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**Lidia Londar**

PhD in Economics, Associate Professor,  
 Research Fellow, SSI "Institute of  
 Education Content Modernization",  
 Kyiv, Ukraine;  
 e-mail: [londarlidia@gmail.com](mailto:londarlidia@gmail.com)  
 ORCID: [0000-0002-0873-5664](https://orcid.org/0000-0002-0873-5664)  
 (Corresponding author)

**Marcus Pietsch**

D.Sc. in Pedagogy, Professor of the  
 Institute of Educational Sciences,  
 Leuphana University of Lueneburg,  
 Lueneburg, Germany;  
 ORCID: [0000-0002-9836-6793](https://orcid.org/0000-0002-9836-6793)

# KEY ASPECTS OF MANAGING EDUCATION RESILIENCE DURING THE WAR: THE CASE OF UKRAINE

## ABSTRACT

The global experience of educational functioning during wartime has received insufficient attention, which makes the research topic relevant. In Ukraine, between 2014 and 2022, key directions in the transformation of educational management became evident, demonstrating the resilience of the education system during the most challenging moments of the full-scale war. The purpose of the research is to study the Ukrainian experience of education management and its resilience in wartime. A comprehensive literature review has enabled the authors to refine the definition of organizational resilience within the education system and propose a dynamic model delineating its components and stages of development under crisis conditions.

An analysis of various educational indicators was conducted, revealing patterns of managerial influence on infrastructure support, particularly by improving financing, adopting new tools and technologies, expanding educational forms, and achieving learning effectiveness. Mathematical modelling confirmed the correlation between providing schools with protective shelters and students' transition to full-time education, which has become more active. In general, the study of the functioning of the Ukrainian education system in the conditions of prolonged wartime has shown that the key factors in ensuring its resilience to new challenges are, first of all, the flexibility and adaptability of educational management. Systemic transformation of approaches to decision-making and management tools aimed at ensuring continuous operation and strategic development of education also has a decisive impact on the formation of human capital and the country's economic prospects.

The study's practical significance lies in the generalization of the education management experience and its resilience in wartime with the possibility of its use by other countries in emergencies.

**Keywords:** the transformation of educational management, organizational resilience of education, educational technologies, management instruments, educational subvention, learning models, protective structures and shelters, refugee students, educational losses, internally displaced persons

**JEL Classification:** I21, I28, C51

## INTRODUCTION

In Ukraine, the Constitutionally guaranteed right to accessible free education is implemented through recognized forms of education - institutional, individual, and dual. Educational institutions of Ukraine provide preschool education; full general secondary education; out-of-school education; special education (vocational education and training, and pre-tertiary vocational education); higher education; and adult education (including postgraduate education). The state education system is governed at three levels: parliamentary (Verkhovna Rada of Ukraine [VRU], Cabinet of Ministers of Ukraine [CMU]), central ministerial (Ministry of Education and Science of Ukraine [MESU], departments), and regional (local governments, local education managers, directors of educational institutions). This structure ensures an optimal unity of centralization and decentralization of management with a clear division of functions at different levels.

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However, current conditions require the modernization of approaches to education management that are in line with the requirements of the times.

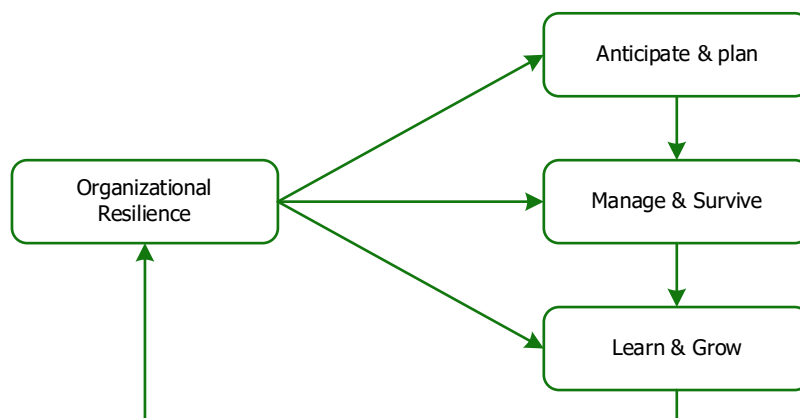
The systemic and modernization changes in Ukrainian education initiated after independence have faced some challenges, but the biggest challenge for education has been the humanitarian crisis caused by the war. Russia's long-term aggression against Ukraine can be divided into two periods: the hybrid war that began in 2014 with the annexation of Crimea, and the full-scale war that followed the invasion of Ukraine by Russian troops on February 24, 2022, which continues to this day. As a result, the number of occupied Ukrainian territories has increased, and thousands of people have been forced or psychologically pressured to relocate to safer regions of the country or become refugees abroad. During the period 2022-2024, the number of Ukrainians in need of humanitarian assistance (OCHA, 2024) increased from 2 million to more than 14.6 million persons; 3.7 million persons are internally displaced persons (IDPs), of which almost 1 million are children. Significant destruction of the educational infrastructure deprived children of access to traditional education and normal living conditions.

This article focuses on full general secondary education, which is compulsory and has three levels: primary education (Grades 1–4); basic secondary education (Grades 5–9); and specialized secondary education (Grades 10–12). This focus is because this education is a fundamental component of Ukraine's national education system, has the largest network of educational institutions, and the contingent of students and teachers. As of May 2024, the general secondary education system has 12 596 functioning schools, 3,815, 565 students, and 383,032 teachers (SSI-IEA, 2024). It is also important that teenagers - schoolchildren are characterized by a special vulnerability of their psyche to the devastating effects of war, the scale of which is impressive. From February 24, 2022 - December 2024 (Gerasimchuk, 2024), 595 lost their lives, 1,716 children were injured, 1,935 children went missing, 19,546 children were deported or forcibly resettled, and 16 children were sexually abused. In total, 3,428 educational institutions were damaged, 365 were destroyed. In response to these threats, Ukraine's education system transformed traditional approaches to education management and demonstrated resilience during the prolonged period of war, with schooling continuing even in the most challenging moments of Russia's full-scale armed invasion.

## LITERATURE REVIEW

Organizational resilience in crises requires effective management to prepare for and respond appropriately to extreme events and conditions. To counter risks and avert damage, especially in a turbulent environment (Heineman and Hatfield, 2017), a manager's primary task is to maintain stable organizational functioning through managerial transformations that exceed traditional approaches, i.e., become adaptive. In this context, the ability of an organization to adapt to disruptions and unexpected sudden shocks (Ma, Xiao, and Yin, 2018), that is organizational resilience and resilience management are usually considered desirable systemic characteristics to overcome all kinds of adversities (Linnenluecke, 2017).

Although organizational resilience is a fuzzy concept (Vakilzadeh & Haase, 2021), that "has two or more alternative meanings and therefore cannot be reliably identified or applied" (Markusen, 2010), nevertheless, as Ma, Xiao, and Yin (2018) argue, always includes three main aspects (Figure 1).

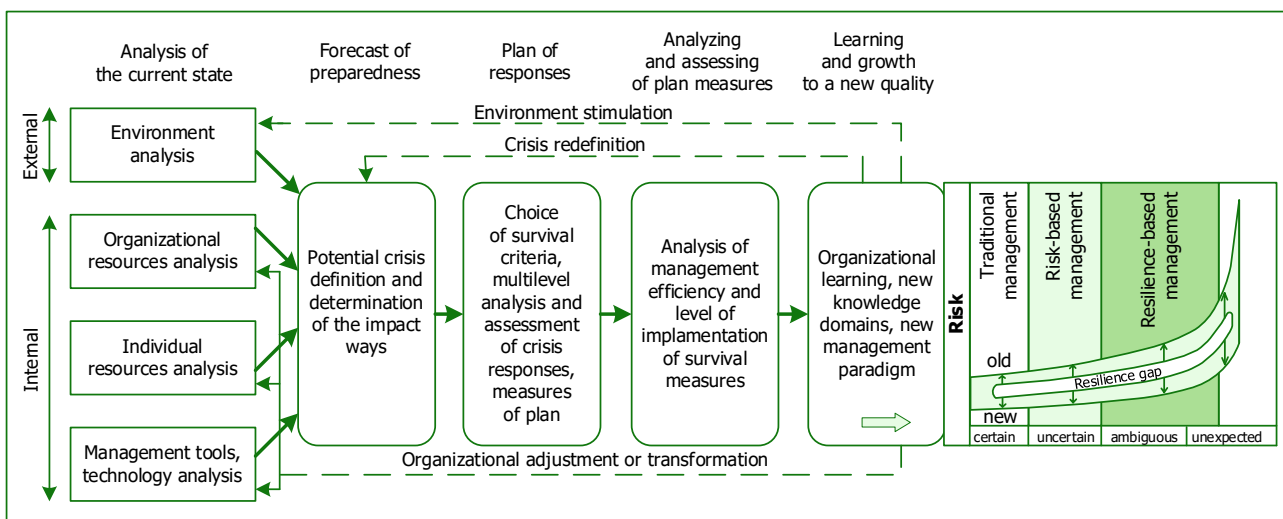


**Figure 1. Organizational Resilience and Organizational Coping Strategies.** (Source: Ma, Xiao, and Yin, 2018)

Firstly, it is the ability to manage crises in an unstable and changing environment; second, it focuses on survival, adaptation, recovery, and improvement in disruptive situations; and third, it is a multi-level concept that encompasses organizational resources, procedures, and processes.

