Education at the Edge: Resilience, Recovery, and Innovation in Wartime Ukraine

Monograph

Open Science Initiative

EDUCATION AT THE EDGE:
RESILIENCE, RECOVERY, AND INNOVATION IN WARTIME UKRAINE

Monograph

Open Science Initiative

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Edited by Olena Semenikhina

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EDITORS' NOTE

The monograph *"Education At The Edge: Resilience, Recovery, And Innovation In Wartime Ukraine"* grew out of an experience that none of us would have chosen, yet one that cannot be ignored. Since 2014, and especially after the full-scale invasion of 2022, Ukrainian education has found itself in a situation where familiar theoretical models and methodological guidelines often prove insufficient in the face of air-raid alarms, forced displacement, loss, and uncertainty about the future. Despite this, educational institutions continued their work, learners continued their studies, and teachers and university staff sought ways to support one another while preserving their own psychological well-being and professional integrity. It is in these efforts that new meanings, new forms of interaction, and new practices of support and development have emerged – and they require scholarly reflection and documentation.

This monograph aims to collect and analyze what has become an often-invisible dimension of educational resilience. It brings together theoretical inquiries, historical and pedagogical studies, empirical survey results, and case studies drawn from the everyday work of educational institutions during wartime. The contributors examine how the roles of teachers and university staff are evolving, which resources of human potential are mobilized in critical situations, and how creative activity, emotional intelligence, social support, and collaborative practices become effective means of coping with traumatic events. Particular attention is paid to studies that demonstrate how digital tools, flexible formats of organizing the educational process, and new approaches to subject content make it possible to maintain educational quality under conditions of physical danger, unstable connectivity, and constant threat.

The structure of the monograph reflects a movement from historical foundations to contemporary responses and future perspectives. The first part focuses on the historical and value-based dimensions of resilient education. It examines how systems of teacher training evolved in different periods, which ideas of the teacher's moral and ethical profile were embedded in educational models, and how the value framework on which today's wartime teacher relies was formed. Subsequent chapters shift attention to the human dimension of resilience. They present models for restoring human potential in educational institutions and demonstrate how the development of emotional intelligence, social skills, self-regulation, and empathy enables both learners and educators to withstand prolonged tension and establish stable points of reference in a rapidly changing reality. Separate studies demonstrate how creative activity serves as a means of resisting crisis and extreme conditions, thereby opening up a space for reinterpreting experiences and constructing new life trajectories.

Professionalism of teachers and educational leaders in wartime constitutes an important thematic axis of the monograph. The authors analyze how professional roles are being transformed, the forms of mutual support and professional communities that are emerging, and the risks of burnout that arise, as well as the strategies that help mitigate them. Special attention is devoted to the collaborative and communication competencies of STEM teachers, as these competencies enable the organization of joint activities among learners and foster a sense of belonging and trust in uncertain situations. Returning to historical and pedagogical material, the researchers show that, despite changes in political, social, and technological conditions, society's expectations of teachers' moral responsibility, integrity, and capacity to support others remain remarkably stable.

Several chapters are devoted to innovative practices developed in different sectors of education. The reader will find detailed accounts here of how schools and universities continued their work under shelling, evacuated, hosted internally displaced learners, and adapted curricula to blended and distance learning formats. The monograph provides an in-depth examination of teaching mathematics during martial law, including the application of programmed instruction, visualization tools, and flipped-

classroom approaches. It also presents examples of transformations in language, the humanities, and professionally oriented education, where digital platforms, project-based tasks, tools for visualizing knowledge, and other instruments help sustain engagement and learning outcomes even under fragmented timetables and unavoidable interruptions.

The final chapters summarize the lessons that Ukrainian education can derive from wartime experience and outline directions for post-war development. Reflecting on local cases from universities and schools, the authors show that many decisions initially driven by urgent necessity have the potential to become a basis for long-term change. This concerns not only digital infrastructure or updated methodologies, but above all, new forms of collaboration, horizontal ties, readiness for interdisciplinary approaches, and a stronger learner voice in shaping the educational process. In dialogue with international research on education in conflict and post-conflict settings, the Ukrainian experience demonstrates that the combination of historical memory, professional culture, and innovation can create conditions for recovery even under extremely challenging circumstances.

As the editor, I view this monograph not only as a scholarly publication but also as a significant record of its time. Behind each chapter stand particular people, their efforts, doubts, losses, small victories, and major hopes. The authors of this book are researchers, teachers, university lecturers, psychologists, and education managers who continue to work with children and adults, seeking ways to preserve humanity and dignity in exceptional conditions. I hope that this work will be useful not only to academics and learners who study resilience, adaptation, and innovation in education, but also to practitioners who make education possible every day in times of war.

My sincere thanks go to all authors, reviewers, partners, and institutions that supported the preparation of this volume. I believe that the experience we reflect on and document today will help us, in the future, to build an education system in which the traumatic lessons of war are transformed into a resource for a more responsible, just, and human-centered society.

INTRODUCTION

Olena Semenikhina

Russia's full-scale war against Ukraine has become a test not only for security and the economy, but also for education at all levels. Since 2014, and especially after 24 February 2022, Ukrainian schools and universities have been operating under constant threat, forced displacement, loss, and emotional exhaustion among all participants in education. What counts as "normal" functioning of an educational institution has been radically rethought: how to ensure continuity of learning under air-raid alarms, attacks on critical infrastructure, mass migration, and pervasive uncertainty about the future. These circumstances provided the starting point for this collective monograph, *Education At The Edge: Resilience, Recovery, and Innovation in Wartime Ukraine*.

Over the past decades, a substantial body of international research has emerged on education in emergencies, armed conflict, and humanitarian crises. Scholars have examined access to education for refugee and internally displaced children, models of schooling in conflict zones, psychosocial support for learners and educators, and the role of education in rebuilding social fabric after traumatic events. For Ukraine, these studies have offered an important reference point. At the same time, there has been an urgent need for a perspective grounded in local history and empirical evidence – a perspective that captures how resilience and recovery are understood and enacted within the Ukrainian education system itself. When the war escalated, Ukrainian education was already undergoing significant reforms, including

digitalization, the shift to competence-based curricula, increased attention to inclusion, academic integrity, and the development of soft skills. The war intersected with these reform processes, amplifying some trends, sharply exposing systemic weaknesses, and, at the same time, prompting new forms of solidarity and innovation.

The object of analysis in this monograph is Ukrainian education in the context of full-scale war, viewed as a complex socio-cultural phenomenon. Its focus lies on strategies of resilience and recovery that manifest in the work of educational institutions, educators, learners, and professional communities, as well as on innovative practices in organizing the educational process that emerged or were significantly reshaped by the war.

The aim of this monograph is to provide a systematic description and analysis of educational practices related to resilience, recovery, and innovation that have emerged in Ukraine during wartime, drawing on historical, psychological, pedagogical, and organizational perspectives. To achieve this aim, the contributors: synthesize historical models of teacher education and the formation of moral and ethical foundations of the profession; investigate mechanisms for restoring human potential within educational institutions and the role of emotional intelligence and social skills as resources of resilience; analyze the transformation of teachers' professional roles, the development of collaborative and communication competences and the risks of professional burnout; describe innovative digital and subject-specific solutions that sustain continuity and quality of learning; and identify lessons from wartime experience for the future post-war transformation of education.

The methodological framework of the monograph is built upon humanistic pedagogy, theories of educational resilience, competence-based approaches, research on social and emotional learning, concepts of creativity as a resource for coping with crisis, and approaches to psychosocial support for children and adults in traumatic situations. Methodologically, the book combines theoretical and empirical work. The theoretical strand encompasses the analysis and synthesis of Ukrainian and international studies, as well as the historical and pedagogical reconstruction of models of teacher education and perspectives on

the teaching profession. Additionally, it involves clarifying the concepts of resilience, recovery, emotional competence, and creativity. The empirical strand encompasses surveys of teachers, university instructors, and learners; analysis of regional specificities of educational life during the war; case studies of schools and universities operating in frontline, de-occupied, and host communities; and materials from pedagogical interventions designed to test the effectiveness of new formats of teaching and learning.

The empirical base of the monograph covers a wide range of institutions: general secondary schools, vocational colleges, and higher education institutions from different regions of Ukraine, including border areas, territories that have experienced occupation or regular shelling, universities that were partially or fully relocated, and institutions hosting large numbers of internally displaced learners. This breadth makes it possible to trace not only overarching tendencies but also the local specificities of how the war is experienced in education, the different configurations of resources and constraints, and the contrasts between urban and rural communities, as well as large universities and smaller regional institutions.

The scholarly contribution of this monograph lies in its attempt to present wartime education not as a collection of isolated practices but as an integrated space where historical traditions, professional culture, individual strategies of coping with trauma, institutional decisions, and digital innovations intersect. The book refines current understandings of educational resilience. Resilience is treated not merely as the system's ability to "withstand the hit" and preserve a minimum level of functioning, but as an active process of rethinking goals and means, and of constructing new horizons for learners, their families, and educators. Drawing on extensive empirical material, the monograph offers, for the first time, a systematic account of how emotional-psychological, organizational, didactic, and technological factors jointly enable the continued development of learners under conditions of prolonged instability.

The practical significance of the monograph lies in its potential use for designing institutional programs of psychosocial support, professional development for educators, and revised

curricula in teacher education, psychology, education management, and social work. The models and case studies presented here can inform training programs aimed at preventing professional burnout, strengthening emotional competence, building collaborative skills among educators, and creating safe and supportive learning environments during war and in the post-war recovery phase. The empirical findings can serve as a reasoned basis for decision-making by education authorities at different levels regarding recovery priorities, investment in human potential, and targeted support for educational institutions in the most vulnerable regions.

The structure of the monograph is designed to gradually unfold a multi-dimensional picture of education at the edge of war.

Part I addresses the historical and value-based dimensions of resilient education. It reconstructs models of teacher education in earlier periods, analyses conceptions of the teacher's moral and ethical profile, and outlines the professional legacy that today sustains the position of teachers and university staff under wartime conditions.

Part II focuses on the human dimension of resilience. The contributors examine the restoration of human potential in educational settings, highlighting the roles of emotional intelligence, social and communication skills, and creative activity in mitigating the consequences of traumatic events and sustaining motivation to teach and learn.

Part III examines the professionalism of teachers and educational leaders during wartime. It explores changing professional roles, forms of mutual support, the emergence of professional communities, the risks and prevention of burnout, and the development of collaborative and communication competencies, particularly among STEM teachers.

Part IV is devoted to innovative practices that safeguard continuity and quality of learning under extreme conditions. It presents digital solutions, flexible instructional formats, and subject-specific innovations in mathematics, foreign languages, and professionally oriented courses. The chapters describe how schools and universities sustained educational processes under shelling, in evacuation, and within host communities.

Taken together, *Education at the Edge: Resilience, Recovery, and Innovation in Wartime Ukraine* offers the reader not only descriptions of specific educational practices but also an integrated vision of how education can remain a space of support, growth, and hope in times of war. The monograph is intended for researchers, university faculty, schoolteachers, practitioners in educational psychology and management, postgraduate learners, and all those who seek to understand how human potential can be preserved and strengthened through education under conditions of radical challenge.

Chapter 1

HISTORICAL AND VALUE DIMENSIONS OF RESILIENT EDUCATION

1.1. EDUCATION AND WAR: HISTORICAL LESSONS AND CONTEMPORARY CHALLENGES

Olena Semenikhina

Education and war have long coexisted, despite the very concept of a school or university implying stability, predictability, and continuity. Every major war has disrupted educational institutions; yet, it is during these periods that their resilience, capacity for renewal, and moral mission become most visible. When buildings are destroyed, communities scattered, and borders redrawn, education remains one of the few mechanisms that preserve memory, transmit values, and sustain a sense of continuity between generations. Drawing on historical lessons from education in times of war, therefore, helps illuminate and better understand the contemporary challenges faced by Ukrainian education under conditions of full-scale aggression.

In different historical periods, wars not only interrupted teaching and learning but also profoundly reshaped the content, aims, and institutional forms of education. For Ukrainian lands, this includes the imperial wars of the nineteenth century, the First World War, the revolutionary years of 1917–1920, the Second World War, and a series of later local conflicts in which the Soviet education system served both mobilizing and ideological functions. Each of these episodes left behind experiences that are crucial for understanding how schools and higher education institutions respond to violence, loss, deportation, occupation, and regime change.

Historical sources indicate that the role of the teacher undergoes significant changes during wartime. The task is no longer limited to transmitting knowledge; it increasingly entails

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preserving humanity in a situation dominated by the logic of force. In zemstvo schools of Poltava and other regions in the nineteenth century, the teacher often acted as an intermediary between the peasant community and the state, a person who could read official documents, explain new rules, and introduce children to written culture. In times of war and revolution, this role intensified: teachers became not only professionals but also carriers of particular political, national, and moral positions. The historical and pedagogical studies presented in this part of the monograph trace the formation of models of teacher education, the values considered foundational, and the combination of loyalty to the state with commitment to the local community.

War has always sharpened the question of what to teach and why. During the First and Second World Wars, curricula were altered, with new subjects or modules introduced, including military training, civil defense, hygiene, and basic survival skills. Parts of the curriculum were subordinated to mobilization tasks and to the cultivation of patriotism as defined by the ruling regime. At the same time, there were always teachers and institutions that sought to preserve a broader understanding of education as a space for developing critical thinking, ethical reflection, and respect for human dignity. In the tension between the instrumental and humanistic functions of education, the question of resilience becomes particularly salient: can the school resist being fully absorbed into the logic of war and remain a place where not only soldiers, but also citizens capable of independent judgment, are formed?

Historical research on teacher education in Ukraine demonstrates that the value orientations of the teaching profession have never been neutral. The image of the "ideal teacher" changed with political regimes, but expectations regarding moral integrity, exemplary conduct, and the ability to work with children experiencing loss and fear remained constant. During the Second World War and the immediate post-war years, teachers often worked with children returning from evacuation, from occupied territories, or from forced labor camps, and with families deeply marked by trauma. Similar tasks now confront Ukrainian educators working with internally displaced learners,

children of military personnel, and those who have survived occupation or bombardment.

A long-term historical view also reveals another regular pattern: war compels education systems to experiment with forms and spaces of learning. Evacuation of schools and universities, teaching in makeshift premises, shortened official programs, a combination of formal and non-formal learning, and reliance on families and local communities as co-organizers of education – these are recurring features of different epochs. In the twenty-first century, this is complemented by the dimension of digitalization. What previously existed as pilot projects in distance or blended education has become, under wartime conditions, a tool of survival. Today, Ukrainian schools and universities operate in a regime of constant transitions between offline, online, and hybrid formats, adapting timetables, types of assignments, and assessment practices to the constraints of danger and unstable connectivity.

In this sense, the current war both continues and radically transforms historical trajectories. On the one hand, we again see the forced relocation of educational institutions and the teaching of classes in basements, shelters, and temporary classrooms, with the primary aim of maintaining continuity of learning. On the other hand, the digital learning infrastructure developed prior to 2022 opens possibilities that were unavailable in earlier wars: synchronous and asynchronous instruction, storage of materials in cloud services, and online communities of teachers and learners who support one another across distances. Historical lessons intersect here with a new technological reality: the experience of previous generations underscores the importance of human presence, care, and attention to children's emotional states, while contemporary digital tools offer additional means to sustain this presence.

A further distinctive feature of the present situation is that the Ukrainian education system entered the phase of full-scale war after significant reforms related to competence-based curricula, inclusion, internal quality assurance, and greater emphasis on academic integrity. This means that today's educators possess a professional "toolkit" different from that of their predecessors. They are familiar with formative assessment, project-based

learning, development of emotional intelligence, and working with heterogeneous groups. These approaches provide more options for supporting learners, but at the same time impose new demands on teachers' own resilience. The historical perspective helps to identify which elements of this professional culture should be preserved and strengthened, and which require rethinking under wartime conditions.

The studies presented in this part of the monograph enable the connection of historical and contemporary narratives into a unified line of analysis. Research on the evolution of teacher education in Ukrainian territories shows how, in different eras, expectations regarding subject knowledge, pedagogical skill, and moral qualities were combined, how the perceived mission of the teacher changed, and which models of education policy prevailed. Investigations of the moral and ethical culture of teachers highlight the persistent expectations of responsibility, exemplary conduct, sensitivity to vulnerable groups of children, and the ability to work with families in crisis. Current empirical data on the state of human potential in education, psychological exhaustion, and strategies for coping with trauma add the voices of today's teachers and learners to this picture.

Bringing together historical and contemporary dimensions enables a more precise understanding of educational resilience. It is not only the capacity of an institution to resume classes after a shell or evacuation, but also a process in which accumulated traditions, professional communities, local memory, and the experience of earlier generations of educators play a crucial role. Historical examples demonstrate that every war has not only left behind destruction but also introduced new educational practices that have become embedded in post-war systems. The task today is to relate to such practices consciously, distinguishing those that foster development from those that reinforce trauma or perpetuate violent patterns of interaction.

This editorial note to Part I of the monograph outlines the frame for reading the chapters that follow. They do not simply depict the past; they provide reference points for understanding the present and for imagining the future. The historical and value-based dimensions of resilient education show that Ukrainian schools and universities are part of a long struggle for the right to

teach and learn, to remain human amid destruction, to preserve memory, and to open up the possibility of a different, peaceful life. In this light, engaging with the experience of earlier generations of educators is not an act of nostalgia, but an essential step towards forming a responsible and mature response to the challenges of war today.

1.2. THEORETICAL PRINCIPLES OF EDUCATION DEVELOPMENT IN EMERGENCY SITUATIONS

Olena Lysenko, Svitlana Mudrynych, Larysa Maslova

***Abstract**. The article highlights the theoretical principles underlying the development of education in emergency situations resulting from military conflicts, natural disasters, and global pandemics. The importance of ensuring the continuity of education and maintaining its quality in unstable conditions is highlighted. The essence of the concepts of "adaptability of the education system", "stability of the educational environment", and "crisis management in education" is determined. The approaches of domestic and foreign researchers to building effective models of the educational process in crisis circumstances are analyzed. The characteristics of four leading models, the Resilient Education Model, the Open and Flexible Learning Model, the Supportive Learning Model, and the Crisis Management Model, are presented. It is shown that these models ensure the continuity of education even in situations of infrastructure destruction and contribute to the psychological stability of participants in the educational process. The role of digitalization, innovative technologies, and open educational resources as tools for supporting learning is emphasized. The importance of a psychologically safe environment and pedagogical support for overcoming the effects of stress is highlighted. It is noted that effective crisis management in education involves flexible management decisions and clear communication protocols. Directions for further research aimed at improving the mechanisms for adapting educational systems to emergency conditions are outlined.*

***Keywords**: education in emergency situations; adaptability; resilience of the educational environment; distance learning; crisis management; psychological support.*

Introduction

The modern education system is increasingly facing challenges that extend beyond the normal functioning of society and require an immediate response to changes in the external

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environment. Pandemics, military conflicts, man-made accidents, natural disasters, and other emergencies disrupt the stability of social institutions, destabilize traditional educational practices, and force the pedagogical community to seek new forms of organizing education. Such circumstances not only change the living conditions of people but also the very structure of the educational process, which is increasingly acquiring signs of flexibility, mobility, and technological openness.

In conditions of constant turbulence, education ceases to be just a tool for transferring knowledge from teacher to student. It becomes an important social institution that ensures the individual's adaptation to new realities, fosters critical thinking skills, psychological resilience, and the ability to self-study. The educational space in crisis situations performs not only educational, but also compensatory, integrative, and therapeutic functions, contributing to the restoration of a sense of security, maintaining social cohesion, and preserving the humanistic values of society.

Thus, modern education appears as a key factor in social stability, capable not only of ensuring the continuity of the educational process but also of serving as the basis for the restoration and development of society after crisis events. That is why the study of the features of educational systems' functioning and transformation in emergency conditions acquires special scientific and practical significance.

