during power outages or bombing raids (Milton et al., 2021).

For Berdyansk State Pedagogical University, the strategic use of IT has not only allowed the university to continue its operations during the full-scale war but has also enhanced its ability to adapt to future challenges.

A key component of the information space in the educational process is the Moodle Learning Management System. The university has successfully utilized this system for over 20 years to support in-person learning, giving faculty and administration considerable experience in its operation. This globally recognized Open Source system enables the online dissemination of materials for all academic courses, facilitates collaborative work among students, and allows for both formative and summative assessments to be conducted asynchronously. This is particularly crucial under martial law conditions, where there may be interruptions in electricity and Internet access across different regions of the country at various times. First, the Moodle system software was deployed on servers located directly on the university campus. After the occupation, university staff, with the support of the American IT giant EPAM, successfully migrated the data to the cloud and restored the system from backups following a successful evacuation. This system was prioritized for deployment as it is essential for resuming the educational process, which was halted in the middle of the semester due to the outbreak of war. The suspension of the educational process lasted only six weeks, with some activities being postponed to the summer break. The restored system was utilized to complete the current academic year.

Throughout the 2022/2023 academic year, the university gradually restored its information resources and infrastructure. In the summer of 2023, the current version of Moodle was deployed in the GigaCloud environment, enabling faculty to restore their teaching materials in a new, stable system.

Figure 1 presents user activity as derived from the system's technical data. It is based on data from the system's log file, which automatically records all user interactions with the distance learning support system. This automated process provides a quantitative assessment of activity types, offering a comprehensive overview of student and faculty engagement, including content creation and its utilization. The technical characteristics illustrated in Figure 1 ensure clarity and precision in representing these metrics.

User activity reflects the seasonal nature of the academic process, with higher activity levels during the winter semester, which correlates with the system's updates and preparations for the academic year. Analysis of user activity segmented by role

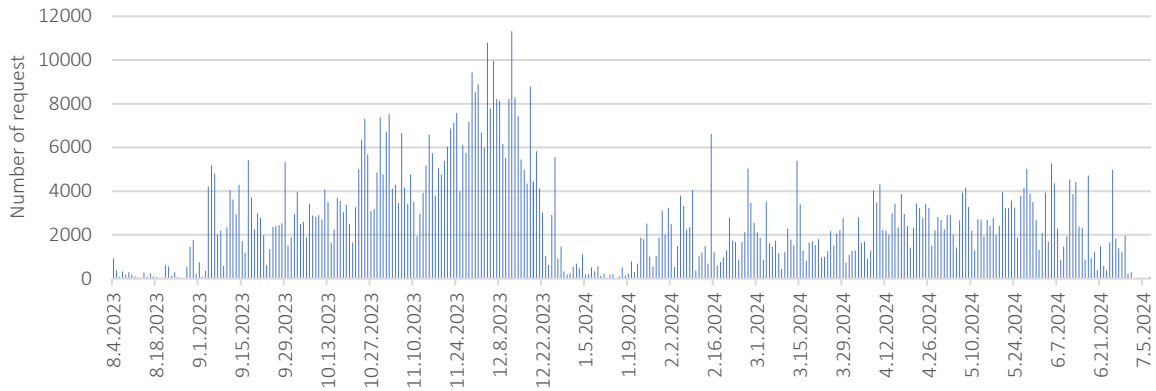

Figure 1. User activity in university Moodle during the 2023/2024 academic year

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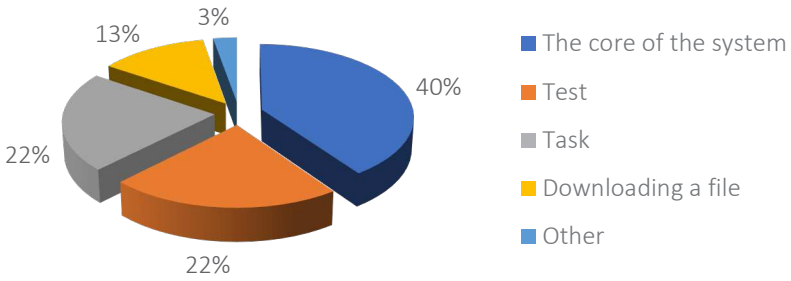

Figure 2. Activity in university Moodle by components

within the system (instructor or student) reveals that the average number of system interactions per user is approximately 500 transactions per year. Notably, for every student transaction, there are at least two instructor transactions.

Figure 2 illustrates the analysis of activity types within the system. The system's core functionality is centered around administrative activities, including actions such as creating new courses, adding various types of activities, populating the system with content, and managing users. These activities are focused on building and preparing the system for the educational process.

User activities directly related to the learning process are categorized as follows:

- Test: Students completed various types of test assignments.
- Task: Students submitted assignments in the form of text or files, and instructors evaluated these assignments.
- Downloading a file: Accessing educational materials from course pages, such as presentations, articles, and spreadsheets.