Hillman and Guenther (2020, 31) define organizational resilience as "the ability of an organization to maintain functions and quickly recover from adversity by mobilizing and accessing the necessary resources," that is, to dynamically develop at the individual, organizational, and environmental levels (Tasic et al., 2019). However, as Horne and Orr (2011) argue, that the key to organizational resilience is the collective, systemic level of action, where the environment (governance) and the organization are in an interdependent learning loop (Tasic et al., 2019). Thus, the creation of resilient organizations depends especially on resilient governance (Heineman and Hatfield, 2017), which develops sensitivity to the "weak signals" that precede a crisis (Vogus and Sutcliffe, 2007).

Importantly, the concept includes the assumption that resilient organizations not only succeed during crises but also learn and even thrive as a result (Miceli et al., 2021). Figure 2 shows our author's vision of the model of organizational resilience, its constituent elements, and stages of transformation in crisis.



**Figure 2. The Author's Model of Organizational Resilience in Crisis: Formation Stages and Components.**

The first stage involves analyzing current organizational functioning and considering its interactions with the environment and the internal interactions between elements of the organizational structure. It allows organizations to identify potential risks, plan and implement threat countermeasures, and evaluate the effectiveness of countermeasures. If necessary, the leaders of the organization can restructure and create a new management paradigm to promote its development, which leads to the transition of quantitative changes to quality, increasing the ability of the organization to function sustainably under higher risk. Within this concept of organizational resilience, we examine the managerial transformation of Ukrainian education to highlight important aspects of ensuring resilience in wartime.

## AIMS AND OBJECTIVES

The purpose of the study is to investigate and summarise the Ukrainian practical experience of managing the education system in wartime and managing its resilience. Achieving this goal involves: identifying wartime challenges in education and determining priorities for structural countermeasures; identifying trends in the forced displacement of Ukrainian students and teachers and the specifics of organising a continuous educational process in war conditions; assessing the effectiveness of implementing new management tools and new educational technologies in the context of reducing educational losses and increasing the resilience of education.

## METHODS

Following Eisenhardt and Graebner's (2007) case study approach, we adopted a mixed methodology that combined qualitative, quantitative, systemic, and structural approaches within a descriptive design. The triangulation method was applied: administrative information, statistical data, official documents, educational bulletins, and legal and regulatory sources

were obtained. Administrative and statistical information collected throughout Ukraine between 2013 and 2024 was obtained from the Ministry of Education and Science of Ukraine's (MESU) website and the Automated Information Complex of Education Management (AICEM) database. The operational information is contained in the reports of the military-civilian administrations of the regions of Ukraine, which they periodically provide within the Dashboard directly to the State Scientific Institution "Institute of Educational Analytics" (SSI-IEA).

The obtained data facilitated the calculation of several educational indicators, including the percentage of schools with access to different types of protective structures; the percentage of students protected by all types of structures; the percentage of schools connected to the Internet; the number of students per school computer connected to the Internet; the number of teachers per school portable device. Methods of compilation, grouping, and total aggregation processed all data. Methods of analysis and synthesis and mathematical and statistical methods using ranking, necessary visualization, thematic mapping, and regression modelling were also used. In particular, the interdependence between the number of full-time students and the share of schools with different types of shelters is approximated by linear functions.

## RESULTS

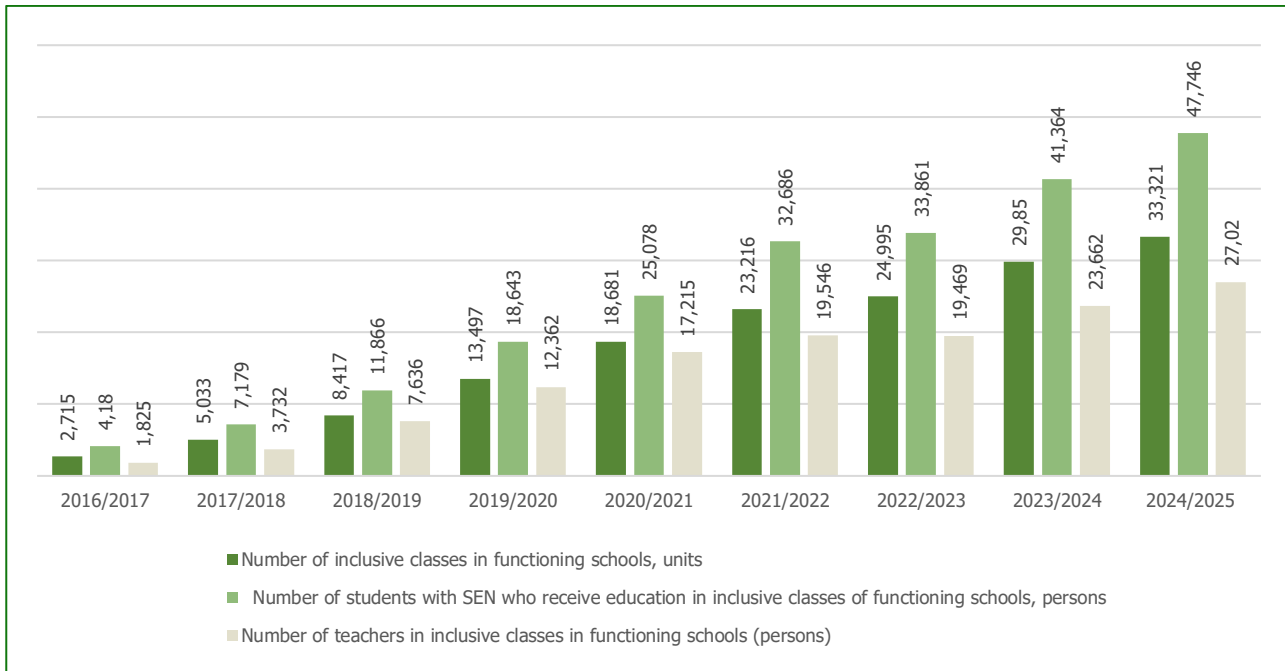
### *Resilience Dimension 1: Anticipation and Planning*

In the difficult period 2014-2021, education cultivated sensitivity to "weak signals" of growing future risks. Preserving studentship in the Ukrainian educational space has become one of the main management measures on the way to the formation of educational resilience. Education managers made decisions to ensure conditions for the end of the academic year in the temporarily occupied territories. Thus, in 2014, the MESU produced and issued 16,824 basic certificates and 14,012 full general secondary education diplomas of state standard to graduates in annexed Crimea. Due to the introduced preferential quotas for free education, about 10,000 graduates from Luhansk, 22,000 from Donetsk and 968 from the annexed Crimea entered Ukrainian universities in 2015 (MESU, 2015). Between 2016 and 2020, 8,225 graduates from the temporarily occupied territories were admitted to Ukrainian universities with the assistance of the Donbass-Ukraine and Crimea-Ukraine educational centres (MESU, 2020). Thanks to these practical steps, it was possible not only to attract students from the occupied territories to Ukrainian education but also to pilot certain educational tools (distance learning, external education) long before the onset of future extreme conditions.

During this period, significant changes took place in the educational legislation, which provided legal regulation of the education system: new laws On Education, Comprehensive General Secondary Education, and the Concept of a New Ukrainian School (NUS) were adopted. Additionally, MESU decided to gradually transition to a twelve-year education system. A pedagogical internship program has been introduced to improve the professional skills and qualifications of teachers. As part of the territorial reforms, the school network transformed, including consolidation, and autonomy expansion.

Since 2015, Ukraine has changed its approach to financing education: one of the main budgetary instruments for financing schools has been introduced - the "educational subvention". The total allocations for this initiative from 2015 to 2021 amounted to UAH 551.7 billion, and for the period of the full-scale war - UAH 303.6 billion. Furthermore, targeted subventions were introduced during this period, the use of which facilitated the improvement of school infrastructure and increased the financial motivation of teaching staff through salary increases. Thus, the created economic and legal framework for the functioning of schools strengthened their ability to provide continuous education in the difficult conditions of war.

The reform of inclusive education, launched by MESU in 2017, regulated access to education in all institutions for children with special educational needs (SEN). These changes introduced distance and individual forms of learning for students with SEN, established inclusive classes, provided psychological and pedagogical support during education, personnel changes in schools, and established inclusive resource centres (IRC), the total number of which in 2022 was 667 units. As a result, from 2016/2017 to 2021/2022 academic years, the total number of students with SEN in inclusive school classes increased by 7.8 times, the number of inclusive classes – by 8.6 times, the number of assistants working with children with SEN – increased by 10.7 times (Figure 3).



**Figure 3. The dynamics of inclusive education indicators in 2016-2024.** (Source: calculated and compiled by the authors based on SSI-IEA)

By the end of 2024, 673 IRCs were functioning in Ukraine, the premises of 45 IRCs were destroyed as a result of the war, and 47 IRCs were located in temporarily occupied territories. These changes contributed to the socialization of students with SEN, reducing psychological barriers and improving the quality of education.