The relevance of this study lies in the need for a deep theoretical understanding of the processes of adapting education to crisis circumstances, as well as the development of effective models, mechanisms, and strategies for enhancing educational systems during periods of social, political, or economic uncertainty. Modern emergencies, particularly the COVID-19 pandemic, military conflicts, natural disasters, and man-made threats, have exposed the vulnerability of traditional educational structures that were previously oriented towards a stable environment. At the same time, these challenges have become a catalyst for the intensive implementation of distance technologies, the development of digital competencies among teachers and students, and the modernization of educational content and its organizational forms.

Global and national experience convincingly shows that the sustainability of the educational environment directly depends on its ability to rapidly transform, flexibly respond to external challenges, innovative management decisions, and the psychological readiness of all participants in the educational process to change. In this context, the issue of forming an adaptive, technologically equipped, and human-centered education system that can ensure continuity of learning even in emergency conditions is of particular importance. That is why theoretical research into the patterns of education development in crisis situations is an important scientific and social need of today.

The **purpose** of this study is to theoretically substantiate the principles of developing a modern education system in emergency situations and to determine strategic directions for its adaptation to crisis circumstances. The object of the study is the educational process as a socio-pedagogical system that functions in conditions of instability and external challenges.

The subject of the study is the theoretical and methodological foundations, principles, models, and mechanisms of education development in emergencies, with the aim of ensuring its sustainability, continuity, and efficiency.

Research objectives:

- To analyze the current state of scientific development of the problem of education development in emergencies in the world and domestic scientific thought.
- To clarify the essence of the concept of "education in emergencies", to determine its content, structure, and key characteristics in the context of global challenges.
- To characterize theoretical and methodological approaches to the study of education development in crisis conditions, humanistic, competency-based, innovative, and continuous.
- To identify the main socio-psychological factors that influence the educational process during crises (stress, uncertainty, information risks), and outline the ways of forming the psychological stability of participants in the educational process.

- To investigate organizational and pedagogical models of education in emergencies, in particular forms of distance, blended, and mobile learning.
- To reveal the management strategies of educational institutions in crisis conditions and the role of digital technologies in ensuring the continuity of the educational process.
- To analyze the regulatory framework and ethical principles that regulate educational activities in emergencies at the international and national levels.
- To outline the prospects for the development of education in the post-crisis period, in particular, the directions of restoring educational infrastructure, improving the professional training of teachers, and increasing the role of education as a factor in the humanitarian stabilization of society.

The methodological basis of the study is a combination of general scientific, philosophical, pedagogical, and socio-humanitarian approaches, which provide a holistic understanding of the processes of education functioning and development in crisis conditions. The work employs a systemic approach, which enables us to view education as a complex, multi-level social system that interacts with its economic, political, and cultural environments. Within the framework of this approach, education is viewed as a dynamic structure capable of self-regulation, transformation, and restoration in the face of external influences. The competency-based approach orients the study towards the development of the ability of all education subjects to act effectively in uncertain conditions, think critically, make informed decisions, and maintain psychological balance. The digital-humanistic approach involves understanding technological innovations not only as a technical tool, but also as a means of preserving humanity, communication, and continuity of learning in a distance format.

To achieve the goal, the following research methods were used:

- Theoretical analysis, synthesis, comparison, generalization, classification, modeling, and systematization of scientific sources;
- Empirical study of pedagogical experience, analysis of regulatory documents, educational strategies and practices, observation of the processes of adaptation of educational institutions during crises;
- Prognostic modeling of possible scenarios for the development of education in emergency situations and determining the directions of its innovative renewal.

Research results

The problem of developing education in emergencies requires an interdisciplinary approach that combines pedagogical, psychological, social, managerial, and information and technological components. The theoretical and methodological basis of the research is grounded in modern concepts of education, which explain its ability to adapt, transform, and ensure sustainable development in crisis conditions.

In global practice, the concept of education in emergencies (EiE) is understood as a system of organizational, pedagogical, and psychological measures designed to ensure access to quality education during wars, natural disasters, epidemics, or social crises (UNESCO, 2023). It is actively developed by international organizations, such as UNESCO, UNICEF, OECD, and the International Network for Education in Emergencies (INEE), which define EiE as the process of ensuring continuous access to quality education for children, youth, and adults affected by a crisis or displaced as a result of it. According to the INEE Minimum Standards for Education (2010, 2024), education in emergencies is not only a humanitarian need but also a means of restoring social stability, psychological safety, and community development.

Domestic researchers (V. Kremen, V. Luhovyi, O. Vorobyova, L. Lukyanova, M. Tkachuk, L. Hrynevych, I. Bekh) define education in such conditions as a tool for restoring and stabilizing society, which performs not only an educational but also

a humanitarian function it supporting social cohesion, psychological balance, and faith in the future. Modern Ukrainian researchers (Hrynevych, 2024; Vorobyova, 2024) focus on building resilient education systems that can ensure the continuity of the educational process even in conditions of war, pandemic, or natural disasters.

Foreign researchers (M. Fullan, A. Hargreaves, T. Anderson, G. Siemens, S. Bonk) emphasize that education during crises should be viewed as an adaptive system capable of transforming in response to changing external conditions. For example, T. Anderson and G. Siemens consider digital learning as a key tool for ensuring the accessibility of education, and the concept of connectivism (Siemens, 2005) justifies a new learning paradigm in which knowledge is created through networked connections between people, technology, and content.

So, theoretically, education in emergency situations is considered a system of adaptive response, which includes flexible educational models, innovative technologies, and a psychologically safe learning environment. Let us consider the main scientific approaches to the development of education in crisis conditions.

The humanistic approach is based on the ideas of C. Rogers, A. Maslow, I. Bekh, and others, who emphasize that in crisis conditions, the most important thing is to preserve the dignity, emotional well-being, and integrity of the individual. The humanistic approach defines the teacher as a person who creates conditions for self-development and psychological safety of students. During distance learning in wartime, the teacher not only performs an educational function but also acts as a source of support, stability, and empathy.

Competency-based approach. According to the works of V. Kremen, O. Pometun, as well as M. Fullan and A. Hargreaves, this approach focuses on the development of key life and professional competencies, specifically digital, communicative, emotional, and stress-resistance skills. In emergency situations, the competency of resilience becomes especially relevant, as it enables the ability to adapt and maintain the effectiveness of activities despite the crisis's effects. Training programs encompass

tasks designed to develop critical thinking, self-organization, and effective team interaction.

The continuous (andragogic) approach, developed by P. Jarvis, M. Knowles, M. Tkachuk, O. Vorobyova, V. Luhovyi, L. Lukyanova, determines that learning continues throughout life (lifelong learning), which is especially important in crisis situations when it is necessary to quickly master new skills or change the professional trajectory. During the COVID-19 pandemic, teachers took advanced training courses in digital literacy in large numbers, ensuring the continuity of education.

The innovative and technological approach is based on the ideas of G. Siemens, T. Anderson, C. Bonk, and O. Spivakovsky. This approach emphasizes the role of digital ecosystems, cloud services, and open educational resources in supporting the educational process during times of crisis. Innovative technologies become not only a tool, but also an environment for the development of pedagogical interaction. Integration of Moodle, Google Classroom, and Zoom platforms, which provide flexible access to education regardless of the applicant's location.

In modern conditions of crisis, challenges, and social instability, the formation of sustainable and adaptive models of education functioning becomes particularly relevant. Based on the generalization of scientific approaches (Anderson, 2011; Siemens, 2005; Bonk, 2006; Rogers, 1983; Bekh, 2003; Fullan, 2001; Jarvis, 2004; Kremen, 2011; Vorobyova, 2024; L. Lukyanova, 2021), four conceptual models can be distinguished that ensure the continuity and quality of the educational process in emergency conditions.

The Resilient Education Model seeks to establish educational structures that can maintain their functionality, adapt to changes, and recover quickly from the impacts of crises. Its essence lies in the formation of a system that combines organizational, technological, psychological, and social resilience. The main principles of the system model include reserving resources, creating alternative learning scenarios, and forming a support network for students and teachers (INEE, 2010; Vorobyova, 2024). The main principles of this model are:

- Decentralized management structure, which allows educational institutions to make decisions independently in crisis situations.
- Flexibility of the educational process, which involves changing formats (online, offline, blended learning) depending on external conditions.
- Multi-platform and data backup, which ensures continuity of learning even in the absence of material infrastructure.
- Social interaction and support as factors of stability of the educational community.

Thus, the Resilient Education Model focuses on creating an educational environment that is resilient to external threats, ensuring the preservation of the educational process even in the event of complete destruction of the material and technical infrastructure (Anderson, 2011).

The Open and Flexible Learning Model is based on the ideas of openness, accessibility, and autonomy of education seekers. According to the approaches of G. Siemens (2005) and C. Bonk (2006), it involves the use of distance platforms, hybrid learning, adaptive educational programs, and interactive resources, as well as the utilization of open educational platforms (Open Educational Resources, MOOCs) and support for independent learning. Key characteristics:

- Accessibility of educational content regardless of geographical location and social status.
- Use of open licenses (Creative Commons), which ensures legal freedom to share knowledge.
- Individualization of the educational trajectory through digital tools and analytics of educational achievements.
- Mobility and autonomy of the learner, which allows him to independently plan and control the learning process.

The Open and Flexible Learning Model is an effective response to the challenges of the mass transition to a distance format and contributes to the democratization of education during crisis restrictions.

Psychologically Supportive Learning Model emphasizes the importance of emotional well-being, psychological safety, and humanistic interaction in the educational environment. Its ideological principles are based on the humanistic pedagogy of C. Rogers (Rogers, 1983) and the concept of person-centered education (Bekh, 2003).

The main components of this model:

- Creating a safe, emotionally comfortable environment in which the learner can freely express his thoughts and feelings.
- Supportive communication between participants in the educational process, based on empathy, trust, and mutual respect.
- Integration of psychological support into the educational process through consultations, reflective practices, and stress resistance training.
- Development of emotional intelligence skills in teachers and students as a resource for overcoming crisis situations.

The psychologically supportive model provides not only educational outcomes but also fosters the formation of internal balance, motivation, and personal resilience in uncertain conditions.

The Crisis Management Model in Education (Crisis Management Model) is formed within the framework of the theory of educational management and anti-crisis management (Fullan, 2001; Kremen, 2011). Its goal is to ensure effective response of educational organizations to emergency events, minimize risks, and quickly restore stable functioning.

The main elements of the model:

- Availability of security strategies and plans developed at the level of the educational institution.
- Communication protocols that regulate the actions of participants in the educational process in the event of a crisis.

- A system for monitoring risks and regularly updating response plans.
- Training of managers and teaching staff for actions in emergency situations, including crisis training and simulations.

The crisis management model ensures the coordination of actions among all participants in the educational process, increases the system's readiness for extreme circumstances, and reduces the consequences of destabilizing events. Each of the above models has its own logic of construction, but they are all united by a common goal: to ensure the continuity, stability, and humanistic orientation of education, even in the most difficult circumstances. Their combination forms an integrated paradigm of adaptive and safe education, which meets the challenges of the modern world.

Thus, the theoretical and methodological foundations of education development in emergency situations are based on a combination of humanistic, competency-based, continuous, innovative, and technological approaches, as well as on the concepts of stability, adaptation, and openness. These approaches form the basis for further analysis of socio-psychological and pedagogical factors of the functioning of education in crisis contexts.

Socio-psychological and pedagogical factors of education development during emergencies

Education in emergencies is influenced by numerous socio-psychological and pedagogical factors that determine its effectiveness, sustainability, and ability to ensure the development of participants in the educational process. One of the key factors is stress, uncertainty, and information risks, which directly affect the cognitive, emotional, and motivational components of learning.

The impact of stress on the learning process manifests itself in various forms. Chronic or intense stress can reduce concentration, make it difficult to remember and assimilate new information, and negatively affect interpersonal interactions in the

classroom or online environment. Modern works (O. Kresan, S. Smolyaninova, etc.) in the field of pedagogical psychology emphasize that to overcome the effects of stress, it is important to create a safe educational environment, provide support for students and teachers, and integrate elements of emotional regulation, group exercises, and psycho-emotional support.

Uncertainty, a characteristic of crisis conditions, affects students' ability to plan educational activities, evaluate their own achievements, and form realistic expectations. It arises due to a change in the format of learning (transition to distance platforms), unpredictability of curricula, as well as constant changes in the socio-political and economic situation. The competency-based approach in education (O. Pometun, V. Kremen) suggests developing adaptation, critical thinking, and self-regulation skills in students, which allows them to effectively respond to uncertain circumstances.

Information risks include information overload, fake news, manipulation, and media panic. In the educational process, this can manifest itself in loss of concentration, disorientation, and the formation of biased judgments. Modern research on digital education and media literacy (O. Spivakovsky, G. Siemens) emphasizes the need to integrate training modules on the critical evaluation of information, digital security, and effective management of media content.

Pedagogical factors encompass the ability of educators to adapt teaching methods to crisis conditions, apply distance and blended learning approaches, support students' emotional well-being, and create collaborative educational environments. The humanistic approach (M. Tkachuk, I. Bekh) emphasizes concern for psychological safety and the development of intrinsic motivation. Innovative methods, particularly digital platforms and interactive educational resources, enable the continuity of learning and preservation of social interaction in conditions of isolation or limited access to classrooms.

In general, socio-psychological and pedagogical factors are closely interrelated: stress, uncertainty, and information risks affect motivation, attention, and academic achievement, while pedagogical strategies aim to mitigate these negative impacts. To

ensure the effectiveness of education in crisis conditions, it is essential to integrate psychological support, competency-based approaches, elements of continuous learning, and innovative methods, which collectively form a sustainable and adaptable educational system.

During emergencies, the educational process faces serious challenges, one of the most important of *which is ensuring the psychological safety of training participants. Pedagogical* support in this context becomes a key factor that allows maintaining motivation, promoting effective learning, and forming sustainable socio-psychological competencies.

Psychological safety is defined as a state of confidence in protection from emotional, social, or cognitive pressure in the learning environment. It creates conditions under which a learner can openly express thoughts, experiment with new ideas, and make mistakes without fear of judgment. Research by M. Tkachuk, I. Bekh, and other educators indicates that a sense of psychological safety has a direct impact on the level of student participation in the learning process and the development of critical thinking and creative abilities. Pedagogical support in crisis conditions includes several interrelated aspects:

- *Emotional support* provides students with the opportunity to express emotions, fears, and anxieties through conversations, group discussions, or psychological exercises.
- *Methodological support* for adapting educational materials and methods to the conditions of limited access to classes, distance learning, or a blended format. This ensures continuity of learning and allows learners to feel a sense of control over their educational trajectory.
- *Social support* forms collective interaction between students, developing collaborative learning, mentoring, and mutual assistance. In times of crisis, social support helps alleviate feelings of isolation and boosts motivation to learn.

Competency and humanistic approaches (O. Pometun, I. Zyazyun) emphasize that pedagogical support is not limited to

the transfer of knowledge. It aims to develop students' ability to adapt to new conditions, self-regulate their behavior and emotions, and form socio-psychological competencies. In this context, the role of the teacher is transformed: he becomes a facilitator of learning, a mentor, a consultant, and a source of stability in a changing environment.

Particular attention should be paid to interaction with students through digital platforms, which allows for maintaining a safe educational space even during periods of distance learning or partial isolation. Interactive methods, the integration of elements of emotional self-regulation, and support for media literacy help students critically evaluate the information field, reduce anxiety levels, and provide psychological comfort.

Therefore, pedagogical support and psychological safety are fundamental factors of effective learning in crisis conditions. They provide emotional, cognitive, and social balance, form the resilience and adaptability of learners, and create conditions for a safe and effective educational process regardless of external circumstances.

Resilience is a key indicator of the ability of educational systems, teachers, and learners to adapt to emergency situations, quickly restore functioning, and maintain an effective educational process. In conditions of crisis, the ability to exhibit psychological, social, and professional resilience becomes one of the main competencies that ensures the continuity and quality of education.

The resilience of teaching staff is fostered through systemic support, professional development, and the cultivation of a corporate culture that emphasizes mutual support and collective decision-making. An important role is played by:

- Psychological training of teachers in emotional self-regulation, stress and conflict management, development of empathy and communication skills.
- Collaborative and supportive, creating a safe environment for discussing difficult situations, sharing experiences, mutual mentoring, and coaching.
- Innovative adaptability, the ability to quickly change teaching methods, integrate distance or blended learning,

and use digital resources to support the educational process.

Learner resilience is shaped by a combination of cognitive, emotional, and social factors. Key components include:

- Emotional regulation and self-control develop the ability to cope with stress, anxiety, and uncertainty, which is especially important during crisis situations.
- Critical thinking and problem-based learning teach learners to analyze information, make informed decisions, and solve practical problems in changing environments.
- Social support and teamwork, engaging in group projects, cooperative learning, and building support networks among peers and mentors.

Research by O. Pometun, O. Vorobyova, and V. Luhovyi demonstrates that the combination of pedagogical support, a competency-based approach, and continuous education fosters the development of resilience in both teaching staff and students. The humanistic aspect provides emotional protection and moral support, the innovative aspect provides prompt response to changes, and the competency aspect develops life skills necessary for adaptation.

Thus, the formation of resilience is an integral element of modern education in emergency situations. It ensures the ability of educational systems to function effectively during crises, supports the psychological well-being of participants in the educational process, and creates conditions for the development of adaptive, critically thinking, and socially responsible citizens.

Organizational and pedagogical principles of education in emergency situations

In modern emergency situations, the traditional organization of the educational process often becomes impossible. Scientists and practitioners distinguish several models of education organization that ensure the continuity of learning and adaptability of educational systems: distance, blended, and mobile.

Distance learning involves the full use of information and communication technologies to organize the educational process outside the traditional classroom. It includes online lectures, webinars, interactive platforms, and virtual laboratories. The main advantages of distance learning in crisis situations:

- ensuring access to education regardless of the location of applicants;
- the possibility of flexible planning of study time;
- reducing risks to the health and safety of participants in the educational process.

Blended learning combines traditional face-to-face classes with distance learning elements, allowing for live interaction between teachers and students while utilizing flexible online tools. This model is especially effective in partial restrictions or during periodic crises, as it enables a swift shift in emphasis between face-to-face and online forms of learning without compromising the quality of education. Researchers (Bonk, 2006; Fullan, 2016) emphasize that blended learning contributes to the development of digital competencies of teachers and students, supports motivation and engagement in the learning process.

Mobile learning (m-learning) utilizes mobile devices (such as smartphones, tablets, and laptops) to enable learners to access knowledge and resources at any time and from any location. This model is particularly relevant in crisis situations where access to traditional educational institutions is limited. Mobile learning supports adaptability, personalization of the educational process, as well as the integration of elements of gaming technologies, online testing, and communication platforms for interaction between students and teachers.

The integration of distance, blended, and mobile learning allows for the creation of *flexible educational environments* that meet the modern requirements of the crisis. The key factors in the effectiveness of these models are teachers' readiness to use digital tools, the availability of infrastructure and access to the Internet, pedagogical support, student motivation, and the integration of adaptive educational materials that cater to the needs of different student categories.

Thus, the organizational and pedagogical principles of education in emergency situations are based on a combination of distance, blended, and mobile learning models, which ensure the continuity of education, the development of digital competencies, and the resilience of education systems in the face of crisis challenges.

In crisis conditions, effective management of educational institutions becomes critically important for ensuring the continuity of the educational process, maintaining the psychological safety of educational participants, and preserving the quality of education. Management strategies should consider the dynamics of crisis phenomena, the uncertainty of circumstances, and the need for prompt decision-making.

Flexible planning and adaptive management. Educational institutions should develop plans that allow for the possibility of quickly adapting the format of education from full-time to distance or blended learning. This includes adaptive scheduling, the utilization of reserve resources (such as digital platforms, online courses, and mobile applications), and the establishment of operational teams to facilitate informed decision-making in the event of unforeseen circumstances.

Communication strategy and information transparency. In crisis situations, it is crucial to maintain effective communication among the administration, teachers, students, and their parents. Key elements of the communication strategy include regular updates on changes in the educational process, the creation of centralized information channels (electronic platforms, messengers, and webinars), and the provision of feedback to facilitate the rapid identification of problems and needs among education participants.