These distinctions illustrate the dual focus of the system on both administrative preparation and facilitating direct educational engagement, ensuring a comprehensive support framework for the learning process.

Course creation and instructional design account for about 40% of the overall activity, while the remaining activity is related to direct learning, monitoring, and control of the educational process. The most significant activities in the system are task completion and test-taking, which account for 22% and 22.2%, respectively, followed by activities related to downloading educational materials. Over the 2023/2024 academic year, more than 1 million actions were recorded in the system, representing a 23% increase compared to the previous academic year.

A new institutional repository for Berdyansk State Pedagogical University became operational at the end of 2023. Within a year, approximately 3,500 materials authored by university faculty were collected. Figure 3 presents the distribution of materials by type. During the academic year, the repository recorded over 7,000 total views, further demonstrating the increasing engagement with university's restored digital resources.

To facilitate synchronous video conferencing for classes, Berdyansk State Pedagogical University selected remote conferencing software from the American company, Zoom Video Communications. The company provided the university with a free license, allowing for unlimited conference hours and up to 300 participants simultaneously.

During the 2023/2024 academic year, more than 32,000 conferences were held, averaging about 200 sessions per instructor. The timing of these conferences closely matched user activity on Moodle, with each webinar typically attended by approximately 10 students.

Figure 4 shows the geographic distribution of student connections to real-time video conferences. Technical logs from the system indicate that at least 23% of students are located abroad, yet they

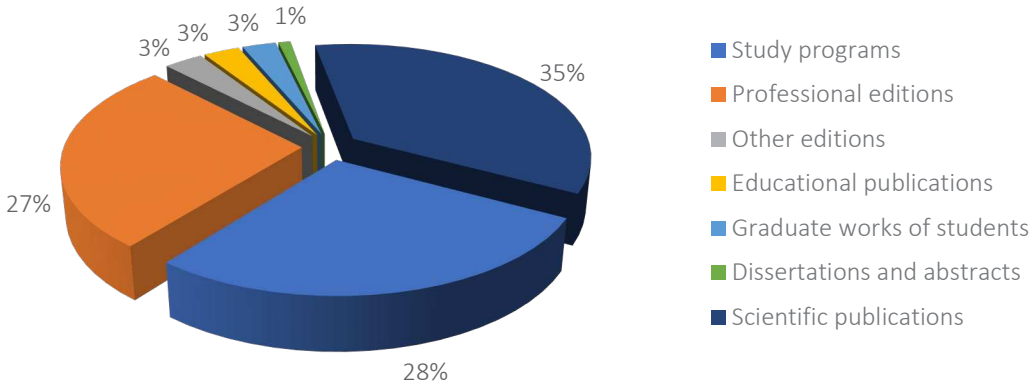

Figure 3. The content structure of the materials of the institutional repository

continue to study at the Ukrainian educational institution, maintaining their culture and national identity. This highlights the global reach of university's educational offerings and its ability to connect students despite geographic distances.

The university's rapid adaptation to challenging conditions and its ability to maintain nearly uninterrupted educational operations have allowed it to persevere and continue functioning despite difficult circumstances. Table 1 provides statistical data on the changes in the number of students and faculty over the past five years, highlighting the resilience of the institution in the face of adversity.

The sparkline clearly illustrates that the decline in student enrollment has been successfully mitigated, with even a slight increase observed. However, the situation regarding faculty remains a significant challenge, as the ongoing war has resulted in a substantial brain drain from the country, a problem that continues to require a viable solution.

In contrast, the study results emphasize the critical role of digital technologies in ensuring the continuity of academic operations for higher education institutions after their relocation. Tools such as cloud services, LMS, Microsoft Teams, and AI-driven chatbots enabled the transition to remote learning, allowing continued interaction between faculty and students and the continuation of administrative tasks.

Data collected in the study show that tools like Moodle and Microsoft Teams had a positive impact on maintaining educational continuity. These

Table 1. Dynamics of Berdyansk State Pedagogical University contingent, 2019–2024, person

	Oct 1, 2019	Oct 1, 2020	Oct 1, 2021	Oct 1, 2022	Oct 1, 2023	Oct 1, 2024	Sparklines
Students	5,294	5,084	4,695	4,005	4,242	4,204	
Teachers	265	255	236	216	191	204	