Ongoing challenges, particularly the COVID-19 pandemic, have caused additional problems for traditional education, which have led to the adoption of alternative models, such as distance and blended learning. This shift has increased the use of modern educational technologies, so their wider introduction into Ukrainian education became a priority: from 2014 to 2020, the share of schools with Internet access increased by 12.4 %, and the provision of computers in schools by 4.0 %.

The information component of the education management system at the central level. To collect, process, and store administrative and statistical data, the MESU has created a national education management information system (EMIS), the basis of which is the Automated Information Complex of Education Management (AICEM). Thanks to this EMIS, making management decisions based on reliable information (allocation of budget funds for teachers' salaries, distribution of computer equipment, ordering textbooks) has become flexible and transparent, and educational policy is more effective. Ukraine's participation in PISA-2018 was a significant step in assessing the quality of national education and improving school programs with a special emphasis on strengthening the quality of STEM education, the development of which intensified during this period.

Thus, the implemented management measures ensured the continuation of educational reforms, thereby increasing the educational system's resilience and readiness for future wartime challenges.

### Resilience Dimension 2: Managing and Surviving.

**New and Revised Laws Regarding Education.** Russia's full-scale invasion of Ukraine disrupted the national education system's normal operations and pushed it to the limits of survival. Responsibility for management at the regional level was transferred to civil-military administrations, which, together with the MESU, developed and implemented educational policy. This led to amendments to several legislative acts of previous years (the Laws "On Education" and "On Comprehensive General Secondary Education") and the enactment of new laws by the VRU intended to address numerous educational challenges. By the Law "On Amendments to Certain Laws of Ukraine in the Field of Education" (VRU, 2022a), MESU cancelled the state final certification of students from the 2021/2022 academic year and replaced external independent assessment (EIA) with simplified multi-subject national testing (MNT). It also provided special conditions to applicants that do not consider the results of EIA, a single entrance (or professional entrance) exam. This allowed the students to finish the academic year and enter the university, avoiding additional psycho-emotional stress.

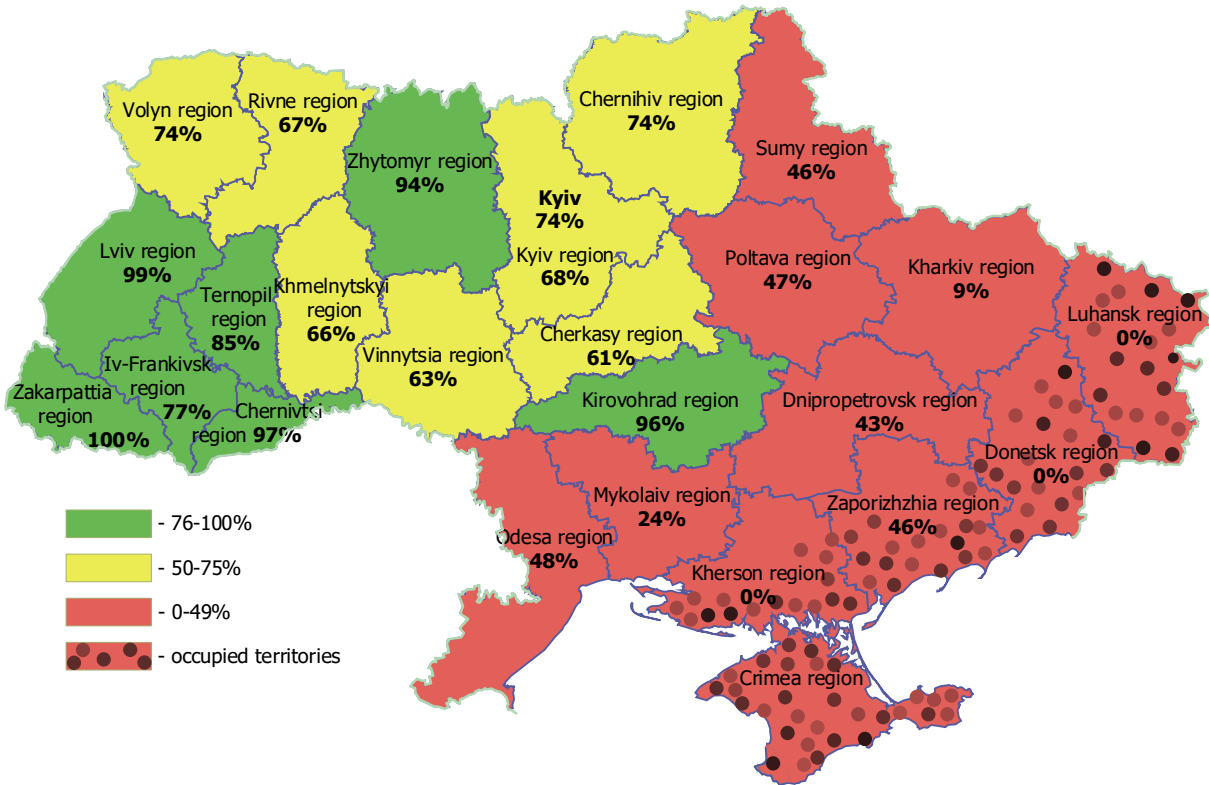
Another law provides additional guarantees under martial law during the organization of distance (other safe forms) learning for all students and staff of educational institutions, including IDPs (VRU, 2022b), in particular: provision of accommodation, if necessary, as well as food; preservation of the teacher's workplace; payments average salary, and scholarship to students. Other legislative and governmental initiatives under martial law suspended the typical duration of education, regulated the maximum number of classes, and significantly expanded the functions of IRCs in the education of students with disabilities, especially IDPs. Thanks to the legislative expansion of its powers, MESU adopted about a hundred by-laws and normative legal acts in 2022 alone to create safe conditions and access to continuous education for all students. Thus, the prompt legal response of the Verkhovna Rada and MESU to new challenges adapted the functioning of schools and their provision of educational services to wartime conditions and led to flexible education management.

**Securing Education—Safety Measures.** In times of war, protecting education from attacks and preserving educational institutions as safe spaces is crucial (Klanduch and Malik, 2016). In the conditions of intense destruction of school infrastructure due to hostilities, the main responsibility of managers is to create a safe educational environment, which is a fundamental requirement for continuous learning. Managers are focused on equipping civil protective structures (bomb shelters, dual-purpose structures, and the simplest shelters) by standards, in compliance with the principles of barrier-free access for persons with SEN (taking into account the needs of students with limited mobility). This includes ensuring shelters have emergency lighting, ventilation systems, and primary firefighting equipment, providing reserves of drinking and technical water, first-aid medicines, and long-term food storage. To provide emergency assistance, local managers have created 2,674 "resilience centres" equipped with individual heating, electricity, satellite, and mobile communications, as well as necessities. Such managerial measures contributed to providing autonomous functioning of schools and continuing education during long-term power and heat blackouts. The analysis demonstrates a generally positive trend in implementing protective measures in Ukrainian schools (Table 1).

**Table 1. Dynamics of indicators of the security component in Ukrainian schools in 2022-2023.** Note: Information on the state of the shelter of participants in the educational process in the fund of protective structures of civil protection of Ukrainian schools is provided upon request. (Source: calculated compiled by the authors based on MESU)

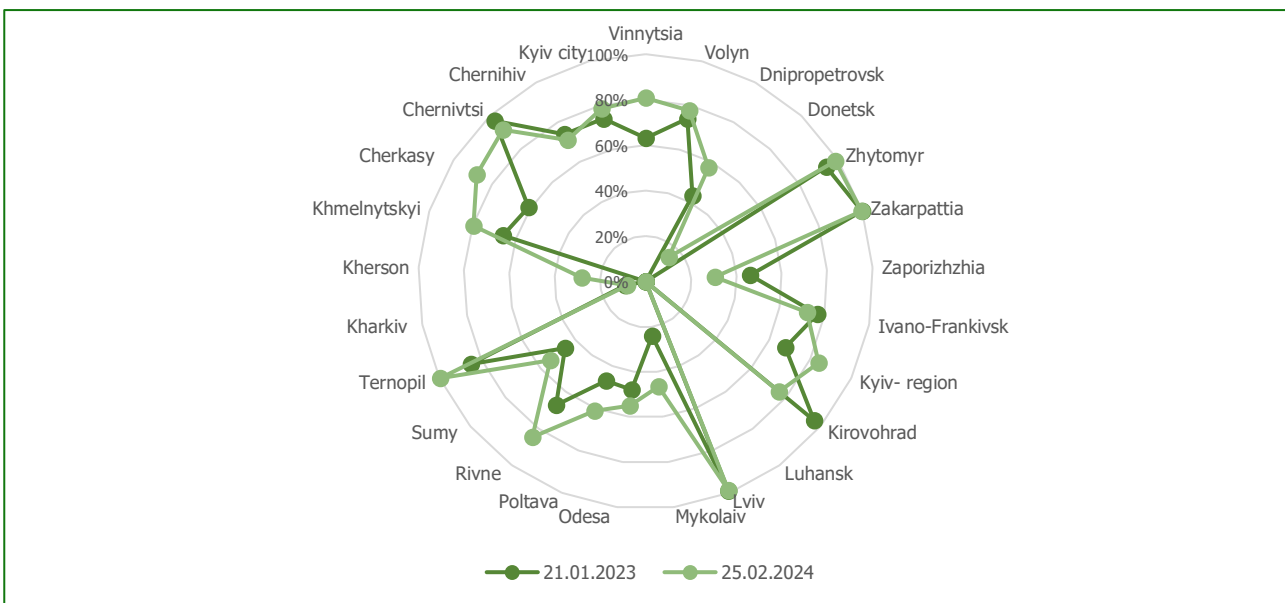
| Indicator/date  | 25.06.2022 | 25.07.2022 | 12.08.2022 | 23.09.2022 | 07.10.2022 | 25.12.2022 | 15.01.2023 |
|---|------------|------------|------------|------------|------------|------------|------------|
| Percentage of general secondary education institutions with access to any protective structure types, %   | 12         | 35         | 48         | 68         | 69         | 71         | 71         |
| Percentage of students of secondary schools protected by all types of protective structures, %  | 14         | 38         | 47         | 62         | 62         | 62         | 62         |
| Percentage of general secondary education institution facilities (buildings) equipped with traffic signs on the routes of educational process participants to the protective structures, %        | 11         | 25         | 34         | 54         | 60         | 63         | 63         |
| Percentage of general secondary education institution facilities (buildings) equipped with warning systems, in particular, signal and loud-speaker devices, Internet connection, %                | 8          | 23         | 26         | 38         | 40         | 40         | 40         |
| Percentage of general secondary education institution facilities (buildings) equipped with electronic boards and other technical means for warning persons with visual and hearing impairments, % | 0          | 1          | 1          | 1          | 1          | 1          | 1          |