Support for teaching staff. Crisis conditions increase the level of stress and emotional burden on teachers. Management strategies should include support and professional development systems, such as training teachers in digital and hybrid technologies, providing psychological support and supervision, and creating conditions for sharing experiences and joint problem-solving.

Monitoring and evaluating the quality of education. Managing education in a crisis requires constant monitoring of the educational process's effectiveness and the rapid adjustment of the strategy. This involves assessing the level of student engagement and learning outcomes, utilizing online tools for data collection, and analyzing the adaptability of educational programs to ensure their compliance with participant needs.

Innovative management practices. The integration of digital technologies into the management system ensures efficiency and effectiveness, including automated educational process management systems, platforms for remote coordination of teachers and administration, and the integration of analytics for real-time forecasting and decision-making.

Thus, the management strategies of educational institutions in crisis conditions should be flexible, adaptive, and focused on supporting both the teaching staff and students, with an emphasis on maintaining learning continuity, ensuring transparency of information, and introducing innovative technologies. They form the basis of the sustainability of educational systems and ensure the ability to effectively respond to emergency challenges.

In modern emergency conditions, digital technologies are becoming a critically important tool for ensuring the continuity of learning. They allow you to maintain access to educational resources, support interaction between teachers and students, and ensure the adaptability of the educational process to changing conditions.

Distance and blended learning platforms. Learning Management Systems (LMS), such as Moodle, Google Classroom, Microsoft Teams, and others, provide online classes, access to learning materials, testing, and performance monitoring. Using an LMS enables you to organize learning into modules, provide personalized learning and support for learners, and store data on student progress to analyze educational outcomes.

Using video conferencing and interactive platforms. Using Zoom, Google Meet, Webex, and interactive whiteboards allows you to: conduct synchronous lectures, seminars, and consultations; support live interaction between teachers and

students; and integrate group assignments, discussions, and collaborative projects.

Mobile technologies and educational applications. Mobile devices and specialized applications provide access to educational materials anytime, anywhere. They contribute to learning flexibility (learning on the go), responding quickly to changes in the curriculum or class schedule, and engaging learners in interactive exercises and self-assessment.

Digital resources and content for distance learning. The use of electronic textbooks, video lectures, simulation models, and interactive courses enables the following: ensuring continuity of learning even in the event of physical restrictions on access to educational institutions; adapting materials to the individual needs of students; and integrating multimedia and game elements to increase motivation and engagement.

Assessment and monitoring tools for success. Digital technologies enable online testing, automated task assessment, learning activity analytics, and reporting for teachers and parents. This enables operational monitoring of student progress, facilitates the identification of knowledge gaps early, and enhances the effectiveness of individual support for students.

Thus, the integration of digital technologies into the educational process is a key factor in ensuring its sustainability, flexibility, and continuity in emergency situations. They not only support learning but also create conditions for the development of digital competence of teachers and students, which is a necessary component of the modern educational ecosystem.

Legal and ethical support for education in emergencies

Ensuring the functioning of education systems in emergencies is impossible without clear legal and ethical principles. These principles define the responsibilities of educational institutions, the rights of learners and educators, as well as the procedure for responding to crises and emergencies. A crucial component is the integration of international standards, recommendations from organizations such as UNESCO, WHO, and

UNICEF, as well as national legislation that regulates educational activities in crisis conditions.

UNESCO: reports and recommendations of the International Commission on Education for the 21st Century (for example, "Education: The Hidden Treasure", 1998) define education as a basic human right and a key factor in the resilience of societies during crises. UNESCO also develops guidelines on education in emergencies, including principles for ensuring safety, psychological support, and accessibility of education.

WHO: sets standards for the mental health and safety of children and staff in emergencies, and provides guidance on organizing education during pandemics, disasters, and humanitarian crises.

UNICEF develops programs to support children in crises, including educational models for schools in conflict zones, mobile classrooms, and distance learning initiatives.

INEE (Inter-Agency Network for Education in Emergencies): sets minimum standards for education in emergencies, covering preparedness, response, and recovery of education systems.

In Ukraine, the regulatory and legal support for education in emergency situations is based on:

- The Laws of Ukraine "On Education", "On Complete General Secondary Education", and "On Adult Education", which guarantee the right to education in any circumstances;
- The Ministry of Education and Science of Ukraine: methodological recommendations and orders on the organization of distance and blended learning during war or emergency situations;
- National standards of psychological support, which regulate the creation of a safe educational environment and ensure access to consultations and social assistance for education seekers and teachers.

In addition to legal norms, ethical principles of education play a crucial role in determining the behavior of teachers and administrators in crisis conditions. The main principles are: prioritizing the interests and safety of education seekers; ensuring

equal access to education for all categories of students; respecting the psychological state and personal needs of participants in the educational process; and transparency and responsibility in making management decisions.

Thus, the combination of international standards, national regulations, and ethical principles creates a comprehensive legal and moral framework for organizing the educational process in emergencies. This ensures the protection of the rights of students, teachers, and communities, and also supports the resilience of the education system even in crisis situations.

Equal access to education is one of the key principles of sustainable development of education systems and is guaranteed by both international documents (UN Convention on the Rights of the Child, UNESCO Framework Program for Education in Emergencies) and national laws (Laws of Ukraine "On Education", "On Complete General Secondary Education", "On Adult Education"). In emergencies, this principle assumes particular importance, as crises, military actions, natural disasters, or pandemics create additional barriers to accessing education, particularly due to the temporary closure of educational institutions, Internet disruptions, mobility restrictions, and socio-economic difficulties.

The main principles for ensuring equal access to education during crises include:

- The principle of non-discrimination and inclusion: education should be accessible to all categories of learners, regardless of age, gender, social status, ethnicity, physical abilities, or place of residence. Particular attention is paid to vulnerable groups: internally displaced persons, children with disabilities, and low-income families.
- The principle of accessibility of educational resources: ensuring equal access to educational materials (printed and digital), distance and blended learning platforms, internet connectivity, and adapted equipment for students with special needs.
- The principle of flexibility in the educational process: adapting curricula, forms, and learning methods to the specific conditions of the crisis. This includes mobile

educational modules, distance courses, and short-term educational programs that enable maintaining the educational trajectory even in unstable environments.

- The principle of social and psychological support involves ensuring access to psychological assistance, mentoring, and support from teachers, which helps reduce the negative impact of stress and anxiety on the learning process.
- The principle of monitoring and assessing accessibility: systematically collecting data on the level of coverage of education seekers, identifying problem groups, and assessing the effectiveness of measures to ensure equal access. This allows for adjusting educational strategies in real time and eliminating emerging barriers.

The consistent application of these principles creates an educational environment that not only supports the continuity of learning but also contributes to the preservation of equality of opportunities for all learners. In emergency situations, they become the foundation of a democratic, sustainable, and humanistic-oriented education system.

The ethical dimension of education in emergency situations is of particular importance, since technological innovations, distance formats, and information openness create not only new opportunities but also a number of moral challenges. Distance and crisis learning require not only organizational and technical solutions, but also clear ethical guidelines aimed at protecting the rights of learners, ensuring fairness, trust, and psychological safety.

First and foremost, it is essential to adhere to the principle of academic integrity, which encompasses honesty in completing tasks, avoiding plagiarism, and maintaining transparency in assessment. In a distance format, the risk of violating this principle increases, since control by the teacher is limited. Therefore, it is necessary to implement systems of self-reflection, a culture of mutual trust, and the formation of internal responsibility among students.

No less important is the ethics of digital interaction, which involves respect for personal space, confidentiality, and copyright.

Teachers should be aware of the limits on the use of personal data, particularly during online learning, recording classes, or monitoring educational activities. At the same time, it is essential to teach students digital ethics, promote tolerant behavior in online communication, prevent cyberbullying, and observe network etiquette.

The ethical responsibility of a teacher in crisis conditions is to maintain a balance between demandingness and empathy. Educators should consider the emotional state of participants in the educational process, including the consequences of stress, loss, or forced displacement, and provide support that fosters students' internal resilience. In this context, ethics is closely related to humanistic pedagogy, which emphasizes the respect for the dignity of each individual.

Special attention should be paid to the ethical aspects of assessment. In a distance format, it is important to ensure equal access to tests, tasks, and communication tools to prevent discrimination due to technical limitations or socio-economic differences. A flexible approach to assessment is ethical, focused not only on the result but also on the process, motivation, and individual capabilities of the applicant.

Also particularly relevant are the ethical issues of using artificial intelligence in education, including automated assessment, personalized recommendations, and analytics of educational data, which require transparency, user consent, and the prevention of bias. The development of digital literacy should encompass an ethical understanding of technological solutions, the ability to distinguish between reliable and unreliable information, the responsible creation of content, and the critical evaluation of algorithms.

Thus, the ethical aspects of distance and crisis learning form a multidimensional system of norms and practices that encompasses integrity, respect, justice, and humanity. They must be integrated into all levels of the educational process, from policy planning to the everyday interaction of teachers and learners. It is the ethical culture of education that forms the foundation, ensuring its sustainability, trust, and effectiveness in times of global challenges.

Prospects for the development of education in the post-crisis period

After the end of emergencies, hostilities, natural disasters, epidemics, or socio-economic crises, the primary task of state education policy becomes restoring educational infrastructure. This is not only the material and technical restoration of premises and resources, but also the restoration of the social, digital, and psychological components of the educational environment.

Firstly, the restoration process encompasses the physical reconstruction of educational institutions, including the repair or construction of destroyed schools, kindergartens, vocational and higher education institutions, as well as the creation of safe shelters and evacuation zones. A key direction is energy-efficient modernization, the use of environmentally friendly materials, the adoption of autonomous energy sources, and the integration of inclusive architectural solutions. Thus, education becomes part of a broader strategy for promoting sustainable community development.

However, modern restoration is not limited to the material aspect. Restoring digital infrastructure, including high-speed internet access, modernizing computer labs, distance learning platforms, and cybersecurity tools, is crucial. Digital technologies are becoming the foundation for flexible, risk-resilient education that can quickly transition between face-to-face, blended, and distance learning.

At the same time, the human resource potential of education is being restored. After crises, teaching staff often face professional burnout, personnel migration, and the loss of specialists. Therefore, programs of support, retraining, mentoring, and psychological assistance are necessary for teachers. Returning trust in the educational process and a sense of professional dignity is the key to a qualitative renewal of the system.

No less important is the restoration of the social infrastructure of education, in particular, the formation of safe and supportive communities. In the post-crisis period, a school or university must once again become a space for socialization, communication, and the restoration of a sense of normality. This

requires increased cooperation between educational institutions, communities, local authorities, international partners, and public organizations.

In the context of war and post-war challenges, the reintegration of internally displaced persons (IDPs) into the educational space is of particular importance. It is necessary to create adaptation programs, develop inclusive education, and provide psychological and pedagogical support for children and youth who have experienced traumatic experiences.

The restoration of infrastructure also has a strategic dimension. It presents an opportunity to update the content of education and modernize programs focused on 21st-century competencies, including critical thinking, communication, digital literacy, and civic responsibility. Thus, the reconstruction process becomes an innovative rethinking of education, rather than simply returning to the previous state.

In summary, the restoration of educational infrastructure in the post-crisis period is a multifaceted process that encompasses material reconstruction, digital modernization, social support, and the renewal of pedagogical potential. Its strategic goal is to create sustainable, inclusive, technologically advanced, and humanistic-oriented education that not only survives in crises but also becomes an engine of social recovery.

The professional development of teachers in the post-crisis period is of particular importance, since it is the teacher who is the key figure in restoring the quality of education, creating a safe educational environment, and forming the resilience of participants in the educational process. In modern times, traditional models of advanced training are being gradually replaced by flexible, innovative approaches that take into account the needs of digital transformation, psychological and emotional challenges, and the requirements of continuous learning.

One of the leading directions in the development of pedagogical skills is the concept of continuous professional development (CPD). It involves systematic learning throughout the teacher's professional life, the integration of formal, non-formal, and informal learning. Forms such as online courses, webinars, mentoring programs, and professional communities of

practitioners enable teachers to quickly update their knowledge, exchange experiences, and maintain professional motivation even in challenging social circumstances.

An important component of modern teacher development is a reflective approach, which is based on the ideas of D. Kolb, L. Vygotsky. It focuses on reflecting on one's own pedagogical experience, critically analyzing learning situations, and seeking effective teaching strategies. In crisis and post-crisis conditions, reflective practice enables teachers to adapt to change, develop emotional resilience, and enhance the quality of their interactions with students.

Digital competence is another strategic direction for professional growth among teachers. It involves not only technical skills in using digital platforms, but also pedagogical understanding of the digital environment, the ability to organize distance and blended learning, maintain academic integrity online, ensure cybersecurity, and the digital well-being of students. This concept is developed in the works of O. Spivakovsky, M. Fullan, and A. Hargreaves, who emphasize that digital competence is a combination of technological, communicative, and value-based skills that teachers possess.

The focus of modern pedagogy is also the emotional competence and resilience of teachers. The experience of crisis periods has shown that a teacher's ability to self-regulate, empathize, manage stress, and communicate constructively has a direct impact on the effectiveness of the educational process. Therefore, professional development programs are increasingly including training in psychological support, emotional intelligence, non-violent communication, and conflict management.

Finally, one of the leading trends is the network approach to professional development, which is implemented through the creation of communities of educational practice. Such communities foster horizontal knowledge exchange, cultivate a culture of peer support, and contribute to the dissemination of pedagogical innovations. In the context of post-crisis development, this approach enables teachers to overcome professional isolation, restore confidence in their own strengths, and collectively develop solutions for the new educational realities.

Thus, new approaches to the professional development of teachers are based on the principles of continuity, flexibility, reflexivity, digital, and emotional competence. They aim to form a modern teacher, not only a carrier of knowledge, but also a facilitator, a leader of change, and a creator of an educational community capable of ensuring the restoration and sustainable development of education in the face of crisis challenges.

Education in the post-crisis period acquires strategic importance as one of the key factors in social stabilization and humanitarian restoration of society. In situations where a country is experiencing the consequences of war, natural disasters, or other extraordinary events, it is the education system that acts not only as a medium for the transfer of knowledge but also as a space for psychological support, social unity, and the formation of new value orientations.

Firstly, education serves a social integration function, contributing to the restoration of trust between citizens, maintaining social cohesion, and mitigating the consequences of disinformation or societal polarization. Through educational programs focused on developing civic education, critical thinking, media literacy, and a culture of dialogue, an active and responsible citizen is formed, capable of participating in the democratic restoration of the state.

The second important function of education is psychosocial rehabilitation. Educational institutions become a place of safety and stability for children and youth who have experienced traumatic events. Teachers, school psychologists, and social workers provide the support necessary for emotional recovery, a return to a normal rhythm of life, and the formation of positive behavioral patterns. At the same time, educational programs incorporate elements of socio-emotional learning, which foster the development of resilience, empathy, and mutual support.

From a humanitarian perspective, education is a means of restoring human potential. It provides the opportunity for retraining, the development of new professional skills, and the return of the population to productive activities. Vocational education and adult training programs in post-crisis regions aim to integrate displaced persons, support women, veterans, and

other vulnerable groups. Thus, education contributes to economic stability, reducing unemployment and social inequality.

No less important is the humanistic mission of education, which involves fostering a culture of peace, inclusivity, interethnic understanding, and solidarity. In this context, international initiatives, including those of UNESCO, UNICEF, and INEE, play a significant role in emphasizing the right of every person to education, even in times of crisis. Such approaches emphasize that the restoration of the education system is not only a technical or administrative task, but primarily a value-based process aimed at recreating a humanitarian space of trust, cooperation, and mutual respect.

Thus, education in the post-crisis period appears as a powerful tool for social revival, which combines the functions of training, psychological recovery, civic education, and economic rehabilitation. It ensures not only the restoration of infrastructure but also the spiritual renewal of the nation from the individual level to collective identity, contributing to the formation of a sustainable, solidary, and humane society.

Conclusions

Analysis of scientific sources on Education in Emergencies (EiE) reveals that modern education serves not only as a means of knowledge transfer but also as a powerful tool for social stabilization, humanitarian recovery, and psychological support. In international practice, EiE is considered a set of organizational, pedagogical, and psychological measures that ensure access to quality education during war, crises, pandemics, or natural disasters. Ukrainian researchers emphasize the humanitarian function of education, supporting social cohesion, psychological well-being, and faith in the future.

Theoretical and methodological approaches to the development of education in crisis conditions include:

- The humanistic approach, which focuses on preserving the dignity, emotional well-being, and psychological safety of participants in the educational process. In this approach,

the teacher becomes a mentor and facilitator who provides stability and moral support to students.

- The competency approach aims at the formation of key life and professional competencies, including digital, communicative, emotional, and stress resistance. The ability to resiliently adapt and effectively function in crisis conditions is especially important.
- A continuous (andragogical) approach, which involves lifelong learning, ensures the prompt acquisition of new knowledge and skills in emergency situations.
- The innovative and technological approach which emphasizes the importance of digital ecosystems, cloud services, and open educational resources to support the continuity of learning and flexible organization of the educational process.

Based on these approaches, several models of education adaptation to crisis conditions have been proposed in the scientific literature: system adaptation model, which provides flexible interaction of components of the education system and resource reservation; the resilience model, which forms the resilience of students and teachers, technological readiness, and the ability to quickly restore functioning; humanitarian-oriented model, which creates a psychologically safe and supportive learning environment; technological-innovative model, which integrates digital platforms, hybrid learning, and adaptive educational resources; competency-oriented model, which aims to develop critical thinking, self-regulation, and vital skills.

Socio-psychological and pedagogical factors of the effectiveness of education in crisis conditions include: stress, uncertainty, information risks, psychological support, and teacher competence. Psychological safety and pedagogical support create an environment that fosters open learning, the development of critical thinking, and the cultivation of creative abilities.

Building resilience is crucial to ensuring the effectiveness of the educational process, as it encompasses psychological and emotional resilience, critical thinking, social interaction, and the ability of both teachers and students to adapt to change. The combination of humanistic, competency-based, continuous, and innovative approaches creates a holistic theoretical

and methodological foundation for the development of modern education in emergency situations.

Appendix A

Table 1

Organizing education in emergency situations and the post-crisis period

Category	*Key Elements*	*Purpose / Functions*	*Examples / Tools*
Learning Models	Distance Learning	Continuity of education, safety, and flexibility	Online lectures, webinars, virtual labs
	Blended Learning	Maintaining live interaction, developing digital competencies	Combination of in-person and online classes, interactive platforms
	Mobile Learning	Learning anytime/anywhere, adaptability	Smartphones, tablets, interactive apps, online quizzes/tests
Management Strategies	Flexible Planning and Adaptability	Rapid change of learning format	Adaptive scheduling, backup resources, and rapid-response teams
	Communication and Transparency	Effective information exchange, feedback	Centralized platforms, messengers, webinars
	Teacher Support	Professional and psychological support	Digital technology training, supervision, and experience sharing
	Monitoring and Assessment	Evaluating effectiveness, adjustments	Online monitoring tools, student progress analytics
	Innovative Practices	Responsiveness, effective management	Automated LMS, coordination platforms, and real-time analytics

Category	*Key Elements*	*Purpose / Functions*	*Examples / Tools*
Digital Technologies	LMS (Learning Management Systems)	Organization of learning, personalization	Moodle, Google Classroom, Microsoft Teams
	Video Conferencing Tools	Synchronous interaction	Zoom, Google Meet, Webex
	Mobile Applications	On-the-go learning, interactivity	Kahoot!, Quizlet, educational games
	Digital Content	Continuity, motivation	E-textbooks, video lectures, simulations
Regulatory Framework	International Standards	Guaranteeing the right to education, safety, and psychological support	UNESCO, WHO, UNICEF, INEE
	National Legislation	Regulating education in crisis contexts	Laws of Ukraine "On Education", Ministry of Education orders
Ethical Principles	Academic Integrity	Honesty, transparency, trust	Anti-plagiarism tools, online supervision, and self-reflection
	Digital Ethics	Privacy, respect, safety	Cybersecurity, netiquette, and data protection
	Psychological Support	Empathy, resilience of students and teachers	Individual support, training, and social-emotional learning
Equal Access to Education	Inclusion	Non-discrimination, support for vulnerable groups	IDPs, children with disabilities, and low-income families
	Resource Accessibility	Equal access to learning materials	Printed and digital resources, internet access, and assistive equipment

Category	*Key Elements*	*Purpose / Functions*	*Examples / Tools*
	Flexibility and Adaptation	Programs adapted to crisis conditions	Mobile modules, distance courses, short-term programs
	Accessibility Monitoring	Identifying vulnerable groups, strategy adjustment	Systematic data collection, analytics
Post-crisis Development	Infrastructure Restoration	Physical, digital, social reconstruction	School reconstruction, LMS modernization, and safe shelters
	Professional Development of Teachers	Continuity, reflection, digital and emotional competence	CPD, online courses, mentoring programs, communities of practice
	Social Integration	Restoring trust, social cohesion	Civic education, critical thinking, media literacy
	Psychosocial Rehabilitation	Support for children and youth, psychological recovery	SEL programs, psychologists, social workers, and adaptation programs

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1.3. TEACHER TRAINING IN POLTAVA PROVINCE DURING THE 19TH –EARLY 20TH CENTURIES

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***Abstract**. The article examines the evolution of teacher training in Poltava Province during the nineteenth and early twentieth centuries, revealing the historical preconditions, institutional structures, and pedagogical tendencies that determined the professionalization of education in the region.*

The study identifies and systematizes key stages in the development of pedagogical institutions in Poltava Province, focusing on the activities of teacher seminaries, gymnasiums, pedagogical courses, and institutes for noble maidens.