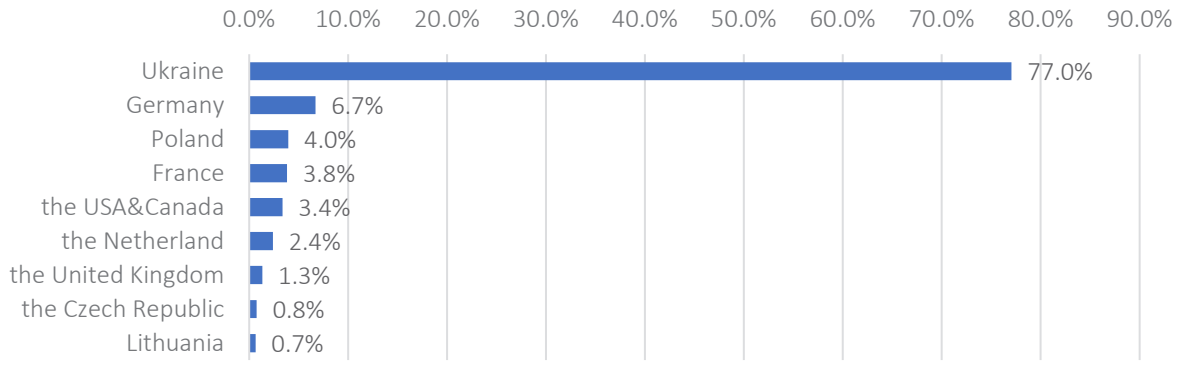

Figure 4. Geography of students' connections to Zoom in real time

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platforms allowed faculty to conduct lectures, distribute educational materials, and organize synchronous classes despite the physical relocation. The majority of students appreciated the use of cloud-based solutions, which provided them with access to educational materials regardless of their location.

Additionally, the use of chatbots to provide support proved effective. They allowed students to access real-time information, even during power outages or other disruptions. These tools helped maintain the educational process and administrative functions in war conditions.

The findings demonstrate that for Ukrainian institutions, the implementation of digital technologies allowed them to survive the immediate challenges of relocation and laid the foundation for long-term adaptation and development in education. Digital technologies became crucial not only in responding to the war challenges but also in driving the long-term transformation of education, offering a potential model for other institutions in similar situations.

4. DISCUSSION

The resilience of HEIs in Ukraine is demonstrated by their ability to swiftly adapt to the challenges posed by relocation and war actions. This study highlights the critical role of digital tools in maintaining the continuity of education during such crises. Specifically, the successful implementation of platforms provided by companies like Microsoft, along with other IT solutions, has been central to the survival and ongoing operation of these institutions. The ability to transition quickly to digital environments, even in the face of lost physical infrastructure, underscores the resilience of the sector.

This finding aligns with previous research on crisis management in education, which emphasizes the importance of digital technologies in ensuring educational continuity during disruptions (Varnavska & Chepok, 2024). Similar conclusions have been drawn in studies conducted in other conflict-affected regions, where digital tools have proven instrumental in maintaining educational operations (He et al., 2019).

The successful adoption of technologies such as Microsoft Teams, Azure, LMS, and AI-driven chatbots suggests that digital transformation will help institutions weather crises and shape the future of education in the long term. This shift is in line with global trends where institutions are increasingly adopting hybrid learning models, blending in-person and online education (Blayone et al., 2018). The experience in Ukraine confirms the potential of these digital tools to enhance educational delivery, both during the war and beyond, positioning digital transformation as a long-term strategic priority for HEIs.

A significant finding of this study is the integration of AI-driven tools, such as chatbots, into educational platforms. These tools have been instrumental in providing real-time information and support during emergencies, such as bombing raids or power outages, ensuring that students and faculty maintain access to educational content and critical information. This finding is consistent with Essel et al. (2022), who demonstrated the positive impact of AI tools on student engagement and learning outcomes.

Moreover, the use of chatbots has resulted in positive changes in several key quality indicators, such as increased accessibility of information, greater student involvement, and improved satisfaction with the organization of the educational process.

The findings of this study have significant implications for other war-affected regions. The strategies employed by Ukrainian HEIs, particularly their use of digital tools to overcome logistical and infrastructural challenges, can serve as a model for institutions facing similar disruptions. The integration of digital technologies not only helps maintain the educational process but also enhances the long-term resilience and adaptability of these institutions.

This paper also underscores the importance of ongoing international support and collaboration in strengthening the resilience of educational systems in war zones. The ability to implement and sustain digital transformation initiatives is crucial for ensuring the continued operation and quality of education in hostile environments. It will be essential for HEIs to continue refining these digital strategies and for global partnerships to play an active role in supporting educational continuity.

CONCLUSION

This study examined the impact of the Russia-Ukraine war on higher education institutions in Ukraine, particularly the role of digital tools in maintaining educational continuity. The findings underscore the significant resilience these institutions demonstrated, especially through digital platforms like Microsoft Teams, LMS, and AI-driven chatbots, which enabled educational continuity despite severe disruptions caused by war actions and relocation.

The results indicate that the accelerated digital transformation of HEIs has allowed them to continue operations and paved the way for long-term innovation in higher education. The widespread adoption of these tools highlights their potential to remain integral to educational systems even after the war subsides, ensuring more flexible and hybrid education models.

The study emphasizes the importance of global technological support and continued innovation in educational tools to maintain the operational capacity of HEIs in war zones. Future research should focus on further optimization of these technologies to enhance educational resilience in regions affected by war and displacement.

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