Only from June to December 2022, the share of schools with access to protective structures increased from 12% to 71%. However, the level of compliance of existing shelters with the requirements is only 11.8%. During this period, the share of students protected by all types of shelters also increased from 14 % to 62 %. However, there are regional differences in their protection by shelters (Figure 4).



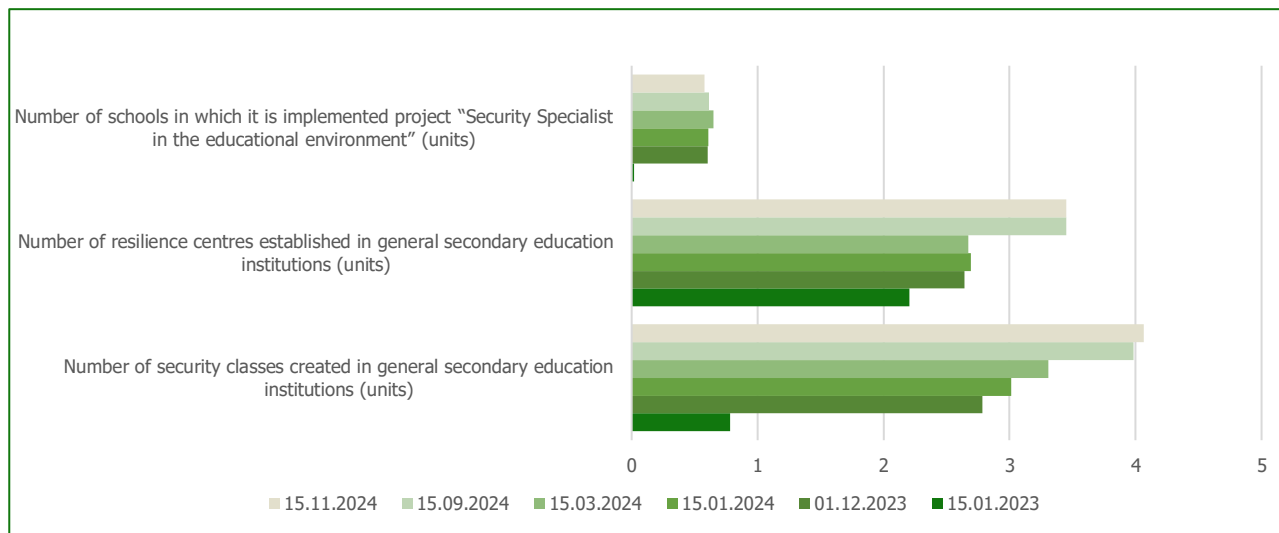
**Figure 4. Providing students of general secondary education institutions with protection in shelters of all types from January 21, 2023, %.** Note: Information on the state of the shelter of participants in the educational process in the fund of protective structures of civil protection of educational institutions is provided upon request.

Western Ukraine (Zakarpattia, Ternopil, Lviv, Chernivtsi, and Zhytomyr regions) is the most protected. Some disparities in the Ivano-Frankivsk region are likely related to the limited capacity of shelters and the increase in the number of IDP students: 97% of schools have access to shelters, but only 77% of students are protected. Temporarily occupied, de-occupied territories and front-line regions have a critical security threat level, which requires leaders to be flexible in their approach to ensuring the protection of students and teachers. Despite these regional differences, the overall trend of improving the protection of students in school shelters in Ukraine continues (Figure 5).



**Figure 5. Dynamics of the share of students protected in school shelters of all types by region for 01.21.2023 - 02.25.2024, %.** Note: Information on the state of the shelter of participants in the educational process in the fund of protective structures of civil protection of educational institutions is provided upon request.

Preventing the impact of an invasion by enemy military or sabotage groups, ensuring timely warning and unhindered evacuation are becoming urgent wartime problems for school administrators: only 1% of schools (Table 2) are equipped with notification systems for students with visual and hearing impairments. This critically low rate creates additional risks to the lives of students in schools during attacks. Ukrainian managers use various opportunities for safe education: educational space at underground metro stations; conversion of existing school premises into shelters; the construction of modular defence structures, and from 2023 - the construction of underground schools in the front-line territories. Local leaders are actively implementing other solutions to identify and address threats to the safety of students and teachers (Figure 6), including the creation of safety classes and points of invulnerability, and training in fire and mining safety measures. Therefore, prioritizing management decisions to create a safe educational environment has become a guarantee of resilient performance of the main functions of educational institutions in wartime conditions.



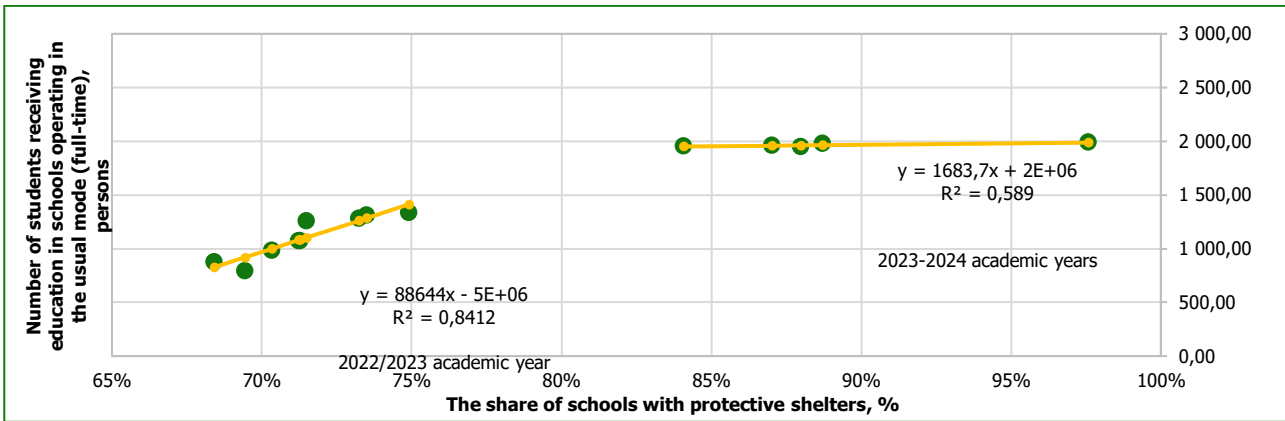
**Figure 6. Dynamics of selected safety indicators in general secondary education institutions of Ukraine in 2021-2024.** (Source: calculated by the authors based on SSI IEA data)

In September 2024, the pilot project "Educational Security Service" started in Ukrainian schools with the involvement of National Police inspectors. At the end of November this year, the project covered 1,101 general secondary education institutions.

**Ensuring Educational Continuity in Wartime.** The organization of education during a war depends significantly on students' geolocation, so finding the optimal educational models is a management priority. Students residing in safe areas have different experiences than those in deoccupied territories, combat zones, and temporarily occupied territories. Each group faces unique educational and organizational challenges, but all education seekers in these circumstances are affected by the loss of skills and knowledge (Angrist et al., 2022) and heavy psychological burdens with far-reaching negative consequences (Koehler, Palaiologou, and Brussino, 2022). Improved security conditions in schools have positively changed trends in the organization of the educational process. In September 2022, 4,041,976 students in 12,898 Ukrainian schools began their education. Educational formats are determined by the proximity to the line of active hostilities: almost 95 % of schools in the eastern regions and about 80 % in the south of Ukraine are forced to study remotely. In the western regions, more than 61 % of rural schools were full-time, and 69 % of urban schools were mixed (SQE, 2023).