A special emphasis is placed on the humanization and feminization of pedagogical education, the formation of curricula integrating moral, psychological, and methodological disciplines, and the role of educators.

The results of this study enrich the historiography of Ukrainian education and provide a foundation for understanding the traditions that influenced the modernization of teacher training in Ukraine today.

***Keywords**: Poltava Province; teacher training; pedagogical education; seminaries; gymnasiums; zemstvo; female education; historiography; nineteenth century; early twentieth century; Ukraine.*

Introduction

The modernization of education in Ukraine is closely linked to an understanding of its historical foundations. In the nineteenth century, the transformation of teacher training became a national issue as the need for professional educators grew in tandem with the expansion of public education. Within the Russian Empire,

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Ukrainian territories, and Poltava Province in particular, developed distinctive systems of teacher preparation that combined state regulation, church influence, and civic initiative.

The early nineteenth century marked the beginning of systemic efforts to organize education. The Manifesto on the Establishment of Ministries (1802) and the creation of the Ministry of Public Education became milestones in the institutionalization of teacher training. The inclusion of the teacher's rank in the Table of Ranks (1803) recognized teaching as an official profession.

The development of teacher training in Poltava Province was influenced by a combination of social, economic, and cultural factors. The mid-nineteenth-century reforms, particularly the Regulations on Public Elementary Schools (1864) and the Regulations on the Preparation of Teachers for Gymnasiums and Progymnasiums (1865), established the legal framework for teacher education. This system provided the foundation for specialized pedagogical schools, seminaries, and courses that emerged across the province.

In addition to state and church initiatives, zemstvo organizations – institutions of local self-government introduced by the 1864 reform – played a decisive role. They financed the construction of schools, established libraries, opened Sunday schools, supported pedagogical training, and subsidized teachers' salaries. The zemstvo became a major agent of educational democratization, encouraging access to schooling and improving the professional status of teachers.

The aim of this article is to reconstruct the evolution of teacher education in Poltava Province between the early nineteenth century and 1917. The objectives include identifying the key stages of development, analyzing the activities of pedagogical institutions, and highlighting the theoretical and practical contributions of educators and administrators who shaped the region's educational tradition.

Research Results

Socio-Pedagogical Background and Early Institutional Development

The evolution of teacher training in Poltava Province during the nineteenth century was closely tied to the administrative and socio-economic transformations that occurred within the Russian Empire as a whole. The creation of the Ministry of Public Education by the Manifesto of September 8, 1802, initiated a new state system of educational management that replaced the earlier fragmented control exercised by church consistories and local authorities.

At the same time, the Scientific Committee attached to the Ministry (functioning in 1818–1831 and 1856–1917) assumed responsibility for supervising curricula and approving textbooks, thus shaping the intellectual foundations of teacher education. In the context of the empire's modernization, these measures reflected a broader shift from religious to secular principles of schooling, which directly affected the territories of present-day Ukraine, including Poltava Province.

The first decades of the nineteenth century witnessed the gradual emergence of an institutional network that combined church and secular education. The Poltava Theological Seminary, established in 1803, became the earliest and most authoritative educational center of the province.

Parallel to spiritual education, the government introduced a secular model of classical learning. In 1808, the Poltava Men's Gymnasium opened, offering a comprehensive curriculum in Latin, Greek, mathematics, geography, and natural sciences.

The establishment of the Poltava Institute for Noble Maidens in 1818 was equally significant. Conceived under the patronage of the Empress Maria's Department, it represented one of the earliest forms of organized female education in the Ukrainian provinces.

The expansion of schooling during the first half of the nineteenth century was closely linked to economic and demographic growth in the region. Urban centers such as Poltava, Kremenchuk, Lubny, and Pryluky required increasing numbers of literate officials and teachers.

Throughout this period, the Church retained a leading influence in education. Ecclesiastical authorities supervised the opening of parish schools, controlled teacher appointments, and ensured the confessional orientation of instruction.

During the reign of Emperor Alexander I, a series of charters and circulars laid the basis for the state-school network. The Charter of Educational Institutions Subordinate to the University Districts (1804) and the Charter of Gymnasia and District Schools (1828) regulated the structure and governance of schools, including the provinces of Left-Bank Ukraine.

By mid-century, Poltava Province had a diversified yet still loosely coordinated educational network, comprising the Theological Seminary, the Men's Gymnasium, the Institute for Noble Maidens, and several parish and county schools. Together, they produced the first generation of professionally oriented teachers who combined religious devotion with emerging pedagogical literacy.

The groundwork laid in these decades enabled the subsequent professionalization of the teaching profession. The early institutions not only transmitted knowledge but also embodied new social values, discipline, service, and enlightenment, which turned education into a distinct public mission.

Reforms and Expansion of the Teacher Training Network (1860s–1917)

The second half of the nineteenth century became a turning point in the history of education in Poltava Province. Profound socio-economic transformations associated with the abolition of serfdom (1861) and the subsequent administrative reforms created a favorable environment for the modernization of schooling.

Two legislative documents played a decisive role in organizing the process of teacher preparation: the Regulations on Public Elementary Schools (1864) and the Regulations on the Preparation of Teachers for Gymnasiums and Progymnasiums (1865). These decrees established unified standards for

elementary education, defined the qualifications of teachers, and authorized the creation of specialized pedagogical institutions.

Under the influence of these reforms, the zemstvo institutions, introduced by the administrative reform of 1864, became the leading force in the educational field. The zemstvo councils, elected by local landowners and representatives of urban and rural communities, assumed direct responsibility for establishing and maintaining schools.

The zemstvos' role extended beyond financial assistance. They organized pedagogical congresses and conferences, where teachers discussed methodological innovations and the moral aspects of their profession.

Parallel to civic initiatives, the Orthodox Church continued to influence the spiritual and moral dimensions of education. Responding to the growing need for teachers, the Holy Synod encouraged the establishment of church teacher schools, where the curriculum combined theology, moral instruction, and elementary pedagogy.

A distinctive feature of Poltava's educational landscape was the cooperation between the zemstvo and the church. While the Church maintained confessional education, the zemstvos ensured material support and advocated for methodological improvements.

By the 1870s and 1880s, teacher training institutions had become the backbone of professional development in the province. The first such institutions, the Poltava, Hadyach, Lubny, Zinkiv, and Pryluky seminaries, offered a three-year course that integrated general subjects (History, Geography, Arithmetic, and Natural Science) with pedagogical ones (Pedagogy, Psychology, Didactics, and Methodology of Elementary Instruction).

The professionalization of teacher education during this period also manifested in the establishment of the Poltava Teachers' Institute in 1914. It became a regional center for the scientific and methodological coordination of pedagogical institutions, preparing teachers for secondary schools and offering retraining for those already employed. The Institute's foundation marked the culmination of a half-century process of institutional

consolidation. It united the experience of seminaries, gymnasiums, and pedagogical courses within a unified educational framework.

At the turn of the century, Poltava Province could boast one of the most comprehensive educational networks in Ukraine. Statistical reports from 1910–1915 indicate the following structure:

- The Poltava Theological Seminary (founded 1803);
- The Poltava Institute for Noble Maidens (1818);
- Four religious schools under the jurisdiction of the Holy Synod;
- Five teacher seminaries (Poltava, Hadyach, Lubny, Zinkiv, Pryluky);
- One Teachers' Institute (1914);
- 26 female and 13 male gymnasia (departments of the Empress Maria, Ministry of Education, and private);
- One full diocesan and one parish female school;
- Four incomplete female parish schools;
- The Oleksandr-Mykolai Church Teachers' School and four two-class male church teacher schools;
- One Zhdaniv female church teacher school (three-year term);
- Short-term pedagogical courses and seven biennial pedagogical programs (Zen'kiv, 1906; Poltava, 1910; Pryluky, 1911; Khorol, Kremenchuk & Hadyach, 1910; Lubny, 1912).

This network represented a multi-level and functionally differentiated system. Theological institutions provided moral and religious formation; seminaries and pedagogical courses offered practical preparation; gymnasia and the Institute ensured theoretical depth and a broad cultural foundation. The combination of these levels guaranteed a continuous pipeline of qualified teachers for all tiers of the educational system, from parish to gymnasium.

The short-term pedagogical courses played a particularly important role in supplying rural schools with instructors. Their emergence was a direct response to the acute shortage of trained teachers in the countryside. Funded primarily by zemstvos and, later, the Holy Synod, these courses evolved through three phases. In the 1870s and 1880s, these were brief literacy programs, lasting two to three months, that emphasized reading, writing, and arithmetic. By the 1890s, the curriculum included catechism, pedagogy, and psychology. In the 1910s, the courses evolved into two-year programs with a distinct pedagogical profile, incorporating supervised teaching practice in local schools.

Students of these courses were typically young men and women aged 16–25 who had completed city or district schools. The training combined lectures, practical exercises, and pedagogical observation. Participants conducted lessons, prepared class journals, and compiled "psychological characteristics" of pupils, which encouraged reflective teaching. Upon completion, graduates received certificates granting the right to teach in elementary schools under either the Ministry of Education or the Synod.

The experience of Poltava's pedagogical courses demonstrated the local adaptability of education policy. Despite limited funding and modest facilities, they achieved considerable success in raising literacy and introducing modern teaching methods. Their programs were periodically reviewed at teachers' congresses, where zemstvo and church representatives discussed issues such as teacher discipline, remuneration, and moral conduct.

A remarkable example of methodological progress was the Velykosorochynsk Teachers' Seminary, whose curriculum included electives such as Natural Science, Beekeeping, and Land Surveying. This integration of practical agrarian knowledge reflected the socioeconomic character of the province, where the majority of the population depended on agriculture. The seminary thus embodied a pedagogical synthesis between scientific instruction and the realities of peasant life.

By the early twentieth century, the educational landscape of Poltava Province had evolved into a coherent system of institutions

characterized by interaction among the state, the church, and local self-government. Its organizational model combined centralized regulation with local initiative, ensuring both ideological unity and adaptability to regional needs. The result was not only the quantitative growth of schools and teachers, but also the qualitative improvement of pedagogical culture, which by 1917 had reached a level comparable to that of the most advanced regions of the Russian Empire.

Curricular Structure and Content of Teacher Education in Poltava Province

By the end of the nineteenth and early twentieth centuries, the system of teacher training in Poltava Province had reached a level of internal differentiation that enabled it to prepare educators for various types of schools, from parish to gymnasium, within a unified pedagogical framework. The curriculum of pedagogical institutions reflected the synthesis of three educational traditions that had developed in the region: religious, civic-humanistic, and practical-professional.

The theological and moral component, inherited from the early nineteenth-century seminary system, remained central to all programs. Courses such as *Holy Scripture, Church Slavonic Grammar, Moral Theology,* and *Catechism* continued to be taught in theological and church-teacher schools, forming the ethical foundation of the teacher's worldview. At the same time, these institutions increasingly supplemented religious content with elements of pedagogy and psychology. Inspectors' reports from the 1890s testify that seminary graduates were evaluated not only for their piety and obedience but also for their ability to manage a class, maintain order, and apply modern teaching methods.

The general education block in all teacher-training institutions included *History, Geography, Mathematics, Physics, Natural Science, and Languages* (Russian, Latin, Greek, and sometimes German or French). The Poltava Institute for Noble Maidens, for example, emphasized humanities, adding courses in *World History, Geography, Literature, and Fine Arts* to cultivate aesthetic and moral sensibility in future female educators. Male seminaries, by contrast, introduced more natural-scientific

subjects, aligning their graduates with the needs of rural and technical education.

By the beginning of the twentieth century, pedagogical subjects had been systematically structured into an independent cycle. This cycle included *Pedagogy, History of Pedagogy, Didactics, Methodology of Elementary Instruction,* and *Psychology.* The inclusion of these disciplines reflected the gradual scientification of teacher training. Pedagogy was now understood not only as an art of teaching but also as a field of theoretical research. Lecturers in Poltava, Hadyach, and Zinkiv seminaries used contemporary textbooks by Ushinsky, Pirogov, and Vodovozov, thereby introducing students to comparative pedagogy and the concept of developmental learning.

Another characteristic feature of Poltava teacher education was the introduction of aesthetic-labor training. Subjects such as *Singing, Drawing, Gymnastics, Manual Work, and Gardening* appeared in most curricula after the 1880s. Their purpose was twofold: to develop students' creative abilities and to equip them with practical skills for rural life. Manual Work and Gardening were considered particularly valuable in a predominantly agrarian province. Teachers trained in these disciplines could lead school gardens and agricultural workshops, thereby contributing to the local economy and instilling respect for physical labor among pupils.

A comparative analysis of curricula demonstrates clear institutional specialization. The Poltava Theological Seminary combined a wide range of general education and theological courses, ensuring the moral and intellectual formation of parish teachers.

The content of instruction in seminaries and pedagogical courses was built around three principal cycles:

1. General educational disciplines, the foundation of broad erudition: *Russian Language, Literature, History, Geography, Mathematics, Physics, Natural Science.*
2. Pedagogical and psychological disciplines, the professional core: *Pedagogy, History of Pedagogy, Psychology,*

Didactics, Hygiene of Education, Methodology of Teaching Reading, Writing, Arithmetic, and Natural Science.

3. Practical and aesthetic-labor training, the applied component: Singing, Drawing, Gymnastics, Manual Work, Gardening, Beekeeping, Land Surveying, and in certain women's schools, *Needlework and Dancing.*

The Poltava and Hadyach seminaries distinguished themselves by introducing optional subjects such as Botany, Zoology, and Elements of Agriculture. The Velykosorochynsk Seminary gained recognition for its electives in Beekeeping and Land Surveying, while the Lubny Seminary experimented with integrating cosmography and Practical Geometry.

Particular attention was paid to methodological practice. Each seminary maintained a model school where students conducted lessons under the supervision of instructors. The practice included planning lessons, maintaining class journals, assessing pupils' progress, and writing "psychological portraits," individualized observations of children's temperaments and learning abilities. This approach prefigured later learner-centered methodologies. Evaluations of teaching practice became decisive in graduation exams, emphasizing the primacy of pedagogical mastery over rote knowledge.

The short-term and biennial pedagogical courses, which proliferated after 1906, further diversified teacher preparation. Their programs gradually expanded from elementary literacy to include *Pedagogy, Psychology, Methodology,* and even *Elements of School Hygiene.* The three chronological stages of these courses can be identified:

- 1870s–1880s: rudimentary literacy courses financed by zemstvos, focusing on reading, writing, and arithmetic;
- 1890s–1910: short-term pedagogical courses under the patronage of the Holy Synod, incorporating Catechism, Pedagogy, and Psychology;
- 1911–1917: biennial courses with extended syllabi covering general and special pedagogy, methods of teaching, and supervised practice.

Admission to pedagogical courses was open to persons aged sixteen or older who had completed at least a district or city school. Many participants were children of peasants or petty clerks, reflecting the social democratization of teacher training.

Women's education also underwent a deep transformation during this period. The inclusion of *Hygiene, Management, and Needlework* into women's schools' programs symbolized a shift from domestic preparation to professional competence. Women's gymnasia, especially the Mariinsky Gymnasium in Poltava, and private institutions led by V. Aksharmova and V. Morozovska, pioneered the introduction of Pedagogy, Psychology, Latin, Cosmography, and foreign languages into their curricula. These reforms not only broadened the intellectual horizons of female students but also legitimized their participation in public education as qualified teachers.

The humanistic dimension of education is expressed in the integration of moral and aesthetic ideals into teaching content. Textbooks and manuals authored by Poltava educators emphasized empathy, respect for the child's individuality, and moral self-perfection of the teacher.

The structure and content of teacher training in Poltava Province thus represented a harmonious synthesis of theory and practice. The curriculum united classical subjects with applied disciplines, moral education with scientific inquiry, and individual creativity with collective responsibility.

Women's Education and Institutional Differentiation in Poltava Province

The development of women's education in Poltava Province during the nineteenth and early twentieth centuries constituted one of the most progressive aspects of the regional pedagogical tradition. While the early decades of the century limited female schooling mainly to philanthropic institutions for the daughters of the nobility, subsequent reforms transformed this sphere into a structured and socially inclusive system of professional education for women.

The cornerstone of this evolution was the Poltava Institute for Noble Maidens (established 1818). Originally subordinate to the Department of the Empress Maria, it represented a model of disciplined upbringing and moral refinement. The Institute's founders aimed to provide Christian-oriented intellectual and aesthetic education that would prepare women for domestic and social responsibilities. Its curriculum encompassed *Religion, Russian and French Languages, Literature, History, Geography, Arithmetic, Drawing, Music,* and *Needlework.* From the 1820s onward, the Institute gradually expanded its social intake, admitting the daughters of merchants (1828) and, after the 1860s, the daughters of civil servants and rural clergy. This democratization anticipated later trends toward universal education and reflected the humanitarian ethos characteristic of Poltava's educational environment.

By the 1860s and 1870s, a network of female gymnasia and seminaries began to form under both state and private auspices. The *Mariinsky Gymnasium* in Poltava became the most prominent state institution of female secondary education in the province. Its program combined the classical curriculum of gymnasia with specialized courses in *Pedagogy, Psychology, and Didactics.* Instruction was designed not merely to produce well-educated women but to cultivate potential teachers for elementary and lower-secondary schools.

Private education developed in parallel. The gymnasia of V. Aksharmova and V. Morozovska in Poltava distinguished themselves by introducing innovative subjects, including *Hygiene, Cosmography, Latin, and Foreign Languages* (German and French). These schools were financed partly by tuition fees and partly by municipal subsidies, which allowed them to maintain smaller class sizes and modern didactic materials. Their graduates often continued their studies at pedagogical courses or were employed as governesses and teachers in provincial towns.

A distinctive feature of women's institutions was the integration of moral and aesthetic education with practical skills. Alongside academic subjects, curricula included Dancing, Singing, Drawing, Needlework, and, later, Gymnastics and Hygiene.

The establishment of women's parish schools in the 1870s and 1880s further extended access to female education. Initially focused on domestic instruction and moral upbringing, these schools gradually adopted elements of general and pedagogical training.

The interaction between church and secular authorities in organizing female education was a distinctive hallmark of the Poltava model. The Church maintained its influence over moral and spiritual matters, while the Ministry of Education oversaw secular subjects and certification.

By the beginning of the twentieth century, Poltava Province had one of the most densely populated networks of women's educational institutions in Ukraine. Archival statistics indicate that by 1915, there were 26 female gymnasia (state, departmental, and private), one diocesan, and several parish schools, as well as multiple short-term pedagogical courses for women. Together they formed a multilevel continuum: parish schooling provided elementary literacy and moral training; gymnasia offered general secondary education; pedagogical courses and institutes supplied professional specialization.