The analysis of educational indicators from 2022 – March 2024 revealed a positive trend of returning to traditional education: the number of full-time students increased by 2.3 times and amounted to 1,987,940 persons in March 2024. At the same time, the contingent of distance education students decreased from 1,959,742 to 886,151 persons, or 2.2 times.

Figure 7 confirms the correlation between the number of full-time Ukrainian students and the proportion of schools with different types of protective structures.



**Figure 7. Dependence of the number of full-time students on the level of provision of schools with protective shelters in 2022/2023 and part of the 2023-2024 academic years.** Note: Information on the state of the shelter of participants in the educational process in the fund of protective structures of civil protection of educational institutions is provided upon request. (Source: calculated by the authors based on MESU)

The relationship shown in the figure can be approximated by linear functions with a sufficient level of the coefficient of determination ( $R^2 = 0,8412$  та  $R^2 = 0,5895$ ).

The mathematical expression for this ratio is:

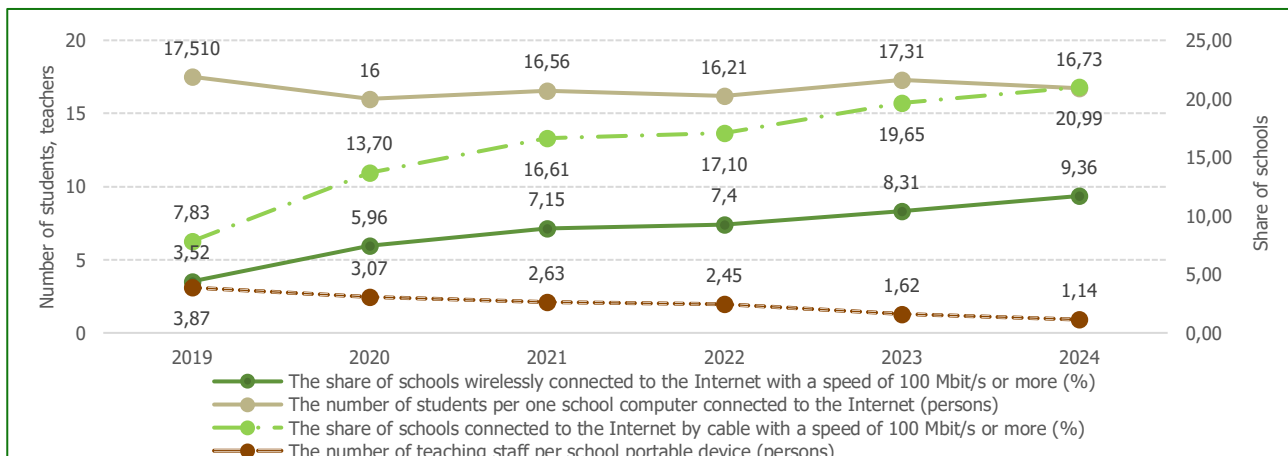
$$y = 88644x - 5E+06 \quad (1) \text{ and}$$

$$y = 1683,7x + 2E+06 \quad (2)$$

where  $y$  is the number of full-time students, and  $x$  is the share of schools with different types of shelters.

Despite the slow establishment of shelters, the school year 2022/2023 saw a rapid transition to full-time education, with an average of about 88,644 students for each additional percentage of schools with shelters (formula 1), due to the significant displacement of students to safer (western and central) regions. After the holidays, from September 2023 to February 2024, despite intensive shelter building, this figure fell to 1,684 students for every additional percentage of schools protected (formula 2). In the frontline areas, by a joint decision of parents and local military administrations, education is mostly remote or mixed, even if schools have shelters. Also, even in safe regions, schools are not always able to provide full-time education for all students due to the limited capacity of existing shelters or their non-compliance with regulations. In general, this may indicate that the process of students' transition to full-time education tends to saturation and, with more data, can be represented by the well-known Gompertz curve or logistic curve, which are suitable for describing saturation processes.

The process of digitalization of education, which began during the COVID-19 period, was intensified by military conditions (Figure 8). During the period 2019-2024, the provision of schools with access to cable Internet increased by 13.2%, and wireless access - by 5.8%. During the war, the emphasis on providing distance learning tools shifted to teachers, due to which the number of personal devices provided to teachers increased by 3.4 times in the analyzed period (Figure 8).



**Figure 8. Dynamics of indicators of digital provision of education in 2019-2024.** (Source: calculated by the authors based on SSI IEA data)

Londar and Pietsch (2023) suggest that improving the ratio of teachers to portable devices increases the average score for school students by 0.090 on the EIA. According to official data (MESU, 2024), as of December 2024, 230,771 digital devices were distributed to 11,642 educational institutions, but there is still a need for 311,170 devices for students and 68,881 devices for staff. Thus, the prevalence of distance and blended learning in wartime indicates an urgent need to improve information technology (IT) infrastructure, including access to the Internet, personal computers, and laptops, as well as resources of national educational platforms, such as All-Ukrainian Online Schools.

In Ukraine, changes in the psycho-emotional state of students have become one of the most common factors of educational losses, which actualizes the problem of continuing psychological support of the educational process. Negative trends are observed in many indicators: in 2023 (compared to 2022), the number of students who feel safe decreased by an average of 17%, feeling calm - by 20 %, and feeling relaxed - by 31 %. However, 19 % more students feel tired, 11 % more anxious, and 17 % more stressed and the total number of requests for help increased from 2,829,475 to 4,769,969 (SQE, 2023). The launch of the program of qualified psychological assistance to persons affected by the war began in 2014: more than 75,000 displaced students received help from over 10,800 professionals at the Crisis Center for Medical and Psychological Assistance (Maksymenko, 2015).

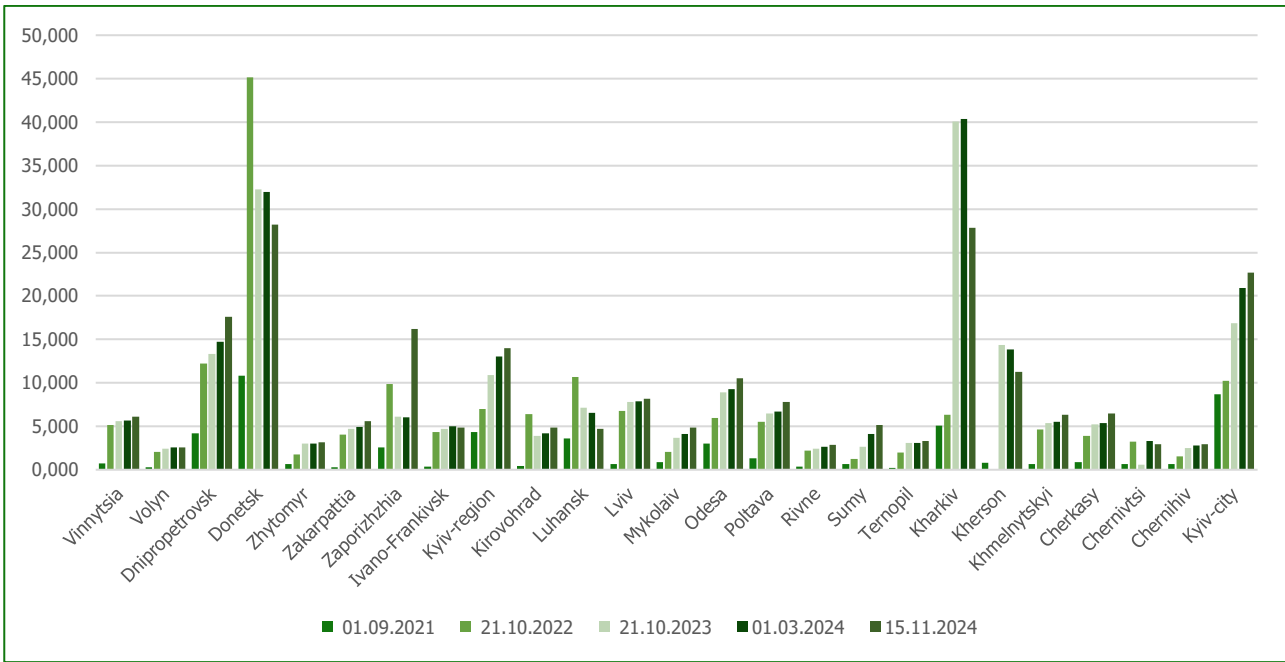
During the 2014/2015 academic year, a correctional and development program Safe Space (Bogdanov, 2017) was piloted in twenty schools in Donetsk and Luhansk regions for children living in the conditions of a prolonged military conflict. Thanks to this, rates of abnormal hyperactivity decreased from 28 % to 14 % among boys and from 10 % to 4 % among girls. Similarly, levels of psychosocial stress decreased from 37 % to 11.3 %, and the share of children with significant behavioural difficulties – from 16 % to 2 %. In December 2022, the Interdepartmental Coordination Council at CMU developed a Roadmap for mental health and psychosocial support during and after the war. To provide psychological support to participants in the educational process, leaders launched some initiatives: consultations through the application "Office of a Psychologist/Social Pedagogue", "Nearby", "Support a Child", and "Be Healthy" projects. Today, 9,662 practical psychologists and social educators work in secondary education institutions, which is 83.12% of their total needs. Thus, the practical efforts of education managers contributed to increasing students' resistance to future psycho-traumatic factors of the period of full-scale war.