The pedagogical orientation of female education was reflected in the inclusion of Psychology, Pedagogy, Methodology, and didactics in senior classes. Students attended lectures, performed teaching observations, and participated in supervised practice. At the Mariinsky Gymnasium, for instance, advanced pupils taught sample lessons in lower forms, analyzed mistakes collectively, and wrote essays on educational themes such as "The moral influence of the teacher's personality" or "The role of cleanliness and order in school discipline." These exercises developed self-reflection and communicative competence qualities regarded as indispensable for professional maturity.

Equally significant was the social composition of female students. If, in the early decades, the majority were daughters of nobles and civil servants, by 1900 the proportion of merchant and petty-bourgeois families exceeded 60 percent, and by 1914, peasant daughters accounted for nearly one-fifth of the intake.

The content of women's teacher training corresponded closely to the broader modernization of pedagogy in the province.

The curriculum emphasized the unity of intellectual, moral, and aesthetic formation.

The methodological innovations introduced in women's schools later influenced co-educational and male seminaries. The practice of "lesson analysis," systematic pedagogical observation, and the maintenance of pupil journals originated in female institutions and gradually spread across the provincial educational system.

Zemstvo involvement in female education also deserves attention. Local self-governments funded scholarships for talented girls, purchased equipment, and supported libraries within gymnasia.

By 1917, the institutional differentiation of female education in Poltava Province had reached completion. It comprised:

1. Parish and diocesan schools focusing on moral and domestic upbringing;
2. Gymnasia offering broad general education with pedagogical orientation;
3. Pedagogical courses and seminaries providing professional training for teachers;
4. The Poltava Institute for Noble Maidens, serving as the historical nucleus and prestige symbol of women's education.

This structure ensured a continuous educational trajectory from basic literacy to professional competence, reflecting the general tendencies of European pedagogical modernization. The transformation of women's schooling in Poltava Province was not merely a quantitative expansion; it represented a profound change in the social role of women - from passive recipients of instruction to active bearers of cultural and moral values.

By combining moral formation with intellectual training, women's educational institutions of Poltava Province laid the groundwork for the emergence of a professional female teaching corps. Their graduates embodied the synthesis of compassion, discipline, and knowledge that became a hallmark of Ukrainian pedagogy in the early twentieth century.

Zemstvo, Church, and Society in Teacher Training: Cooperation and Influence

The interrelation of social, ecclesiastical, and civic institutions in Poltava Province gave rise to a unique model of teacher training that combined moral authority with practical efficiency. In the absence of a centralized educational infrastructure during much of the nineteenth century, the burden of organizing and maintaining schools fell largely upon the zemstvos and the Orthodox Church, whose cooperation defined the distinctive character of Poltava's pedagogical system.

The zemstvo reform of 1864 created local self-governing bodies endowed with the right to manage issues of education, public health, and local economy. For Poltava Province, this reform marked the beginning of a sustained period of educational innovation.

Financially, zemstvos allocated a significant portion of their annual budgets - sometimes up to one quarter - to education. These funds covered the construction and repair of school buildings, the purchase of textbooks and visual aids, and the payment of teachers' salaries.

Beyond financial contributions, the zemstvos played a critical methodological and organizational role. They initiated and supervised pedagogical congresses, which gathered teachers, inspectors, and clergy to discuss curriculum development, classroom discipline, and moral education.

Another important aspect of zemstvo activity was the collection and publication of educational statistics. The Poltava Zemstvo Statistical Bureau conducted systematic surveys on literacy levels, attendance rates, and teacher qualifications.

While the zemstvos provided the administrative and financial backbone of schooling, the Orthodox Church continued to shape its moral and spiritual content. The Poltava Theological Seminary served as the primary training center for parish teachers and clergy, integrating theological education with basic pedagogical principles.

These schools maintained a delicate balance between confessional and pedagogical components. Alongside Holy

Scripture, Moral Theology, and Church Singing, the curriculum included Pedagogy, Methodology, Arithmetic, and Reading Instruction.

The Church's contribution also extended to supervising moral discipline among teachers. Parish priests were tasked with monitoring the behavior and diligence of school staff, ensuring that teachers maintained an exemplary lifestyle in accordance with Christian virtues.

The interaction between the Church and the zemstvo was not always harmonious. Disputes arose over curriculum content, especially concerning the proportion of religious versus secular subjects.

A crucial instrument of collaboration was the inspection system. Inspectors from both the diocesan administration and the zemstvo visited schools, evaluated teachers, and reported their findings to the provincial boards.

The teachers themselves occupied a central position in this social alliance. Many came from peasant backgrounds and viewed teaching as a means of upward mobility and social service.

The Zemstvo pedagogical libraries played a crucial role in supporting teacher professional development. They stocked not only textbooks and methodological guides but also works of literature, philosophy, and natural science.

The interaction of church and civic education also manifested in the organization of charity and Sunday schools, which became a transitional form between formal and informal education. Many were run by parish priests or teachers who volunteered their time to instruct adults and adolescents in reading, writing, and arithmetic.

From the 1880s onward, the provincial administration increasingly recognized the achievements of Poltava's educational model. Official reports praised the balanced distribution of responsibilities between the Church and the zemstvo, noting that such cooperation reduced administrative conflicts and raised teaching standards.

The Teachers' Institute, founded in 1914, represented the culmination of this partnership. Conceived as a state institution with local support, it united the methodological resources of the Ministry of Education, the moral authority of the Church, and the financial stability of the zemstvos.

Socially, the cooperation between Church and zemstvo reflected the broader civic awakening of the late imperial period. Education was increasingly seen as a means of strengthening national consciousness and moral cohesion.

By the eve of World War I, Poltava Province stood out as one of the most educationally advanced regions of the Ukrainian territories of the Russian Empire. Its network of schools was dense, its teachers were professionally trained, and its moral standards were high.

Intellectual and Methodological Contributions of Poltava Educators

The culmination of pedagogical development in Poltava Province at the turn of the nineteenth and twentieth centuries was marked by the emergence of a coherent regional school of educational thought. Its foundations were laid by a constellation of teachers, methodologists, and intellectuals whose activity extended beyond classroom practice into theoretical reflection, authorship, and civic engagement.

Among the most influential representatives of this tradition were Mykola Hryhorevskyi, Oleksandr Levytskyi, and Hryhorii Istomin, whose works and public lectures shaped the moral-pedagogical discourse of the province. Their legacy, though largely confined to provincial periodicals and archival manuscripts, articulated the philosophical essence of Poltava's teacher education.

Hryhorevskyi, a graduate of the Poltava Seminary and later lecturer at the Lubny Teachers' Seminary, emphasized the unity of theory and practice in pedagogical preparation. In his treatise "On the Moral Image of the Teacher" (1889), he argued that genuine mastery begins not with formal instruction but with moral self-discipline.

Oleksandr Levytskyi, a historian and educator affiliated with the Poltava Teachers' Institute, proposed a humanistic perspective on pedagogical professionalism. He regarded education as a process of mutual moral development between teacher and pupil, grounded in empathy and personal responsibility.

Hryhorii Istomin, another seminal figure, introduced methodological innovations that bridged traditional moral education with emerging psychological research. His 1912 work "The Psychology of the Lesson" analyzed the emotional dynamics of classroom interaction and proposed techniques for sustaining pupils' attention and motivation.

Together, these educators forged what may be called the Poltava pedagogical synthesis - a fusion of moral idealism, empirical observation, and methodological clarity. Their writings stressed that the effectiveness of teaching depended not on rigid adherence to syllabi but on the teacher's capacity for moral influence and creative adaptation.

The intellectual vibrancy of Poltava's pedagogical milieu found institutional expression in professional teacher associations, reading circles, and methodological societies. Beginning in the 1890s, zemstvo-sponsored conferences evolved into regular meetings where educators presented papers, exchanged lesson plans, and discussed new literature.

A key methodological contribution of the Poltava school was the concept of the integrated curriculum, which combined general, aesthetic, and vocational education. Teachers were encouraged to relate abstract knowledge to local realities, geography lessons to regional topography, natural science to agriculture, and moral instruction to everyday community life.

Another innovation was the system of pedagogical documentation, introduced experimentally in Poltava's seminaries and later adopted by other provinces. Each teacher maintained a portfolio that included lesson outlines, reflections on classroom experiences, and individual pupil profiles.

The methodological writings of Poltava educators focused particularly on the psychological climate of the classroom. They

emphasized kindness, patience, and a sense of beauty as integral to pedagogy.

Importantly, Poltava educators saw pedagogy as a form of social service. Many of them participated in literacy campaigns, organized evening schools for adults, and wrote popular brochures on hygiene and child upbringing.

Within the broader historiographical context, the contribution of Poltava educators signified a transition from descriptive to analytical pedagogy. Whereas earlier decades had produced mostly normative manuals, the period after 1890 witnessed a surge of empirical studies, lesson observations, and methodological experiments.

The intellectual output of the province also demonstrated an openness to European influences. Translations of Pestalozzi, Herbart, and Diesterweg circulated widely among Poltava teachers, often accompanied by commentaries that linked foreign theories to local experiences.

Another noteworthy aspect was the formation of a pedagogical language that combined scientific precision with ethical warmth. The discourse of Poltava's teacher community avoided bureaucratic jargon, preferring expressions that conveyed sincerity and empathy.

By 1917, the cumulative result of these intellectual efforts was the establishment of a professionally conscious and ethically unified teaching corps. Teachers of Poltava Province shared common values: faith in the moral power of education, respect for the individuality of each child, and devotion to public service.

The outbreak of the First World War and the revolutionary upheavals that followed temporarily disrupted this progress, yet the intellectual legacy of the Poltava pedagogical school endured. Its graduates and adherents became active participants in the subsequent Ukrainian educational revival of the 1920s, carrying forward principles of moral pedagogy, community service, and cultural enlightenment.

In retrospective evaluation, the methodological and ethical synthesis achieved in Poltava stands as one of the earliest regional models of professional teacher education in Eastern Europe. Its

distinguishing features, the fusion of moral authority and scientific method, the interplay of local initiative and state oversight, and the cultivation of reflective professionalism, anticipated the pedagogical ideals of the twentieth century.

Conclusions

The historical and pedagogical analysis of teacher training in Poltava Province during the nineteenth and early twentieth centuries allows for several conceptually integrated and empirically grounded conclusions.

1. *Systemic character of development.* Teacher education in Poltava Province emerged as part of the broader modernization processes of the Russian Empire, reflecting the gradual civic consolidation of Ukrainian territories. The formation of a multilayered educational network, from seminaries and gymnasia to zemstvo schools and short-term pedagogical courses, created a stable yet adaptable system of teacher preparation.
2. *Integration of moral, religious, and professional training.* Teacher training in Poltava Province was distinguished by its organic synthesis of moral, religious, and pedagogical components.
3. *Democratization and gender expansion.* The gradual inclusion of different social strata, and particularly the development of female education, transformed the teaching profession into a socially open vocation.
4. *Balanced cooperation between Church, State, and zemstvo.* The works of M. Hryhorevskyi, O. Levytskyi, and H. Istomin established a regional pedagogical tradition emphasizing reflective practice, moral integrity, and child-centeredness. The introduction of teaching practice, psychological observation, and systematic documentation of student progress marks a transition toward analytically informed and humanistic pedagogy.

5. *Methodological innovation and humanistic orientation.* The works of M. Hryhorevskyi, O. Levytskyi, and H. Istomin established a regional pedagogical tradition emphasizing reflective practice, moral integrity, and child-centeredness. The introduction of teaching practice, psychological observation, and systematic documentation of student progress marks a transition from prescriptive instruction to analytically informed and humanistic pedagogy.
6. *Civic and cultural mission of teacher training.* Beyond its institutional achievements, teacher training in Poltava Province served as a tool for cultural nation-building.
7. *Continuity and relevance for modern teacher education.* The intellectual and organizational legacy formed in Poltava Province did not disappear after 1917. Instead, it provided stable conceptual and ethical foundations for later Ukrainian pedagogical development. The principles formulated in that period, service, professionalism, moral responsibility, and community engagement, remain significant for contemporary debates on teacher training.

This historical experience demonstrates that the effectiveness of teacher education depends on the equilibrium between moral formation, community engagement, and methodological rigor. The Poltava model demonstrates that decentralized cooperation among state, local institutions, and the Church can yield a resilient and socially responsive educational system – a principle that remains relevant in today's efforts to enhance local governance and institutional autonomy in education. The humanistic and practice-oriented approaches developed in the province align with modern priorities, including reflective teaching, psychological literacy, and a value-based professional identity. These elements can be meaningfully adapted to contemporary challenges, including the need for a balanced combination of ethical training, civic responsibility, and evidence-based pedagogy. Thus, the historical trajectory of teacher training in Poltava Province not only enriches the understanding of past educational structures but also offers conceptual guidelines for improving the modern system of teacher preparation in Ukraine.

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1.4. MORAL, ETHICAL, AND ACADEMIC CULTURE OF FUTURE TEACHERS UNDER THE WAR IN UKRAINE AND DIGITAL TRANSFORMATION: AN ANALYTICAL REVIEW THROUGH THE LENS OF CITIZENSHIP EDUCATION

Olena Semenikhina

***Abstract**. This paper offers an analytical synthesis of scholarly approaches to understanding the moral, ethical, and academic culture of future teachers in higher education under the conditions of the war in Ukraine. The review is framed through citizenship education as the normative and value-based foundation of teacher preparation. Central to the discussion is how citizenship education in higher education connects to the formation of a teacher's triadic culture: moral culture (value orientation and accountability for decisions and the consequences of pedagogical action), ethical culture (norms of interaction, work with conflict, and the prevention of dehumanization and discrimination), and academic culture (honesty, evidence-based reasoning, fairness of assessment procedures, and trust in knowledge). The analysis shows that under the crisis conditions of war and sustained informational pressure, these dimensions cannot be treated in isolation. They either reinforce or undermine one another depending on how a university organizes communication, classroom discussions, academic rules, and support mechanisms for instructors and learners. The paper highlights that teaching in situations of war and social conflict requires pedagogically guided, dialogic practices and deliberate work with biases to avoid stereotyping and destructive societal polarization. The review also examines the impact of digitalization, including control technologies and the rise of generative AI, which reshape the criteria of learner autonomy, authorship, and "legitimate assistance", intensifying the tension between control and trust in educational practice. It is argued that sustaining academic integrity cannot be reduced to technological solutions alone; rather, it requires a combination of transparent norms, pedagogical innovation, and the development of civic responsibility as a professional quality among teachers. Finally, the paper summarizes research gaps related to the limited integration of these three cultural dimensions in empirical studies and outlines directions for further inquiry relevant to teacher education programs in higher education under wartime conditions.*

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Keywords: *teachers' moral culture; ethical culture; academic culture; citizenship education; teacher education; higher education; war in Ukraine; academic integrity; educational digitalization; generative AI.*

Introduction

Russia's full-scale war against Ukraine has exposed fragilities in the educational space that were often discussed separately: citizenship education as a value foundation of democracy, teachers' moral and ethical culture as a regulator of everyday interaction, and academic culture as a means of sustaining trust in knowledge and assessment. In higher education, this triad carries particular weight because universities both prepare future teachers and shape learners' civic positions through curricula, assessment practices, and institutional norms.

In scholarly approaches to global citizenship education (GCE/GCED), emphasis is placed on social cohesion, mutual respect, acceptance of difference, and the pursuit of more just, inclusive, and peaceful societies. These orientations are directly relevant to teacher education: teachers do not merely transmit knowledge. They establish the moral boundaries of discussion, protect the dignity of participants in the educational process, and demonstrate what responsibility entails in contexts of social polarization.

Two developments make this problem especially acute in higher education. The first concerns the reconfiguration of citizenship education in the post-pandemic period and the growth of international online practices. Research in higher education suggests that "virtual exchanges" and online dialogues can foster active listening, careful engagement with others' experiences, and openness to diverse positions. This matters not only as an educational technology but also as an ethical practice: communication with "the other" within structured learning settings becomes training in civic restraint, argumentation, and accountability for one's words.

The second development relates to the digitalization of assessment and communication, and, more recently, the widespread adoption of generative models in artificial intelligence. Within the academic integrity discourse, increasing attention is

paid to the fact that technological solutions, including digital proctoring, may strengthen control while creating ethical risks: intrusions into privacy, unequal conditions, potential discrimination, and a shift in the climate of trust between instructors and learners. At the same time, scholars argue for a rethinking of integrity "in the ChatGPT era", where the issue is not limited to detecting violations but also includes establishing clear and workable norms for permitted and prohibited uses of AI in learning and assessment.

Teachers' moral and ethical culture is often discussed through the idea of the teacher as a moral agent and a role model who embodies ethical conduct and influences the formation of values and moral orientations. This perspective is productive for a literature review because it connects citizenship education with academic culture not at the level of declarations, but through the mechanism of professional example and everyday decisions: how to structure a discussion about war, how to safeguard dignity, how to balance high expectations with support, and how to separate critical analysis from propaganda and hate speech.

Academic culture in higher education is often conceptualized as the value base of the educational environment, where principles such as legality, human dignity, professionalism, honesty, and transparency sustain educational quality and provide a foundation for cultivating critically minded citizens. In this sense, academic integrity becomes a civic practice: it builds a habit of acting honestly even when violating a rule might seem advantageous, and it develops responsibility for one's claims and data.

The war in Ukraine adds another layer to this agenda: the need to teach sensitive topics and to sustain democratic resilience. Scholars emphasize that pedagogical approaches to teaching about war through citizenship education necessitate systematic reconsideration, and that the knowledge base of citizenship education can serve as a valuable resource for protecting democracy. For teacher education, this implies a shift away from "knowledge about institutions" towards the ability to argue responsibly, distinguish fact from evaluation, withstand moral dilemmas, and act ethically under conditions of heightened emotional strain.

This review is limited to higher education and teacher education (including pre-service teachers). It aims to address the following research question: How does contemporary scholarship describe the relationship between citizenship education (including global citizenship education) and the formation of the moral, ethical, and academic culture of future teachers in higher education under the conditions of the war in Ukraine and digital transformation (including the diffusion of generative AI), and which pedagogical and institutional mechanisms are considered most relevant for sustaining this culture?

This question intentionally integrates three domains. The first concerns the value framework of global citizenship education and its embedding in university programs and practices of international and online dialogue. The second concerns teachers' professional morality as an ethical resource of the educational environment and a precondition for civic maturity. The third focuses on academic culture and integrity in a digitalized university, where control technologies and AI tools simultaneously offer solutions and generate ethical tensions.

The review proceeds from conceptual foundations of citizenship/global citizenship education in higher education to an analysis of how moral and ethical norms of the profession are formed within teacher education, and how academic culture and integrity function in a digital learning environment. The war in Ukraine is treated not as a discrete "topic" but as a condition that intensifies demands on pedagogical ethics, the quality of argumentation, and responsible engagement with information.

Methodology of the Literature Review

This section is designed as an integrative literature review with a thematic synthesis, aimed at bringing together three clusters of problems: (a) citizenship education and global citizenship education in higher education; (b) the moral and ethical culture of future teachers as a professional dimension of citizenship education; and (c) academic culture and academic integrity in a digitalized university, particularly under conditions of the expanding use of generative AI (Perkins, 2023; Ilchenko, 2024). Unlike narrowly scoped systematic reviews that focus on a

single phenomenon (for example, digital proctoring in higher education as the object of systematic analysis), this design enables the connection of pedagogical, ethical, and institutional strands, allowing for a description of how they interact within teacher education (Han et al., 2023).