Significant educational losses were noticeable in the 2022/2023 academic year (SQE, 2023): 57% of rural and 44% of urban teachers reported a decline in student learning outcomes in the Ukrainian language, foreign language (52% and 47%), mathematics (45% and 40%), and computer science (37% and 25%), respectively. The results of the PISA - 2022 test confirmed that fifteen-year-old Ukrainian students lag behind their OECD countries peers by 31 points in mathematics, 48 points in reading, and 22 points in computer science, equivalent to about a year and a half of schooling in mathematics and science and almost two and a half years in reading (UCEQA, 2023). To reduce educational losses, school administrators and teachers adjusted educational and thematic plans (condensed programs); conducted group or individual consultations or additional classes with tutors; and provided students with educational materials (presentations, additional tasks, videos) for independent study. However, the effect of such measures is local and limited and does not solve the problem of educational losses at the national level. The practical experience of Ukraine shows that the quick adaptation and flexibility of management approaches to overcoming challenges, including the choice of a training model in war conditions, are key factors in ensuring the continuity and resilience of the education system as a whole.

***Educating Nondisplaced Students.*** In territories far from the front line, such as the western and central regions, education has hardly stopped since the full-scale invasion. Except in Lviv and Zakarpattia, where full-time education was maintained, distance and blended learning continued.

In the deoccupied front-line territories, the organization of education depends on the state of the school infrastructure and the proximity to the zone of potential shelling. Having assessed the ability of schools to restore the educational process, local managers implemented several security and administrative measures: arranging shelters, restoring lost constituent documents, ensuring access to treasury accounts, and identifying training needs and providing them. It is also clear that the formats of education in the de-occupied territories should be distance learning or individual, if possible - mixed. On the initiative of MESU, 154 Digital Learning Centres (DLC) are organized in 17 regions of Ukraine, the location of which can be tracked on the created interactive map. Such platforms for providing access to education and supporting students in the difficult conditions of war are especially relevant in cases of destruction of school infrastructure.

***Educating IDP Students.*** The main task of the leaders of the regions where the displaced people live is to help these students adapt and organize training in conditions of additional personnel and infrastructure load. In May 2016, 169,368 people moved from the annexed Crimea and occupied Donetsk and Luhansk oblasts to other regions of Ukraine (Government Portal, 2016), half of whom are children. The intensification of hostilities in Ukraine has changed both the number of IDPs and the places of their greatest concentration (Figure 9).



**Figure 9. Dynamics of the number of IDP students from the regions of Ukraine in 2021-2024.** (Source: calculated by the authors based on SSI IEA data)

As of November 2024, the number of IDP students in Ukrainian secondary schools reached 231,079 persons (SSI-IEA, 2024), which is 4.3 times more than in September 2021. If in 2021 the regions selected for resettlement were located near the places of previous residence (Donetsk, Luhansk, Kharkiv, and Dnipropetrovsk regions), today the largest network of operating schools that educate resettlers is located in Dnipropetrovsk, Lviv, Vinnytsia and Ivano-Frankivsk, Kyiv regions. Currently, the largest flow of IDPs is coming from the hottest frontline regions - Kharkiv, Donetsk, Zaporizhzhia, Dnipro, Kherson, as well as Odesa and Kyiv, which are most often affected by shelling. The local management is urgently addressing the issues of security, housing, hot meals, transportation to school, and additional IT support. Full-time education in schools takes place in several shifts, often complicated by blackouts, sirens, and lack of communication, which also necessitates the use of blended learning. Therefore, ensuring quality education involves consolidating the efforts of students and teachers to overcome difficulties, including a decrease in motivation and academic success, additional psychological stress due to adaptation, and communication problems.

**Educating Students in Occupied Territories.** As a result of the annexation of Crimea and the occupation of parts of Donetsk and Luhansk regions in 2014, the Ukrainian education system was fragmented, losing some of the educational participants and infrastructure, and the lack of access to reliable information prevents an objective reflection of the state of education. According to the authors' assessment (Movchan, Sulyalina, Halai, 2021), 399,395 students remained in the occupied territories in the 2014/2015 academic year. Official statistics and practical researchers (Londar, Serhiy, et al., 2023) state that from 2014 to 2021, the Ukrainian secondary education system lost 1,592 schools, the number of students decreased by 517,840, and the number of teachers decreased by 50,682. As a result of the expansion of the occupation territory after February 24, 2022 (Luhansk, Donetsk, Kharkiv, Zaporizhzhia, Kherson, and Mykolaiv regions), the number of Ukrainian education students further decreased by 185,051 students and 113,980 teachers (Table 2).

Providing education according to Ukrainian legislation in the occupied territories is almost impossible because of persecution by the Russian authorities. Since 2014, Ukrainian schools have been closed or subjected to severe repression: educational standards, textbooks, and curricula have been replaced by Russian-language ones, the grading scale has been changed from a Ukrainian twelve-point scale to a Russian five-point scale, and teachers are undergoing forced retraining. Nevertheless, some students in the temporarily occupied territories are secretly studying Ukrainian programs, mostly individually or externally. From 2014 to 2024, 4,447 graduates of basic education from the annexed Crimea and Sevastopol continued their studies in institutions controlled by Ukraine. However, in other occupied territories, especially in the Donetsk and Kherson regions, the total number of students receiving education in Ukrainian schools decreased by 33.9% compared to 2022 and was 64,730 in March 2024 (SSI-IEA, 2024). Therefore, overcoming the growing fragmentation of the Ukrainian educational space will become the primary task of managers in the post-war period.

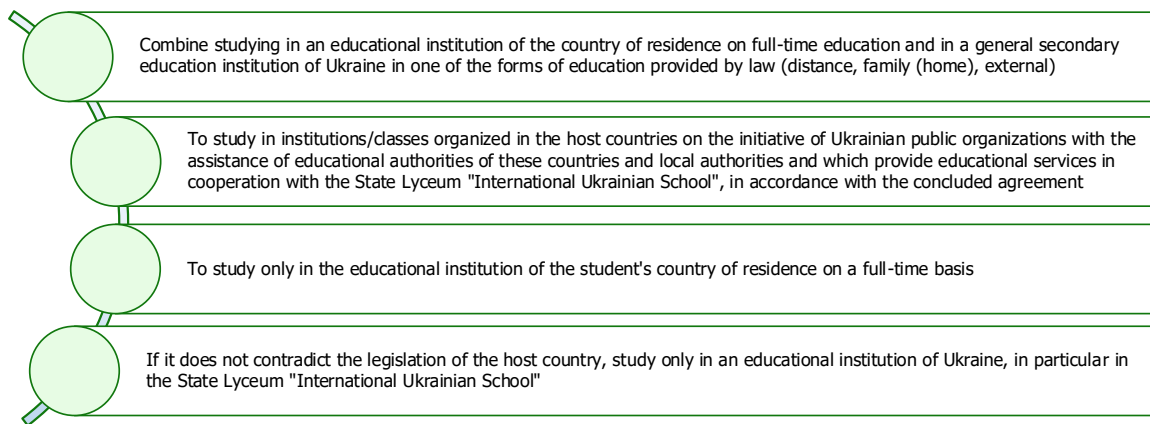
**Table 2. Dynamics of the main indicators of general secondary education caused by Russian aggression and occupation in 2014-2023.**  
Note. According to Consolidated forms of statistical reporting of general secondary education institutions for the 2013/2014 – 2014/2015 and 2021/2022 – 2022/2023 academic years. (Source: calculated by the authors based on SSI IEA data)