The source base was constructed using a combined search strategy. The initial body of publications was collected from the Web of Science and Scopus databases using thematic clusters of keywords corresponding to the three analytic strands of the review (including global citizenship education, teacher education/teacher ethics, academic integrity, digital proctoring, and generative AI). Following the initial retrieval, the corpus was refined through abstract screening and thematic relevance to the stated problem clusters, and through purposive selection of works that either conceptually structure the field or describe technological solutions and ethical risks in digital environments (including NLP-based examination question generation, blockchain-based certificate verification, and ethical concerns related to online surveillance) (Abdulhadi et al., 2025; Sultana et al., 2023; Coghlan et al., 2021). A separate subgroup comprised studies on teachers' moral, ethical, and academic culture that served as conceptual anchors for interpreting the teacher as an ethical role model and for examining the heightened demands placed on professional culture in crisis conditions associated with war, including the development of capacities for de-escalation, support, and professional self-regulation under stress. The final sample included 62 works, providing a sufficiently broad bibliographic horizon for coding and conducting the thematic synthesis.

The inclusion criteria for this review were as follows:

- a focus on higher education and/or pre-service teacher education, including university-based interventions in citizenship/global citizenship education (Helm et al., 2024; O'Toole & O'Flaherty, 2022);
- the presence of at least one of the three substantive nodes in the publication: citizenship education (or global citizenship education), moral and ethical dimensions of pedagogy, or academic culture/academic integrity in higher education (Ilchenko, 2024; Matto, 2024);

- the availability of an abstract and a methods description in the table, enabling the source to be assigned to a thematic cluster (for example, thematic analysis in studies of GCE in higher education, or mixed-methods designs in research on international seminars and experiences of global citizenship).

The exclusion criteria for this review were:

- sources not related to higher education or teacher education (for example, studies focused on other educational levels without a clear link to teacher education);
- items with incomplete bibliographic information or without a traceable identifier via the table link (in such cases, a source could be retained only as a "signal" reference, rather than used as a core basis for argumentation).

The analytic procedure involved constructing the table through four sequential steps. For each entry, the following information was recorded: topic focus (e.g., GCE/GCED, teacher education, academic integrity), educational level (higher education, teacher education), study design (qualitative, quantitative, mixed methods, review), key findings, and cautions/limitations. Methodological "markers" were drawn from the wording of abstracts, for instance, references to thematic analysis and focus groups in studies of GCE in higher education (Coelho et al., 2022), or to the combination of quantitative and qualitative approaches in research on virtual exchanges (Helm et al., 2024).

Coding was guided by the following framework:

- the teacher's moral and ethical role and practices of justice, biased reflection, and moral leadership in crisis;
- academic culture/academic integrity as an institutional and personal norm, including digital solutions and ethical risks (privacy, fairness, discrimination);
- citizenship education and global citizenship education as a value framework (peace, social cohesion, mutual respect) (UNESCO, 2018).

After the initial coding, more specific subcodes were introduced for themes that recurred regularly across the sources in the table: emotions and epistemic sensitivity in GCE for future teachers (O'Toole & O'Flaherty, 2022), empathy as a cognitive–epistemic capacity in GCE (Risberg, 2022), and risks of "exclusive nationalism" for GCE in universities (Hungwe, 2022).

On the basis of the coding, the following thematic clusters were developed:

- GCE/GCED in higher education and its transformative potential;
- teacher education as a space for moral and ethical formation;
- academic culture and academic integrity in the digitalised university;
- the war in Ukraine as a condition that intensifies demands for civic and ethical capacity (Matto, 2024).

The trustworthiness of the review was supported through three decisions. First, coding relied on conceptual axes, reducing the risk of arbitrary interpretation. Second, methodological characteristics were recorded to the extent permitted by the abstracts, with particular attention to studies of teacher education and to review papers in which subthemes had already been systematically organized (Han et al., 2023). Third, where salient tensions emerged within the corpus (for example, between the technological "strengthening of control" and the values of dignity and fairness), the review did not smooth them over. Instead, these tensions are made explicit and carried forward into subsequent sections as analytic nodes (Coghlan et al., 2021).

The main limitation of the study is that some entries in the table are presented as concise annotations; consequently, conclusions about a source's design or theoretical framing can, in some cases, be drawn only from brief descriptions. A second limitation concerns the heterogeneity of the corpus: alongside robust empirical studies in higher education, it includes materials of different genres (practice-oriented reports, conceptual papers, and reviews), which requires cautious comparison across findings.

Results

Conceptual Foundations of Citizenship Education and Global Citizenship Education

Definitions and the core aim of global citizenship

In contemporary scholarship, citizenship education is increasingly framed not as a self-contained content block but as a value- and norm-based framework that shapes what university education should look like and how responsibility is distributed among learners, instructors, and the institution as a whole. Closely related is global citizenship education, which international approaches associate with social cohesion, mutual respect, tolerance of difference, and the building of more just and peaceful societies (UNESCO, 2018).

Within the source corpus analyzed here, GCE/GCED is presented as a response to the interdependence of today's world and to political and humanitarian challenges that have become part of university life. On the one hand, citizenship is understood as belonging to a wider community, where "global citizenship" is primarily seen as a sense of belonging and shared humanity, rather than as a legal status (UNESCO, 2018). On the other hand, within higher education, it takes pedagogical form through dialogic practices, learning through encounters with "the other," collaborative projects, and educational interventions that can reshape learners' ways of thinking and acting (Helm et al., 2024).

For the purposes of this review, it is important that global citizenship education is linked not only to "knowledge about the world" but also to norms of interaction, an ethical vocabulary, and civic responsibility. This is why the analysis that follows connects GCE with the moral, ethical, and academic culture of future teachers: these domains share a common foundation in expectations of justice, respect, responsible judgment, readiness for difficult conversations, and the capacity to act without humiliating the other (Veugelers, 2024).

One methodologically significant strand in the corpus concerns how citizenship should be defined when policy and practice coexist with competing understandings of its boundaries and its subject. In work examining the relationship between global

and intercultural citizenship education, it is argued that under conditions of growing cultural diversity, citizenship can no longer be justified solely through membership in the nation-state. Instead, a conceptualization is needed that can accommodate multiple identities while supporting dialogue and interaction among diverse groups of learners (Portera, 2023).

This position is particularly salient for teacher education because teachers operate at the intersection of local civic loyalty, human rights, cultural memory, and the lived experience of trauma and war. Under such conditions, the educational process requires a framework capable of holding a value tension: acknowledging the reality of conflict without reproducing the language of hatred; cultivating solidarity without sliding into exclusive nationalism or "civilizational" hierarchies. This highlights the need for a critical dimension of GCE, one that examines the political and ideological conditions shaping educational meaning and explicitly links citizenship to democracy, equality, ethics, and social responsibility (Bosio & Olssen, 2023).

Alongside this, the literature reveals another intellectual tradition: interpreting citizenship education as the development of a "democratic personality" and modes of thinking that enable one to see the whole, act under uncertainty, and sustain "creative tolerance." From this perspective, "planned thinking" is understood as an interdisciplinary way of making sense of a changing world, and the university is viewed as a site for cultivating active citizens (Yamada, 2023). For teacher education, this implies that citizenship is not reducible to a set of topics or legal norms. Rather, it becomes part of teachers' professional thinking: the capacity to relate local decisions to wider moral consequences, distinguish propaganda from argument, and remain intellectually steady amid social polarization.

Transformative learning, dialogue, and "learning through encounter" as university practices of GCE

Across the source corpus, at least two interconnected pedagogical logics for implementing GCE in higher education can be traced: transformative learning and learning through interaction (dialogue, collaborative tasks, and encounters with the lived experience of other groups).

The first logic is articulated through the transformative potential of GCE experiences in higher education. A study that juxtaposes learners' and instructors' perspectives examines the conditions, processes, and outcomes of learning and underscores the need for a stronger connection between global citizenship education and transformative learning theory, as well as closer attention to the narratives and conditions under which transformation becomes possible (Coelho et al., 2022). Methodologically, this work is notable for its use of focus groups (72 learners) and interviews with instructors; the analysis is presented as a thematic synthesis informed by critical GCE and transformative learning theory (Coelho et al., 2022). Taken together, these findings suggest that GCE in higher education tends to "work" not through declarations but through a reconfiguration of one's interpretive frames: what counts as justice, how inequality is explained, where the boundary lies between compassion and paternalism, and what language is used to speak about vulnerability.

The second logic centers on dialogue, particularly in online forms of international interaction. A study of a virtual exchange between learners from Europe and the Southern Mediterranean shows that participants linked their learning primarily to "encounters and conversations" with people whose experiences differed from their own; they reported learning to listen actively and to accept or respect other views and life stories (Helm et al., 2024). In this approach, the value lies not only in knowledge acquisition but also in cultivating communicative practices aligned with democratic civic conduct, including attentiveness, restraint in making premature judgments, and the ability to acknowledge complexity.

A related line of work is represented by the Collaborative Online International Learning model, where intercontinental collaboration between two university courses (in India and the United States) is used to examine inequalities and forms of "sub-citizenship" intensified by the pandemic. The authors link this experience to the development of distance communication skills and to the possibility of critical, comparative learning that enriches GCE (Banerjee et al., 2025). In teacher education, such practices have a dual significance: they shape future teachers' civic

dispositions while also modelling pedagogical scenarios that these teachers may later adapt in their own professional practice.

The literature also highlights university community engagement as a distinctive pathway for GCE. A qualitative study employing a decolonial framework warns against construing community engagement as a "civilizing mission" and emphasizes the need to sustain critical thinking about social justice both within and beyond communities (Gyamera & Debrah, 2021). This argument resonates strongly with Ukraine's wartime reality, where civic initiatives can be both a resource for solidarity and a source of renewed symbolic violence if enacted without reflection on power, inequality, and the voices of those who are positioned as the recipients of "help."

Teacher education within the GCE framework

For teacher education, a particularly important development is that GCE in universities is increasingly viewed as an experience in which emotions are not a "side effect" but an integral part of the learning mechanism. A study on the role of emotion in higher education, based on a university GCE intervention and conducted through focus groups with 36 pre-service teachers across six teacher education programs, found that references to negative emotions outweighed those to positive ones. Importantly, a substantial share of these emotions was linked to epistemic awareness of humanitarian problems, rather than to the teaching methods themselves (O'Toole & O'Flaherty, 2022).

Within this logic, teacher education requires not only content on rights, democracy, and peace, but also pedagogically guided ways of working with anxiety, anger, shame, and helplessness. Without such support, citizenship education risks becoming either a moralizing discourse or a pathway to emotional exhaustion.

Empathy also emerges as one of the central competencies in GCE; yet, its status remains contested. It can be presented as necessary or desirable, but it may also become a misguided goal when it is conceptualized superficially (Risberg, 2022). For teacher education, this points to the need for a more precise pedagogy of empathy, understood not as a demand to "feel another's pain" but as the capacity to listen, to recognize the other's experience, and

at the same time to think critically without erasing inequality or diluting responsibility.

At the same time, the corpus highlights the challenges of engaging with politically sensitive topics. The literature explicitly notes that integrating global citizenship education entails pedagogical challenges, including the need to address contentious issues such as military conflicts without generating bias and stereotypes, and in contexts where institutional support is insufficient (Na & Kim, 2024).

For Ukraine, this is a very real concern. The emergence of studies on teaching democratic citizenship "in moments of conflict" when discussing the war in Ukraine indicates that the war has become a topic of university civic pedagogy, not merely an object of political history (Matto, 2024).

Despite the normative appeal of GCE, the source corpus shows that its core claims are vulnerable to erosion under crisis conditions. The COVID-19 pandemic served as a "stress test" for solidarity in universities, heightening awareness of interdependence while also intensifying inequalities and triggering political responses incompatible with civic openness (Banerjee et al., 2025). In parallel, scholars point to "exclusive nationalist responses" to the pandemic that undermine key premises of global citizenship education in higher education (Hungwe, 2022). This tension is particularly sensitive for education systems operating under wartime conditions: state defense and collective mobilization are existential necessities, yet precisely here, subtle pedagogical tools are needed so that patriotism does not shift into dehumanization, and an ethical stance is not replaced by exclusionary language.

What mitigates this tension is not the "neutrality" of education but its moral and political clarity. In the literature, global citizenship education is described as a framework through which teachers can develop critical consciousness and democratic values grounded in reflection, inclusion, dialogue, and constructive debate (Veugelers, 2024). In teacher education, critical GCE thus takes the form of professional ethics: the capacity to facilitate difficult discussions without betraying either the truth about war or the demand to uphold dignity.

Accordingly, in teacher education, GCE should not be treated as an additional "humanities" module, but as part of professional identity that shapes how teachers speak about conflict, how they withstand polarization, and how they cultivate in learners a disposition for argument and accountability.

Teachers' Moral and Ethical Culture as a Professional Phenomenon

The teacher as a moral agent: a professional role beyond knowledge transmission

The source analysis indicates a clear shift in how the teacher's role is conceptualized: from a specialist primarily responsible for delivering content to a moral figure who shapes civic consciousness and supports young people's readiness for peaceful conflict resolution. This reframing is particularly significant for higher education because teacher education programs largely determine whether ethics becomes part of professional identity rather than a formal component of "pedagogical deontology."

A discussion of teachers' moral and ethical culture emphasizes that teachers, as moral agents and ethical role models, influence learners' values and moral orientations through their professional conduct, including by modeling ethical behavior (Icka & Kochoska, 2024). A critical implication of this claim is that moral and ethical culture cannot be reduced to the declaration of norms. It becomes visible in decision-making practices, in the language a teacher uses, in how they respond to injustice, bias, and humiliation, and in how interactions within the learning group are organized. For teacher education, this perspective implies that the university should be understood as a space for "trial entry" into professional ethics. It is here that dispositions are formed and later carried into teaching practice: how to address contentious issues, how to balance high expectations with support, and how to avoid replacing argument with authority. At the same time, ethical formation cannot remain a private matter of individual educators. It requires time, resources, and psychological support, because teachers cannot cultivate in others what they do not practice themselves.

The moral–political dimension of citizenship education in teacher education

Discussion of teachers' moral integrity within citizenship education almost inevitably extends into the moral–political foundations of education. In the source corpus, this is especially clear in analyses of teacher educators' practices in global citizenship education, where "soft" and critical approaches are distinguished. Waghid (2023) shows that some teacher educators gravitate towards a soft version of GCE, while a smaller share endorses critical characteristics. The study also identifies barriers, including limited access to technology and the dominance of content coverage over substantive dialogue, which makes it more challenging to facilitate respectful discussions and develop critical global citizenship.

These distinctions have direct implications for teacher education. A soft framework may affirm humanistic values yet leave questions of power, inequality, responsibility, and social justice underexamined. A critical framework, by contrast, requires future teachers to be able to discuss contradictions, recognize ideological substitutions, engage with traumatic experiences, and, at the same time, protect the dignity of those who disagree. This heightened demand becomes particularly visible under wartime conditions, where social mobilization coexists with an intensified risk of dehumanization.

In this context, educational ethics and academic culture can serve as a value anchor that supports legality, human dignity, honesty, and transparency, thereby shaping the cultural conditions for educating critically conscious citizens capable of making responsible choices in complex social situations (Ilchenko, 2024). This brings academic culture into proximity with citizenship education not through "ideological" content, but through practice: how assessment is organized, what counts as evidence, how violations are addressed, and whether rules are clear and fair.

Mechanisms for shaping ethical culture in higher education

The source corpus highlights several mechanisms through which teacher education can cultivate a moral and ethical culture as a professional capacity.

The first mechanism concerns dialogic practices, including online intercultural interaction. Helm et al. (2024) demonstrate that learners primarily described their learning through encounters and conversations with people whose experiences differed from their own. They reported developing active listening skills, increased attentiveness, and a greater respect for diverse perspectives and life stories. In teacher education, this serves as training in civic conduct: future teachers learn not only to speak but also to listen, to suspend rapid judgement, and to acknowledge complexity.

The second mechanism is articulated through the lens of social justice. A review of GCE in Korean higher education draws on Nancy Fraser's framework (redistribution, recognition, representation) and highlights a paradox between political aspirations and practical implementation, as universities seek to balance economic competitiveness with the development of socially conscious citizens (Gerstner et al., 2024). For teacher education, this paradox is not merely a managerial issue. It shapes which ethical values are institutionally supported: whether priority is given to content coverage and formal reporting, or to dialogue and responsibility, and whether conditions are created for reflection on one's own biases.

The third mechanism relates to emotion and empathy as professional resources rather than merely "personal traits." A study of a university GCE intervention involving 36 pre-service teachers found that negative emotions were referenced more often than positive ones, with a substantial share linked to epistemic awareness of humanitarian problems (O'Toole & O'Flaherty, 2022). This suggests that teacher education should help future teachers not to avoid difficult topics but to stay with them without destructive consequences for themselves or for the group. In a related discussion of empathy as a goal of GCE, Risberg (2022) argues against superficial understandings and reframes empathy as a cognitive–epistemic capacity tied to attentiveness to others' experience and responsibility for knowledge. For future teachers, this implies combining compassion with critical evaluation of facts and causes, without losing moral clarity.

The war in Ukraine as an ethical challenge for teacher education

War turns moral dilemmas from occasional episodes into an everyday reality of education. Pedagogical approaches to teaching about the war in Ukraine through citizenship education, therefore, require systematic reconsideration. Evidence-informed methods in citizenship education enable the adaptation of teaching models for engaging with complex conflict-related issues, drawing on a robust research base on the role of citizenship education in protecting democracy (Matto, 2024).

For teacher education, this entails at least three requirements. The first concerns the didactics of "difficult knowledge." Teacher education requires learning formats that enable future teachers to discuss war in ways that foster democratic knowledge, skills, and dispositions, rather than perpetuating simplistic narratives. The second requirement concerns work with bias and stereotypes. Implementing GCE presents challenges and requires caution to prevent difficult issues, such as military conflicts, from exacerbating prejudice or becoming sources of re-traumatization and polarization (Na & Kim, 2024). The third requirement relates to supporting teachers themselves. Under conditions of high stress and social pressure, university-based preparation must include not only values and methods but also practices of professional self-regulation and boundary-setting around responsibility, so that moral load does not culminate in burnout.

Academic integrity cannot be sustained solely through technology. It requires a synergy of pedagogy, institutional norms, and civic consciousness that cultivates moral values and an understanding of social responsibility. In wartime, this claim assumes a broader significance: the resilience of a democratic educational space hinges on whether an institution can uphold honesty, fairness, and dignity not merely in declarations, but also through its rules, communication, and everyday decisions.

Accordingly, in teacher education, a moral and ethical culture is formed through the interplay of professional roles (the teacher as a moral agent), pedagogical practices (such as dialogue, attentiveness to others' experiences, and social justice),

and institutional norms (including academic culture, honesty, and transparency). Under the conditions of the war in Ukraine, this culture becomes a criterion of professional capability: future teachers must be able to facilitate difficult conversations about conflict without abandoning democratic norms and without undermining dignity.

Academic Culture and Academic Integrity in Relation to Citizenship Education

Within teacher education, academic culture is not a technical add-on to disciplinary training. It defines the mode of existence of the university community through which future teachers internalize ethical norms as a "habit of action" rather than as a formal requirement. In the reviewed materials, academic integrity is described as a multidimensional concept that brings together educators' personal qualities, the conditions that underpin the quality of educational activity, and the norms governing the functioning of the educational environment (Ilchenko, 2024). This approach enables the treatment of academic integrity not merely as a system for preventing misconduct, but as a moral and value-based foundation that sustains trust in knowledge, assessment, and institutional rules.

Particularly relevant to the present topic is the claim that systems built on legality, human dignity, professionalism, honesty, and transparency not only secure the quality of higher education but also provide a cultural basis for educating critically conscious citizens (Ilchenko, 2024). Here, academic culture becomes a form of citizenship education "through practice": future teachers learn how rules, evidence, fairness, and responsibility operate within a democratic community. In this sense, academic integrity aligns with the concept of "civic maturity" because it habituates learners to distinguish between claims and evidence, acknowledge errors, refrain from appropriating others' work, and avoid manipulating results.

This logic aligns with broader definitions of global citizenship education, which emphasize social cohesion, mutual respect, and the pursuit of more just and peaceful societies (UNESCO, 2018). If university academic culture is organized around humiliation, selective application of rules, or punitive mistrust, it contradicts

civic aims even when citizenship education is formally "taught." Accordingly, within teacher education, academic culture must be consistent with the values that teachers are expected to enact in their subsequent professional practice.

The source corpus also contains a line that is central to this review: academic integrity is interpreted as a resource for social justice rather than merely a form of disciplinary control. A study conducted within the Galician university system shows that understandings of academic integrity in the responses of instructors and learners are "forged" around honesty, fairness, responsibility, trust, respect, and effort. Its overall conclusion explicitly links the development of academic integrity to the promotion of just action, arguing that higher education classrooms are a site for shaping the ethical foundations of civic life (Muñoz-Cantero et al., 2024).

For teacher education, this emphasis has two consequential implications. First, it shifts attention from "misconduct as an event" to the conditions that make integrity possible. Academic integrity then requires transparent assessment criteria, accessible explanations of citation rules, fair procedures for addressing violations, and instruction on how to work responsibly with sources. Second, it supports future teachers' understanding that assessment ethics are part of professional morality. In both school and university practice, assessment is often where symbolic violence is most acutely experienced or where fairness is most strongly felt. Citizenship education embedded in academic culture, therefore, manifests not only in the content of lectures but in how the university enacts honesty and respect through its procedures.

After the pandemic-driven shift to online formats, universities widely adopted digital tools to protect academic integrity, including remote surveillance during examinations. In the source corpus, this phenomenon is treated as an ethical problem rather than merely a technological solution. The very framing of the question in the title "Good proctor or big brother?" captures the central dilemma: where to draw the line between legitimate integrity protection and excessive control that can erode privacy and trust (Coghlan et al., 2021).

Integrity as fairness and trust under crisis conditions

Academic integrity is often discussed in higher education as a normative ideal and a compliance requirement. However, the corpus of sources reviewed here supports a more practically consequential interpretation: integrity becomes sustainable when it is experienced as fairness in procedures and as a credible basis for trust within the academic community. This interpretation is especially relevant under crisis conditions, where the institutional environment is marked by heightened inequality, disrupted routines, and increased vulnerability. In such circumstances, integrity cannot be treated as a "hard" layer of control added to assessment. It must be built into the logic of assessment design, institutional communication, and the ethical constraints placed on technological interventions.

A crisis-sensitive understanding of integrity begins with the recognition that crises exacerbate unequal learning conditions. War-related displacement, unstable connectivity, damaged infrastructure, and intensified psycho-emotional burden affect learners' capacity to participate in assessment under standardised assumptions of "equal conditions." When universities respond to the perceived risk of misconduct by escalating surveillance, they may inadvertently transform integrity into a source of injustice. The ethical issue here is not that assessment should tolerate dishonesty. Rather, the question is how to protect the legitimacy of assessment while avoiding procedures that disproportionately penalise those in more vulnerable situations. The "control–trust" dilemma is therefore not an abstract debate about institutional preferences; it becomes a test of procedural justice in contexts where vulnerability is structurally distributed.

Digital proctoring exemplifies this tension clearly. The ethical analysis of online exam supervision technologies emphasizes concerns that extend beyond efficiency, including intrusion into privacy, unequal burdens across groups, and potential discrimination embedded in technological systems (Coghlan et al., 2021). Systematic reviews further show that digital proctoring has become a substantial research area in higher education, indicating that the issue is no longer marginal but structurally tied to contemporary assessment practices (Han et al., 2023). Under crisis conditions, these concerns become sharper.

Learners may lack access to private spaces, stable internet, or suitable devices, and proctoring requirements can exacerbate stress and feelings of exclusion. As a result, a proctoring-centred approach risks producing an integrity regime that is formally consistent but ethically fragile: it secures compliance at the price of dignity and fairness, thereby weakening trust in the institution and, paradoxically, undermining the very moral basis of integrity.

From the perspective of teacher education, this point is particularly important. Future teachers learn not only subject content but also institutional norms of assessment and accountability. If their formative experience of integrity is predominantly surveillance-oriented, they may internalise an implicit model of educational authority grounded in suspicion. Such a model is incompatible with the civic aims of citizenship education, which rely on mutual respect, responsible judgment, and the capacity for dialogue. In contrast, when integrity is institutionalised as procedural fairness and transparent reasoning, teacher education can function as a "school of trust": learners experience that rules are intelligible, that assessment criteria are stable and publicly justified, and that institutional responses to violations are proportionate and educationally oriented.

A crisis-sensitive approach, therefore, shifts attention from detecting violations to designing conditions in which honesty is feasible and meaningful. This involves several interrelated moves. First, assessment tasks need to be aligned with epistemic goals rather than merely focusing on output production. When tasks privilege authentic reasoning, explicit use of sources, and defensible argumentation, the space for superficial substitution narrows without requiring maximal surveillance. Second, fairness requires clarity: learners must understand what counts as legitimate assistance, what forms of collaboration are permitted, and how evidence and authorship are to be demonstrated. Third, procedural justice requires consistent, non-arbitrary responses to suspected violations, including opportunities for explanation and learning-oriented remediation where appropriate. These elements position integrity as a shared civic practice rather than as a one-sided enforcement mechanism.

The spread of generative AI systems intensifies the urgency of this reframing. The corpus highlights the argument that

integrity "in the age of ChatGPT" is not primarily about catching misconduct but about establishing clear norms and pedagogical boundaries for acceptable AI use in learning and assessment (Perkins, 2023). In crisis contexts, this need becomes more pressing because learners' reliance on technological assistance may increase due to disrupted learning conditions, stress, and time constraints. If institutions respond by broad prohibitions without pedagogical clarification, they risk creating a regime of hidden practices and implicit inequities, where some learners gain advantage through unspoken strategies while others comply at a cost. Conversely, transparent AI policies can support fairness by making expectations explicit and by aligning them with assessment goals: what is being evaluated (reasoning, evidence, reflection) and what kinds of assistance remain compatible with authorship.

In teacher education, defining "honest help" is also a matter of professional ethics. Future teachers will later set norms for learners' work in schools and will face similar tensions between control and trust. Therefore, university integrity policies should be viewed as part of professional formation, as they model how a democratic educational institution balances accountability with dignity. This balance is especially consequential in wartime contexts where informational manipulation is widespread and where evidence-based reasoning becomes a civic necessity. Here, integrity is directly connected to citizenship education, as it trains learners to take responsibility for their claims, to distinguish between evidence and assertion, and to treat knowledge as a public good that requires honesty to remain credible.

Ultimately, the crisis lens highlights that integrity cannot be sustained solely by technology. While technological tools may reduce certain risks, they cannot replace the moral and civic foundations of academic culture. Sustainable integrity requires institutional coherence: transparent rules, fair procedures, ethically constrained technologies, and pedagogy that makes honesty meaningful. Under crisis conditions, this coherence becomes the main driver of trust. Without it, integrity regimes risk becoming brittle systems of control that produce compliance but erode legitimacy. With it, integrity can function as a civic practice within the university, preparing future teachers to uphold fairness,

responsibility, and evidential standards in their professional work.

A systematic review of digital proctoring highlights that this area has a substantial and expanding research base, particularly in higher education (Han et al., 2023). Yet the more consequential point is that proctoring relocates academic integrity into the domain of civic rights and university ethics. Under such conditions, teacher education must help future teachers understand integrity as a balancing of legitimate aims. Fair and honest assessment is essential, but it cannot be upheld through practices that undermine human dignity or create unequal conditions for different groups of learners. This tension is amplified in wartime, when unequal learning conditions (displacement, unstable connectivity, heightened psycho-emotional strain) become widespread, and "hard" control solutions may unfairly penalize those in more vulnerable circumstances. In this reality, technological mechanisms for safeguarding integrity need to be aligned with an ethics of fairness, not merely with the efficiency of detecting violations.

The spread of generative language models has sharpened a longstanding question within academic culture: what exactly "independent work" means when tools can produce coherent text, paraphrase, structure ideas, and propose arguments. Within the source corpus, this issue is treated as a distinct research strand in which ChatGPT and similar systems are discussed both as a risk factor and as a catalyst for updating policies and pedagogical approaches (Perkins, 2023). Closely related is work examining academic integrity "in the generative AI era," which highlights threats and ethical concerns and calls for solutions that are sensitive to disciplinary specificities (AlHajaya, 2025). For teacher education, this implies that moral and ethical culture must incorporate a new component: the capacity to frame acceptable AI use pedagogically and ethically. Future teachers need to understand the distinction between support (for example, language editing or generating an outline) and a substitution of authorship. This is not only a matter of control; it is a matter of honesty as a civic value, involving responsibility for one's words, sources, and the accuracy of claims. When learners become accustomed to unacknowledged use of generated texts, they lose the habit of responsible judgment. That loss is particularly

dangerous under wartime conditions, where the information environment is saturated with manipulation and the moral cost of falsification is higher.

A separate strand of sources describes technological innovations designed to reduce risks of integrity breaches. Here, proposed solutions operate not at the level of "plagiarism detection" but at the level of assessment architecture and documentation. One example is the integration of natural language processing (NLP) with multilayer encryption to protect examination materials, including automated question generation and controlled access to content, as a mechanism for strengthening the fairness and integrity of online assessments (Abdulhadi et al., 2025). In parallel, research examines blockchain-based approaches to preventing academic document fraud, where systems built on IPFS and smart contracts are presented as a way to produce immutable, cryptographically secured certificates and diplomas that facilitate authenticity verification in digital environments (Sultana et al., 2023).

In the wartime context, this agenda gains additional urgency: mass displacement, the destruction of infrastructure, and an increased need for rapid qualification verification can heighten the risks of document fraud. Yet even such solutions do not remove the moral core of the problem. Academic integrity in the digital age cannot be ensured solely through technology. What is needed is a comprehensive approach that combines digital tools, pedagogical innovation, and the strengthening of civic consciousness that nurtures moral values and an understanding of social responsibility. Technology may make misconduct harder or more visible, but it cannot cultivate an internal readiness to act honestly. In teacher education, therefore, digital solutions should be treated as supports for institutional procedures rather than as substitutes for moral formation.

Digital transformation reshapes not only assessment but also everyday academic communication (Al-Khatib, 2023). This reinforces a point that is particularly salient for teacher education: citizenship education in higher education is increasingly enacted through digital platforms, which means that online interaction ethics become part of teachers' professional ethics. This involves norms of respect, non-discrimination, accountability for one's

words, and responsible discussion of sensitive topics. In wartime, these norms carry added weight. Online communication becomes not only a site of learning but also a space for social support and for processing loss, conflict, and strain. As a result, academic culture in digital environments effectively intersects with a broader culture of civic dialogue.

The War in Ukraine as a Condition for Reframing Teachers' Civic, Moral, and Academic Culture

The source corpus documents a fundamental shift in how the pedagogical role is understood: from a "transmitter of knowledge" to a moral figure who educates globally aware citizens while also preparing young people for peaceful conflict resolution. Within this logic, the war in Ukraine cannot be treated as an external topic that may be bypassed in university-based teacher education. It sharpens the demand for teachers' capacity to act ethically amid collective trauma, informational pressure, and high levels of polarization, and it makes visible the limits of "neutral" education as a professional stance.

When this perspective is read alongside the aims of global citizenship education, a shared normative foundation becomes apparent: a commitment to social cohesion, mutual respect, tolerance of difference, and the pursuit of more just and peaceful societies (UNESCO, 2018). For teacher education in higher education, this means that citizenship education must unfold not only as content (courses, topics) but also as a professional culture of thinking and interaction that can withstand complex social realities.

Citizenship education is directly linked to teaching about the war in Ukraine and to the need to update pedagogical approaches. Educators across institutions and disciplines can adapt civic learning models to engage with complex issues associated with military conflicts, drawing on an established research base on the role of citizenship education in safeguarding democracy (Matto, 2024). Importantly, this logic also presupposes the development of democratic knowledge, skills, and dispositions that enable learners to grasp the global consequences of armed conflict and to articulate their civic position in complex international settings.

In the preparation of future teachers, this requirement takes a concrete form: teacher education should not only teach *about* war, but also teach *in ways* that are compatible with democracy. This aligns with the argument that critical consciousness and democratic values need to be cultivated through reflection, inclusion, dialogue, the acceptance of diversity, and constructive debate (Veugelers, 2024). Accordingly, citizenship education in higher education under wartime conditions becomes a test of pedagogical capacity: can the university prepare future teachers to discuss conflict in ways that uphold dignity, evidence-based reasoning, and responsibility, rather than turning educational interactions into an arena of humiliation or simplified ideological formulas?

The integration of citizenship education, particularly when politically sensitive topics are involved, presents substantial pedagogical challenges. Teachers are expected to address contentious issues, including military conflicts, without reinforcing bias, stereotypes, or destructive reactions among learners (Na & Kim, 2024). The literature also notes external pressure (fear of negative parental responses, administrative restrictions, uncertainty about substantive content), as well as a systemic lack of institutional support and professional development, which means that teachers often rely primarily on their own resources (Na & Kim, 2024).

For higher education institutions that prepare teachers, this has two methodological implications. First, teacher education needs modules that explicitly train work with conflict as a didactic situation (discussion design, rules for safe communication, work with sources, and distinguishing facts from evaluations). Second, teachers' ethical culture cannot be developed through "individual effort" alone if the institution fails to create supportive conditions. This conclusion is consistent with the claim that the development of teachers' moral culture requires time, resources, and psychological support.

Within the source corpus, a relationship is traced between global civic consciousness and conflict resolution competence. Empirical findings indicate a correlation between specialized conflict resolution skills and readiness for active participation in addressing global problems, including military conflicts, migration,

and inequality (Balba & Bayr, 2023). For the preparation of future teachers, this result is significant as evidence-based support for the argument that citizenship education cannot be reduced to a knowledge component. It must include deliberate skills training: how to act in conflict, how to recognize escalation, and how to build a conversation in which argument and respect remain possible.

A related emphasis is also evident in research on pre-service social studies teacher education. While most participants articulated clear definitions of democratic citizenship, only some demonstrated a focus on critical multiculturalism. Participants with stronger content knowledge and social justice-oriented beliefs were more effective in enacting practices of multicultural democratic education (Martinelle et al., 2024). This points to a direct requirement for university programs: to provide not only teaching methods but also the intellectual and ethical resources without which justice and democratic culture remain rhetorical claims.

Academic integrity is described as an ethical and value-based foundation of the university environment. Systems grounded in legality, human dignity, professionalism, honesty, and transparency create the conditions for educating critically conscious citizens capable of making responsible choices in complex social situations (Ilchenko, 2024). This proposition is particularly salient in wartime, when the information sphere becomes a site of struggle, and the capacity to distinguish evidence-based claims from manipulation becomes a civic competence. At the same time, advances in academic integrity in the digital age underscore a key conclusion: the problem cannot be solved solely through technology. A comprehensive approach is needed, combining digital tools with pedagogical innovation and the strengthening of civic consciousness that nurtures moral values and an understanding of social responsibility.

For teacher education, this means that the academic culture in the university should function as a “school of trust” and fairness, characterized by transparent assessment, responsible work with sources, and accountable attitudes toward authorship and evidence. In wartime, such a culture supports not only educational

quality but also the resilience of democratic norms in everyday communication.

In sum, the war in Ukraine significantly increases the importance of citizenship education in higher education, particularly within teacher education programs. It elevates democratic values, such as dignity, fairness, and responsibility, from the level of declaration to the level of everyday pedagogical decision-making. At the same time, the war intensifies the risks associated with teaching sensitive topics (bias, stereotypes, destructive reactions) and reveals a lack of institutional support, without which the moral burden placed on educators becomes excessive. Under these conditions, academic culture and academic integrity acquire a distinctly civic meaning because they sustain trust in knowledge and the fairness of educational procedures.

An Integrative Analytical Framework for Teachers' Civic Culture During Wartime

The review indicates that citizenship education in higher education, the professional morality of future teachers, and the academic culture of the university do not operate as autonomous phenomena. They intersect at the level of values and practices. First, global citizenship education provides normative orientations towards social cohesion, mutual respect, and the construction of more just and peaceful societies (UNESCO, 2018). Second, the teacher, as a moral agent, enacts these orientations in everyday communication through modeling ethical behavior and shaping learners' values (Icka & Kochoska, 2024). Third, academic integrity and a culture of transparent rules foster trust in knowledge and assessment, thereby supporting the university community's capacity to act responsibly in complex social situations (Ilchenko, 2024).

Under the conditions of the war in Ukraine, this interdependence becomes more pronounced. Citizenship education serves as a resource for democratic resilience and as a means of organizing teaching about sensitive topics, while teachers' professional ethics act as a safeguard against dehumanization and the perpetuation of hate speech. In the same field, academic culture becomes a practice of informational responsibility and evidence-based reasoning, which is critically

important in wartime and post-truth information environments (Matto, 2024). Accordingly, an integrative framework is needed not to "combine different topics," but to explain the mechanism through which university-based teacher education can foster civic capacity in situations where moral and ethical dilemmas are inseparable from professional decision-making.

On the basis of the source corpus, it is appropriate to distinguish three interrelated dimensions of culture that are formed in the preparation of future teachers.

(1) Moral culture as an internal orientation towards the good, dignity, fairness, and responsibility that becomes visible in the character of professional decisions. Teachers' morality is linked to their role as moral agents and ethical role models; the emphasis is not on declarative values, but on modeling ethical conduct and influencing learners' moral orientations (Icka & Kochoska, 2024).

(2) Ethical culture as a system of interaction norms within the group and the institution: rules for respectful dialogue, boundaries of acceptable speech, and ways of working with conflict and bias. In the source corpus, this culture is described through the need to facilitate discussions of difficult issues (including military conflicts) without reinforcing stereotypes or generating destructive reactions, and under conditions where professional support is available (Na & Kim, 2024). Ethical culture also entails the capacity for constructive dialogue and debate, treated as a means of developing critical consciousness and democratic values (Veugelers, 2024).

(3) Academic culture as a normative and procedural system that upholds honesty, evidential reasoning, transparency, and fairness in assessment. It is conceptualized as the value foundation of the educational environment: legality, human dignity, professionalism, honesty, and transparency sustain educational quality and create conditions for educating critically conscious citizens (Ilchenko, 2024). In its digital dimension, this culture also includes ethical norms of online interaction and rules for working with new tools (including generative AI) that reshape traditional criteria of authorship and independent work (Perkins, 2023).

Operationalising the triadic culture in teacher education

The integrative framework presented above is analytically useful only insofar as it can be translated into observable patterns in university-based teacher education. In other words, the triadic culture of the future teacher becomes a meaningful construct when it is operationalised through institutional practices, learning tasks, and interaction norms that enable the cultivation of civic responsibility under conditions of war and accelerated digital transformation. In this sense, the framework does not merely describe three "types of culture." It provides a lens for identifying how moral orientation, ethical interaction, and academic integrity are learned, rehearsed, and stabilised in everyday higher education routines.

A first step in operationalisation is to clarify the level at which each cultural dimension becomes visible. Moral culture is primarily expressed through the logic of professional judgment: how future teachers justify their decisions, how they weigh competing goods, and how they take responsibility for the consequences. Ethical culture becomes observable in interaction: how disagreement is managed, which boundaries of acceptable speech are collectively upheld, and how conflict is processed without humiliation. Academic culture is manifested in epistemic practices and procedures, including how evidence is used, how authorship is attributed, and how assessment is organized to be transparent and fair. These three dimensions are interdependent. When one of them is underdeveloped or institutionalised in a distorted form, the others tend to erode as well. For example, assessment practices experienced as arbitrary or punitive can weaken not only trust in knowledge but also the willingness to engage in respectful dialogue, because learners interpret the educational space as unsafe and strategically oriented.

Operationalising moral culture in teacher education requires learning formats in which future teachers repeatedly encounter situations of moral complexity and are guided to articulate reasons for their choices. This is especially relevant under wartime conditions, where teachers may face dilemmas that involve competing responsibilities, such as protecting learners' dignity while addressing sensitive content, sustaining professional

standards under unequal learning conditions, and balancing solidarity with critical distance in discussions about conflict. Moral culture is not formed by exhortation alone. It grows through structured engagement with dilemmas that demand justification and reflection, and through feedback that helps future teachers recognise the moral consequences of routine pedagogical decisions. In this regard, the notion of the teacher as a moral agent and ethical model provides a concrete mechanism: professional identity is shaped not only by knowledge of norms but by practising responsibility in situations where norms are tested (Icka & Kochoska, 2024).