| Region            | Change from 2014/2015 to 2013/2014 |          |          |              |          |          | Change from 2022/2023 to 2021/2022 |          |          |              |          |          |
|-------------------|------------------------------------|----------|----------|--------------|----------|----------|------------------------------------|----------|----------|--------------|----------|----------|
|                   | Absolute (units)                   |          |          | Relative (%) |          |          | Absolute (units)                   |          |          | Relative (%) |          |          |
|                   | Schools                            | Students | Teachers | Schools      | Students | Teachers | Schools                            | Students | Teachers | Schools      | Students | Teachers |
| Ukraine           | -1.69                              | -446.915 | -54.678  | -8.76        | -10.63   | -10.76   | -1.015                             | -188.382 | -32.919  | -7.25        | -4.45    | -7.57    |
| Crimea            | -587                               | -181.983 | -18.896  | -100         | -100     | -100     | —                                  | —        | —        | —            | —        | —        |
| Vinnitsia         | -6                                 | 725      | -164     | -0.67        | 0.48     | -0.77    | -17                                | 1.178    | -221     | -2.6         | 0.71     | -1.16    |
| Volyn             | -2                                 | 1.808    | -365     | -0.26        | 1.45     | -2.07    | -10                                | -241     | -295     | -1.78        | -0.17    | -1.66    |
| Dnipropetrovsk    | -7                                 | 8.565    | 158      | -0.68        | 2.91     | 0.57     | -12                                | -2.078   | -1.438   | -1.42        | -0.61    | -5       |
| Donetsk           | -557                               | -179.335 | -16.966  | -49.96       | -53.02   | -52.37   | -193                               | -62.447  | -5.553   | -39.31       | -37.18   | -38.8    |
| Zhytomyr          | -3                                 | 127      | -81      | -0.37        | 0.1      | -0.44    | -27                                | -828     | -727     | -4.67        | -0.6     | -4.42    |
| Zakarpattia       | 0                                  | 1.575    | 19       | 0            | 1.03     | 0.1      | -5                                 | -1.828   | -469     | -0.85        | -1.07    | -2.46    |
| Zaporizhzhia      | -2                                 | 4.380    | -271     | -0.33        | 2.82     | -1.52    | -50                                | -14.138  | -2.759   | -10.08       | -8.3     | -16.59   |
| Ivano-Frankivsk   | -1                                 | 225      | -54      | -0.13        | 0.15     | -0.24    | -17                                | -151     | -580     | -2.81        | -0.09    | -2.78    |
| Kyiv (region)     | -6                                 | 7.555    | -1.304   | -0.8         | 4.38     | -6.17    | -16                                | 929      | -872     | -2.44        | 0.39     | -3.99    |
| Kirovohrad        | -2                                 | 734      | 60       | -0.37        | 0.82     | 0.5      | -10                                | 419      | -473     | -3.3         | 0.43     | -4.41    |
| Luhansk           | -375                               | -112.327 | -11.646  | -54.35       | -65.72   | -64.14   | -171                               | -28.184  | -3.728   | -67.32       | -51.03   | -61.36   |
| Lviv              | -11                                | 1.745    | -4       | -0.78        | 0.69     | -0.01    | -16                                | 2.712    | -533     | -1.42        | 0.94     | -1.57    |
| Mykolaiv          | -6                                 | 920      | -53      | -1.07        | 0.84     | -0.43    | -17                                | -4.976   | -715     | -3.75        | -4.18    | -6.28    |
| Odesa             | -3                                 | 5.082    | -333     | -0.34        | 2.16     | -1.31    | -11                                | -6.501   | -938     | -1.49        | -2.31    | -3.83    |
| Poltava           | -2                                 | 1.690    | -271     | -0.28        | 1.34     | -1.69    | -6                                 | 1.734    | -240     | -1.12        | 1.25     | -1.61    |
| Rivne             | -2                                 | 1.491    | 186      | -0.29        | 1.04     | 0.97     | -5                                 | 607      | -357     | -0.9         | 0.36     | -1.85    |
| Sumy              | -5                                 | 866      | -305     | -0.92        | 0.94     | -2.49    | -10                                | -2.090   | -442     | -2.67        | -2.12    | -4.21    |
| Ternopil          | -6                                 | -161     | -150     | -0.7         | -0.15    | -0.82    | -30                                | -938     | -480     | -4.59        | -0.85    | -3.14    |
| Kharkiv           | -10                                | 8.049    | -193     | -1.18        | 3.66     | -0.82    | -101                               | -27.337  | -3.140   | -14.13       | -10.48   | -13.94   |
| Kherson           | -2                                 | 1.063    | -144     | -0.42        | 1.01     | -1.17    | -228                               | -47.969  | -5.256   | -59.38       | -42.24   | -46.67   |
| Khmelnyskyi       | -9                                 | 621      | -419     | -1.11        | 0.49     | -2.2     | -17                                | 1.487    | -336     | -2.94        | 1.07     | -2.11    |
| Cherkasy          | -2                                 | 560      | -160     | -0.31        | 0.51     | -1.05    | -18                                | 820      | -570     | -3.65        | 0.7      | -4.26    |
| Chernivtsi        | 0                                  | -53      | 47       | 0            | -0.05    | 0.38     | -6                                 | 662      | -136     | -1.72        | 0.61     | -1.14    |
| Chernihiv         | -12                                | -70      | -284     | -1.92        | -0.08    | -2.14    | -24                                | -2.509   | -717     | -5.63        | -2.6     | -6.26    |
| Kyiv (city)       | 1                                  | 13.428   | 89       | 0.2          | 5.57     | 0.4      | 2                                  | 3.285    | -1.944   | 0.35         | 0.98     | -7.19    |
| Sevastopol (city) | -73                                | -34,195  | -3,174   | -100         | -100     | -100     | —                                  | —        | —        | —            | —        | —        |

Abduction and militarization of education are an integral part of war crimes in the occupied territories. Educational institutions have become places for recruiting students to military-patriotic organizations aimed at training soldiers: only in Simferopol, from 2016 to 2019, the number of paramilitary cadet classes more than tripled. By the end of 2023, in the occupied Crimea, Sevastopol, Zaporizhzhia, and Kherson regions, the total number of participants of "Unarmy" was over 26,123 students, "Movement of the First" - over 29,960 students; "Southern Youth" - over 500 permanent student activists (Vorobiova, 2023). In total, since 2014, between 16,000 and 300,000 Ukrainian children have been illegally deported (Cherkasets, 2023), and after February 24, 2022, more than 6,000 illegally deported children received re-education in at least forty-three institutions in Russia and the annexed Crimea (Khoshnood et al., 2023). The use of formal and non-formal education by the occupying authorities to recruit students, change their Ukrainian identity, and train future soldiers is a gross violation of international humanitarian law.

**Educating Students on the Move: Refugee Students.** Restoring access to Ukrainian education for students who ended up outside the country due to the war has become one of the tasks of the education management agenda. In May

2022, according to Londar and Pietsch (2023), about 649,000 students of general secondary education institutions from various regions of Ukraine went abroad, with most selecting Germany, Poland, and other European countries. The European Commission (2024) reports that from February 24, 2022, to April 16, 2024, 868,613 Ukrainian students were integrated into the educational systems of EU countries. Refugee students abroad can continue their studies according to one of the models proposed by MESU (Figure 10).



**Figure 10. Education models for refugee students abroad in Ukrainian schools.** (Source: compiled by the authors based on SSI IEA data)

In 2022, 40.4% of refugee students received a mixed education, studying in foreign schools face-to-face and Ukrainian schools remotely; 34.9% studied remotely in Ukrainian schools, and 11% - exclusively full-time education in a foreign school. To avoid a double workload and improve the conditions of distance learning, in 2023 MESU proposed a new Global Ukraine educational program. The following changes are foreseen: the creation of distance classes in selected schools with refugee students studying only the Ukrainian component (history, Ukrainian language, and literature); reduction of study time to 6-8 hours per week; simplification of assessment and crediting of learning outcomes. As of November 2024, the total number of refugee students abroad is 354,261 persons. As a result, in 2024, the share of distance-learning refugee students in Ukrainian schools increased to 52,3 %. Currently, 106,142 refugee students (30%) study in the family form of education; 54,480 persons (15%) — in external education and 8,186 persons (2%) study in "distance classes" (SSI-IEA, 2024).

To conduct external examinations and obtain educational documents for refugee children in 2023, 496 temporary examination centres (TECs) were established in 32 countries and 53 cities in Europe and North America. This allowed 22,543 refugee students abroad to pass tests and enter Ukrainian universities. As of March 2024, the number of Ukrainian students abroad was 395,443, which is 1.7 times less than in 2022, and the number of teachers was 7,114 (3.5 times less, respectively). Therefore, management policy in the direction of maintaining ties with Ukraine stimulates the return of refugee students to the educational and social environment of the country.

**Other Measures.** During armed conflicts, students and teachers may become victims of violence and terror on their way to school (Alfano and Görlach, 2019). A management measure to minimize such risks is the transportation of students and staff, the process of which has been complicated by the loss of part of the school buses and the lack of financial resources for their purchase. The situation was aggravated by the significant destruction of the educational infrastructure, which increased the distance to existing schools. As of November 2024, the network of educational institutions operates 6,730 school buses and transports 345,083 students, which is 1.3 times more than in 2022. However, to transport 370,744 students, an additional 1,724 vehicles are needed (SSI-IEA, 2024). To improve the situation, a new subvention is allocated from the state budget for the purchase of school buses, and in the regional section, the strategy for the purchase of transport involves the use of the remaining educational subvention, co-financing from the state and local budgets, and the attraction of international aid. Only in 2024, 302 buses were purchased from the state budget 20 units - from local budgets, and 61 buses - at the expense of international humanitarian aid. Improving the transport capacity of schools contributed to the safe access of students to full-time (mixed) education and, as a result, increased its effectiveness.

During wartime, local education managers have also struggled to organize hot meals for students at school, especially due to the damage sustained by many school canteens, with a considerable portion of equipment, tableware, and kitchen utensils either stolen or destroyed. Additional challenges have arisen due to interruptions in water and electricity supply, inadequate school funding, and disruptions in food supply logistics. School principals and local authorities have made efforts to improve this situation. As part of the school nutrition reform that began before the war, canteen equipment is

systematically updated, state monitoring of food in educational institutions is regularly conducted, and personnel improve their qualifications. As a result, by the end of 2024, the coverage of hot meals in schools compared to September 2022 has increased by 2 times and amounted to 1,702,857 students, of which 645,611 are students of preferential categories (IDP students and others), who are provided with free hot meals (SSI-IEA, 2024). The issue of providing students with hot meals is especially relevant for local heads of educational institutions in the front-line and de-occupied territories, however, the lack of conditions for its organization complicates the provision of such services.

### ***Resilience Dimension 3: Learning and Growing***

Ukraine's management flexibility has facilitated continued educational reforms and the formulation of postwar education reconstruction strategies. Already today, amid the war, education managers have developed and are implementing a strategic program of major transformational changes "Education 4.0: Ukrainian Dawn" (MESU, 2022). The proposed program is focused on the transformation of school education through an effective network of educational institutions with a safe learning environment (territory of security and comfort), the use of modern content and innovative technologies, elite pedagogical training, and the strengthening of leadership in schools. Measures are being taken to improve the quality of education: 7,953 principals and 9,805 deputy principals of schools upgraded their qualifications at the National School of Management Personnel, and 2,256 primary school teachers successfully passed certification in 2022-2023. MESU is actively working on the formation of key visions for the strategic development of the educational sector: Strategies for the development of education and science until 2030; Strategies for making up for educational losses, Strategies for restoring education in temporarily occupied territories, reforming specialized secondary education. In this context, practical steps were the adoption of the Security Concept and the preparation of other regulatory and legal acts.

To increase the transparency and efficiency of education management based on real data, new digital tools have been implemented: the Solid Info system of management indicators, a Dashboard with educational indicators, and an interactive panel "Distribution of Equipment" (MESU, 2024). Thus, the inclusion of strategic directions in the management of education in wartime expands the possibilities of ensuring a higher level of resilience in conditions and development.

## **DISCUSSION**

Wartime conditions, which are a demonstration of the inhumane experiment set up by Russia's ongoing aggression against Ukraine, are a complex factor influencing the deviation of the education system from the previous state of equilibrium. Processes and management decisions during 2014-2022 confirm the thesis (Vogus and Sutcliffe, 2007), that managers must be able to identify the weak signals of potential crises and respond accordingly. The hybrid war in Ukraine, unleashed by Russia in 2014 through the annexation of Crimea and certain territories in the Donetsk and Luhansk regions, became such signals for educational managers. Using its internal energy and available resources to exceed traditional management methods (Heineman and Hatfield, 2017), Ukraine responded proactively and initiated significant changes in all aspects of education. During 2015-2019, significant legislative norms were adopted that changed the paradigm of management of Ukraine's education system. The network of educational institutions was transformed, the management principle of evidence-based policy-making was implemented, as part of which the national EMIS was created, and digital technologies in education received a significant impetus for development. Some of them, in particular, distance learning was tested and improved in work with students/teachers in the temporarily occupied territories of Donbas and Crimea, and later (during the COVID-19 pandemic) throughout Ukraine. Accordingly, before the full-scale Russian invasion, Ukraine had already "done its homework" and gained a sufficient understanding of the processes and components involved in maintaining organizational resilience in crises (Figure 2).

The active phase of the war in 2022 and the largest humanitarian crisis of the twenty-first century caused by it have changed the priorities of education management in Ukraine: in fact, Ukrainian education has moved into survival and operational management mode. Under these extreme conditions, the most urgent task of managers is to create a safe educational environment, ensuring access to quality education, without losing sight of gender, psychological, inclusive, and other educational aspects. In addition to protecting staff and students, local managers in regions far from the front line faced the challenges of accommodating and integrating IDP students, organizing full-time (blended) learning in several shifts amid frequent blackouts, and overloading infrastructure and staff. Efforts are also aimed at other measures that, according to the authors (Alfano and Görlach, 2019), are important in wartime: providing psychosocial assistance and building students' resilience; transporting students and teachers to prevent violence and injuries on the way to school; and organizing hot meals for students. The growing distance from the Ukrainian educational system is a typical problem faced by those who want to get an education in occupied and de-occupied territories, as well as Ukrainian refugee students

abroad. This requires managers to implement alternative models of training, including the creation of a model of temporary organization of training in case of destruction/damage of schools.

Significant legislative expansion of the powers of MESU and regional military administrations allowed them to quickly address current urgent educational issues by direct orders, without lengthy coordination with other bodies. However, as Ukraine's experience has shown, coordinated interaction between education leaders at all levels and local governments is important during wartime. This confirms the conclusions (Horne and Orr, 2011; Ma, Xiao, and Yin, 2018; Tasic et al., 2019) that the coordinated systemic actions of the management environment and the organization are the basis of organizational resilience, which is manifested in the ability of managers to focus on survival, recovery, and improvements using available organizational resources, procedures, and processes. Thanks to the timely implementation of these processes, Ukraine has strengthened its resilience and stabilized its educational operations in extreme conditions. However, the Ukrainian experience does not provide an exhaustive answer to the question of the final design of the organizational resilience model, and the issues of further development and possible prosperity of the educational system in the face of growing risks (Miceli et al., 2021; Hillman and Guenther, 2020; Tasic et al., 2019).

The near future will show whether the Ukrainian model of military education meets all the requirements of organizational stability, which scientists talk about. One of the key criteria here can be the level of educational achievements of Ukrainian students. The results of the international comparative study of the quality of education PISA-2022 showed a noticeable increase in the educational losses of Ukrainian students compared to PISA-2018. So, the negative impact of the war is obvious. But PISA - 2026 can already answer the question of whether Ukrainian education has managed to reverse this trend for the better, and transform the accumulated positive quantitative changes into qualitative ones, that is, ensure the development of the education system in wartime.

Another area of research that could deepen knowledge about the content of educational resilience and draw on the Ukrainian experience to find its optimal model is to study not only general secondary education but also the specifics of educational management in vocational and higher education.

## CONCLUSIONS

The Ukrainian education system has demonstrated considerable resilience, effectively maintaining its functions amidst the challenges of war by significantly altering certain approaches to managing and organizing the educational process. We define organizational resilience as the ability to flexibly adapt and counteract the adverse impacts of unforeseen risks, events, or challenges by harnessing the system's internal energy to actively and effectively manage change. This ensures the system's capacity for transformation, renewal, and development, positively influencing the formation of human capital and the country's economic prospects.

The author's model of organizational resilience in crisis (figure 2) is confirmed by the experience of the Ukrainian education system during 2014-2024. In search of resilience during wartime, the education system went through complex stages of introspection and transformation, introduced measures to counter potential threats, and evaluated their effectiveness. This process involved restructuring and creating a new management paradigm adapted to emergencies.

Currently, the Ukrainian education system is entering a phase of learning and growth. At this stage, it is necessary to review the content of education, clarify the paradigm of anti-crisis management, and introduce additional management elements aimed at improving the methodological foundations and mechanisms of strategic educational management.

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## ADDITIONAL INFORMATION

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### AUTHOR CONTRIBUTIONS

**Conceptualization:** Lidia Londar, Marcus Pitch

**Data curation:** Lidia Londar

**Formal Analysis:** Lidia Londar

**Methodology:** Lidia Londar

**Software:** Lidia Londar

**Resources:** Lidia Londar, Marcus Pitch

**Supervision:** Marcus Pitch

**Validation:** Lidia Londar, Marcus Pitch

**Investigation:** Lidia Londar

**Visualization:** Lidia Londar, Marcus Pitch

**Project administration:** Marcus Pitch

**Funding acquisition:** Marcus Pitch

**Writing – review & editing:** Marcus Pitch

**Writing – original draft:** Lidia Londar

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## CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

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Лондар Л., Пітч М.

## КЛЮЧОВІ АСПЕКТИ УПРАВЛІННЯ СТІЙКІСТЮ ОСВІТИ ПІД ЧАС ВІЙНИ: ПРИКЛАД УКРАЇНИ

Світовому досвідові функціонування освіти у воєнний час приділено недостатньо уваги, що робить тему дослідження актуальною. В Україні з 2014 по 2022 рік стали очевидними ключові напрями трансформації освітнього менеджменту, що продемонструвало стійкість системи освіти в найскладніші моменти повномасштабної війни. Мета дослідження – вивчення українського досвіду управління освітою та її стійкості у воєнний час. Комплексний огляд літератури дав змогу авторам уточнити визначення організаційної стійкості в системі освіти й запропонувати динамічну модель, що окреслює її компоненти та етапи розвитку в умовах кризи.

Проведено аналіз різних освітніх індикаторів, які виявили закономірності управлінського впливу на підтримку інфраструктури, зокрема шляхом покращення фінансування, впровадження нових інструментів і технологій, розширення переліку форм навчання, досягнення ефективності навчання. Математичне моделювання підтвердило кореляцію між забезпеченням шкіл захисними укриттями та переходом учнів на денну форму навчання, який став більш активним. Загалом дослідження функціонування системи освіти України в умовах тривалого воєнного часу показало, що ключовим фактором забезпечення її стійкості до нових викликів є, насамперед, гнучкість та адаптивність освітнього менеджменту. Вирішальний вплив на формування людського капіталу та економічні перспективи країни має також системна трансформація підходів до ухвалення рішень та інструментів управління, спрямованих на забезпечення безперервної діяльності й стратегічного розвитку освіти.

Практичне значення дослідження полягає в узагальненні досвіду управління освітою та її стійкості у воєнний час із можливістю використання в інших державах у надзвичайних ситуаціях.

**Ключові слова:** трансформація освітнього менеджменту, організаційна стійкість освіти, освітні технології, інструменти управління, освітня субвенція, моделі навчання, захисні споруди та укриття, студенти-біженці, освітні втрати, внутрішньо переміщені особи

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