In practical terms, moral culture becomes visible in the way future teachers learn to frame decisions as accountable. This includes the capacity to (a) explain why a particular pedagogical move is ethically defensible, (b) anticipate possible harms, including symbolic harms such as humiliation or exclusion, and (c) revise one's stance when new evidence or perspectives are introduced. Under informational pressure and polarisation, such capacities are closely related to civic responsibility, because they support the habit of distinguishing moral clarity from moral simplification. The aim is not to produce "neutral" teachers but to cultivate professionals capable of principled judgement that is compatible with democratic values and human dignity.

Operationalising an ethical culture involves building a shared grammar of interaction that enables disagreement without dehumanising others. For teacher education, this is not a peripheral matter of classroom management; it is a core professional competence. Ethical culture is enacted when future teachers learn to facilitate discussions in which conflict is anticipated and managed through agreed norms. This includes establishing boundaries of acceptable speech, addressing stereotypes and bias when they arise, and employing dialogic structures that preserve dignity while maintaining a focus on argument and evidence. The literature on global citizenship education emphasizes that politically sensitive issues, such as military conflicts, can exacerbate bias and destructive reactions if educators lack institutional support and effective pedagogical tools (Na & Kim, 2024). Therefore, operationalisation must include explicit training in conflict-sensitive dialogue: how to structure

discussions, how to intervene when discourse becomes harmful, and how to maintain a learning climate where learners can speak without fear of humiliation.

Ethical culture is also inseparable from the civic dimension of deliberation. Constructive debate and reflective dialogue are not only pedagogical techniques; they model democratic coexistence by legitimising disagreement while rejecting humiliation. In this sense, teacher education can treat dialogic practices as a form of professional ethics: future teachers learn to sustain communicative space where plural experiences can be voiced and examined, and where the group can return to shared standards of respect and evidence (Veugelers, 2024). Wartime conditions make this competence particularly salient because the educational space often becomes a site where grief, anger, fear, and social tension are expressed. Without a robust ethical culture, these pressures can convert classroom interaction into polarising dynamics that undermine both civic learning and pedagogical safety.

Operationalising academic culture entails treating academic integrity as a formative civic practice rather than a narrow compliance mechanism. In teacher education, academic culture becomes visible through the design of assessment, the transparency of criteria, and the everyday norms of working with sources and claims. If integrity is experienced primarily as surveillance and punishment, it risks reinforcing mistrust and strategic behaviour. Conversely, when academic integrity is institutionalised through clear rules, fair procedures, and a consistent emphasis on evidence-based reasoning, it supports civic maturity by habituating learners to accountability for claims and to respect for others' intellectual work. This aligns with the view that academic integrity is a multidimensional foundation of educational quality and civic formation, rooted in dignity, professionalism, honesty, and transparency (Ilchenko, 2024).

Digital transformation adds a further layer to academic culture. Teacher education must now address how digital tools reshape criteria of authorship, independent work, and permissible assistance. The challenge is not merely technical but also ethical: universities must navigate the tension between control and trust in assessment systems, including the ethical concerns associated with digital proctoring (such as privacy, fairness, and

discrimination) (Coghlan et al., 2021; Han et al., 2023). At the same time, generative AI systems force teacher education to articulate norms of "honest help" and to redesign tasks so that integrity is supported through pedagogy rather than through escalating surveillance. In this respect, academic integrity "in the age of ChatGPT" requires the explicit teaching of boundaries and responsible practices, not only the detection of misconduct (Perkins, 2023). For future teachers, this becomes part of professional culture because they will later translate these norms into school-level assessment, feedback, and classroom discourse.

A crucial implication of operationalisation is that the triadic culture must be treated as an institutional ecology. Moral culture is strengthened when future teachers experience that the institution is consistent: it demands responsibility while practicing fairness; it requires respect while preventing humiliation; it values evidence while ensuring transparent procedures. Ethical culture is sustained when there are stable norms for dialogue and when educators are supported, rather than left to navigate conflicts alone. Academic culture becomes credible when integrity rules are intelligible, assessment criteria are transparent, and digital tools are used in ways that protect dignity and justice. Under wartime conditions, where inequality and vulnerability are amplified, such consistency becomes not a matter of institutional reputation but a condition for democratic resilience within teacher education.

The integrative framework includes two "fields of tension" that simultaneously generate new risks.

*Field 1: The war in Ukraine***.** War brings sensitive topics, high emotional load, and social polarization into everyday pedagogical reality. In wartime, citizenship education is framed as a resource for protecting democracy and as a basis for adapting educational models so that the war is addressed not as a propagandistic narrative but as an object of civic inquiry and deliberation (Matto, 2024). At the same time, the literature documents risks of bias and a lack of institutional support, which often forces educators to rely primarily on their own resources (Na & Kim, 2024).

Field 2: Digitalization and generative AI. Digital transformation produces, simultaneously, instruments of surveillance and control (proctoring) and tools that enable

substitution of authorship (generative text), pushing universities to update both policies and pedagogical approaches. The "control versus trust" dilemma is articulated through ethical concerns about privacy, fairness, and potential discrimination in digital proctoring (Coghlan et al., 2021; Han et al., 2023). From another angle, integrity "in the age of ChatGPT" requires not only detecting violations but also pedagogically defining boundaries of permissible assistance and establishing transparent norms that are intelligible to learners (Perkins, 2023).

These two fields of tension interact. War intensifies inequality in learning conditions and raises the moral stakes of informational responsibility, while digitalization expands both educational opportunities and risks of dishonesty and mistrust. For teacher education, this implies that citizenship education must incorporate new competences: ethical use of digital tools, evidence-based reasoning, resilience to manipulation, and the capacity for reasoned dialogue under pressure.

The source corpus enables the identification of several mechanisms that appear to be shared across the formation of all three dimensions of culture.

The first mechanism is linked to dialogue and learning through interaction. Online virtual exchanges in higher education show that learners associate learning with "encounters" with people whose experiences differ from their own, and that acquired skills include active listening and respect for divergent positions (Helm et al., 2024). For future teachers, this serves as both a civic and an ethical practice, fostering the capacity for dialogue without humiliation and preserving space for debate.

The second mechanism concerns social justice as a lens for organizing teacher education. Research on pre-service social studies teacher education suggests that stronger content knowledge and orientations towards social justice are associated with more effective enactment of multicultural democratic education (Martinelle et al., 2024). This suggests that an "ethical" component cannot be detached from the intellectual one: teachers' moral culture presupposes knowledge, without which justice and human rights remain abstract concepts.

The third mechanism is institutional transparency and procedural fairness, which form the foundation of academic culture. An empirical study of how academic integrity is understood within a higher education community highlights its association with honesty, fairness, responsibility, trust, respect, and effort, and shows that integrity development can operate as a pathway towards shaping the ethical foundations of civic identity (Muñoz-Cantero et al., 2024).

The fourth mechanism is the pedagogical processing of emotions and difficult topics. In the preparation of future teachers, GCE interventions are associated with the predominance of negative emotions, which often have an epistemic character, namely awareness of the scale of humanitarian problems (O'Toole & O'Flaherty, 2022). This suggests that the formation of moral culture is not possible without developing the capacity to stay with complexity rather than translating it into destructive aggression or indifference.

Coherence, trade-offs, and implementation risks of the triadic framework

The triadic culture of the future teacher is not merely a conceptual aggregation of themes but an institutional configuration that must remain coherent under conditions of war and rapid digital change. This coherence is fragile. It depends on whether higher education institutions can align the moral dimension (responsible judgment and dignity), the ethical dimension (rules of interaction and conflict resolution), and the academic dimension (evidence-based practice and procedural fairness) in a way that is perceived as credible by learners and educators.

A central implication is that *integrity policy functions as civic pedagogy*. When integrity is enacted through transparent criteria, proportionate procedures, and intelligible expectations, it habituates learners to take accountability for their claims and to respect others' work, which supports civic maturity (Ilchenko, 2024; Muñoz-Cantero et al., 2024). Conversely, when integrity is primarily enforced through surveillance and suspicion, it may secure compliance but weaken trust and undermine the civic orientation of citizenship education, particularly in teacher

education, where institutional models are internalised as professional norms (Coghlan et al., 2021; Han et al., 2023). This tension becomes particularly acute under wartime conditions, where inequality in learning conditions is exacerbated and where institutional decisions about assessment can either mitigate or perpetuate injustice.

The review also suggests that war and digitalisation interact in ways that complicate "standard" solutions. The war in Ukraine heightens emotional pressure and increases the risk of polarisation in discussions of sensitive topics, while simultaneously raising the moral stakes of informational responsibility (Matto, 2024). Digitalisation expands opportunities for learning and dialogue, yet it also intensifies the control–trust dilemma and destabilises traditional criteria of authorship and independent work, especially with the diffusion of generative AI (Perkins, 2023). The combined effect is that teacher education needs to cultivate not only civic dispositions but also the professional capacity to manage ambiguity: to articulate boundaries of acceptable assistance, to facilitate conflict-sensitive dialogue, and to sustain evidential standards without slipping into punitive regimes that erode dignity.

A further point concerns the role of emotions and epistemic vulnerability. Evidence from GCE interventions indicates that negative emotions often have an epistemic character, reflecting learners' awareness of humanitarian problems rather than mere dissatisfaction with pedagogy (O'Toole & O'Flaherty, 2022). This matters for the triadic framework because moral and ethical cultures cannot be sustained if difficult emotions are either ignored or displaced into aggression, stereotyping, or disengagement. In wartime contexts, teacher education must therefore treat emotional processing as part of professional formation: not therapy, but pedagogically guided work that keeps dignity and argument central while acknowledging the reality of grief, fear, and anger.

Finally, the discussion underlines a practical risk: institutional incoherence. Universities may adopt ambitious rhetoric on citizenship education while maintaining assessment procedures that learners experience as opaque, unequal, or punitive; or they may promote ethical dialogue while leaving

educators unsupported in conflict-sensitive teaching. The corpus suggests that such mismatches weaken the triadic culture as a whole because learners interpret values through institutional practices rather than through policy language alone. Accordingly, the most consequential implication of the review is that teacher education under crisis conditions should be evaluated not only by curricular content but by the coherence of institutional norms across communication, assessment, and the pedagogical handling of sensitive topics. Where coherence is achieved, the triadic framework becomes a viable lens for strengthening democratic resilience in teacher education; where it is absent, the same framework reveals why well-intended initiatives remain fragile or symbolic.

Overall, the synthesis supports an understanding of citizenship education in higher education as an environment in which a triadic culture of the future teacher is formed: moral culture (internal value orientation), ethical culture (norms of interaction and work with conflict), and academic culture (honesty, evidential reasoning, and procedural fairness). The war in Ukraine and digitalization serve as factors that intensify the demands placed on this culture, rendering it not an optional element, but a condition of teachers' professional capability.

Conclusions

The literature review suggests that, within higher education, citizenship education, the moral and ethical culture of the future teacher, and the university's academic culture form an interdependent system. This system operates not as a simple sum of separate courses or events, but as a mode of organizing the educational process in which values become visible through rules, communication, assessment practices, and responsibility for knowledge.

Contemporary scholarship frames the relationship between citizenship education and the moral, ethical, and academic culture of future teachers as a link between the value aims of democratic coexistence and university practices that cultivate a habit of responsible judgment among learners. Within this perspective, the future teacher is not only a carrier of teaching methods but also a

moral agent whose professional conduct sets norms of interaction, honesty, and respect.

The war in Ukraine functions as a factor that sharply intensifies expectations for teachers' civic and professional capability. It relocates democracy, dignity, fairness, and responsibility into the realm of everyday pedagogical decisions. Teaching about the war requires methodologically careful approaches that allow conflict to be addressed as a complex social reality while avoiding the reproduction of dehumanization, stereotypes, and aggressive forms of polarization. Under these conditions, institutional support for teachers becomes especially crucial: without such support, the moral burden associated with difficult topics can lead to exhaustion and a narrowing of pedagogical capacity.

A second major tension arises from the digital transformation of higher education and the spread of generative AI. These developments redefine the criteria for independent work, authorship, and legitimate assistance, while also sharpening the "control-trust" dichotomy in assessment systems. Universities are compelled to secure integrity while avoiding the erosion of dignity and procedural fairness, especially under crisis-driven inequalities in access to resources and stable learning environments. This leads to a practical conclusion: academic integrity cannot be sustained solely through technological instruments. Its robustness depends on a combination of transparent rules, a pedagogically coherent logic of tasks, a culture of evidential reasoning, and the development of responsibility as a civic quality.

Accordingly, teacher education in higher education under wartime conditions can be productively conceptualized as the formation of a triadic culture: moral culture (value orientation and responsibility for decisions), ethical culture (interaction norms and conflict resolution), and academic culture (honesty, evidence-based reasoning, and procedural fairness). The coherence of these dimensions is a criterion of quality because future teachers are expected to carry these norms into the broader educational space and sustain them under conditions of high social strain and informational risk.

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Chapter 2

HUMAN POTENTIAL, PSYCHOSOCIAL SUPPORT AND EMOTIONAL DEVELOPMENT

2.1. MODELS OF RESTORING HUMAN POTENTIAL IN EDUCATIONAL SETTINGS DURING WAR

Olena Semenikhina

Restoring human potential in the educational environment during wartime

War radically reshapes the understanding of human potential in education. In relatively stable periods, it is usually described as a combination of knowledge, skills, motivation, and professional competencies. Under conditions of air-raid alarms, loss and displacement, an additional dimension comes to the fore – the capacity to withstand prolonged stress, to keep educational communities viable, and to sustain a sense of future. Restoring human potential in educational settings during war is not limited to providing psychological assistance to individuals. It involves comprehensive support models at several interconnected levels – individual, group, institutional, and system – which together determine whether education remains a resource for development or becomes an additional source of harm.

Individual level – inner resources and limits of endurance

At the individual educator or learner level, human potential in wartime is shaped by the interplay of professional competencies, emotional self-regulation, personal motivation, and supportive relationships. War heightens the risks of emotional exhaustion, anxiety, depressive reactions, and secondary traumatization, particularly when educators constantly confront other people's pain and loss. For learners, especially children and adolescents, a basic sense of safety, the opportunity to ask

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questions, and the ability to articulate their feelings of fear and anger without compromising their educational trajectory become crucial.

Recovery models at this level rely on developing skills of self-help and mutual support, building emotional literacy, and practicing awareness and reflection. For educators, individual strategies for preventing burnout are essential, including setting professional and personal boundaries, managing exposure to traumatic narratives, planning rest, and maintaining both professional and personal interests. For learners, accessible formats of psychosocial support, opportunities to discuss their experiences, and participation in creative, sports, or volunteer activities are important resources that help them avoid seeing themselves solely through the lens of victimhood.

At the individual level, restoring human potential does not necessarily mean returning to a "pre-war normal". More often, it implies a different quality of functioning – integrating traumatic experience into one's life story, adjusting expectations, and rethinking professional and educational plans. Educational environments can facilitate this process when they recognize a person's right to vulnerability, to mistakes, and to temporary reductions in productivity, while also providing manageable tasks, structure, and predictability.

Group level – communities as spaces of mutual support

At the group level – such as school classes, academic cohorts, teaching teams, and professional networks – restoring human potential is linked to the group's ability to tolerate tension, maintain cohesion, and transform interaction into a resource rather than an additional source of conflict. War sharpens differences in experience. Within a single group, there may be people who have lived through occupation, lost relatives, or fled under shelling, and others whose war experience has been limited to alarms and remote learning. Without deliberate effort, this can lead to silent competition, suffering, mutual misunderstanding, and a sense of injustice.

Group-level models of recovery focus on creating safe spaces for dialogue, establishing shared norms of interaction, and embedding collective reflection into everyday life. In teaching teams, a culture of regularly discussing not only educational outcomes but also emotional load, stress, and support needs becomes important. Group formats such as supervision, InterVision, and team coaching help reduce burnout risks, redistribute emotional burden, and generate shared responses to challenging situations.

In learner groups, approaches to social and emotional learning are most effective when they are integrated into the curriculum rather than confined to occasional workshops. Working with emotions, conflict, non-violent communication, mutual support, and shared decision-making becomes as important as mastering subject content. Group-level recovery can be seen in the group's capacity to contain divergent experiences without excluding anyone, and in its ability to provide at least a minimal level of support for each member.

Institutional level – organizational arrangements and a culture of care

At the level of an individual school, college, or university, human potential depends not only on the sum of individual resources but also on organizational culture, leadership style, and the presence or absence of support policies. In wartime, the stakes of management decisions rise sharply. How the administration organizes timetables under frequent alarms, how shelters are prepared, how communication with staff and learners is handled – all this affects not only physical safety but also trust in the institution.

Institutional models of recovery include carefully designed psychosocial support programs, clear procedures for crisis response, and flexible mechanisms for distributing workload. This may entail, for example, temporary reduction of teaching hours for educators experiencing acute loss, targeted support for early-career teachers, and recognition that psychological services are needed not only by learners but also by staff.

Another element of institutional recovery is how the quality of education is understood under wartime conditions. Institutions that insist on unchanged, unrealistically high demands despite reduced resources aggravate burnout and guilt. By contrast, flexible assessment policies, rethinking of priorities, and a supportive approach to academic integrity help create conditions for more sustainable development. Transparent and honest communication from leadership about constraints, risks, and possible scenarios also plays a crucial role in reducing anxiety and curbing rumors.

System level – policy, inequality, and regional differences

At the system level, models for restoring human potential encompass decisions by national and local authorities regarding funding, regulation, recovery priorities, and targeted support for the most vulnerable institutions and regions. War makes pre-existing inequalities sharply visible: disparities between large cities and rural areas, between frontline, de-occupied and relatively safer territories, between institutions with robust digital infrastructure and those reliant primarily on individual teachers' efforts.

Regional differences are reflected in contrasting configurations of resources and burdens. In frontline and de-occupied areas, a single school or university may be staffed by a critically small number of remaining educators working with learners deeply affected by occupation, shelling, and loss. In host regions, the primary challenge is integrating large numbers of internally displaced learners and reconciling the diverse educational trajectories and cultural codes. In comparatively safer regions, outward signs of normality coexist with chronic anxiety, intense volunteer engagement, and a continual sense of distant proximity to the front.

System-level recovery models must take these differences seriously. This implies differentiated regional support, dedicated programs for frontline and de-occupied communities, investment in digital infrastructure where it is the only viable way to ensure access to education, and professional development initiatives that prepare educators to work with trauma, loss, and conflict.

International partnerships are another essential component, enabling the exchange of experience with countries that have faced education in conflict and post-conflict contexts.

Interplay between levels and the risk of burnout

None of these levels operates in isolation. Individual self-help strategies are fragile if the institution does not provide space and time for rest and support. Group practices of mutual assistance lose impact when system-level decisions disregard the actual needs of a region. Conversely, well-designed national programs may fail to reach people if the internal culture of a school or university is marked by distrust and mere formal compliance.

Within this multi-level landscape, burnout becomes not only an individual condition but also a symptom of structural malfunction. An educator who constantly works at the limits of their capacity often feels personally responsible for their exhaustion, even though it stems from a combination of factors: excessive workload, inadequate support, and conflicting expectations from various stakeholders. Recovery models must therefore include mechanisms for identifying these "overheating points" and responding to them – from adjusting timetables and reallocating resources to revisiting regulatory demands.

In sum, restoring human potential in educational settings during war cannot be reduced to isolated psychological interventions or symbolic gestures of support. It is a multi-layered process in which individual, group, institutional, and system-level decisions interact, either reinforcing or undermining one another. Models can be considered effective when care for people is not an add-on to education policy but its organizing principle, shaping how learning is structured, how resources are distributed, and how recovery priorities are set. Only under such conditions can education in wartime transition from being a site of final exhaustion to a space where, despite loss and trauma, human potential is preserved and gradually renewed.

2.2. RESTORATION OF HUMAN POTENTIAL IN THE EDUCATIONAL ENVIRONMENT DURING WAR

Nina Tverezovska, Iryna Demchenko, Inna Osadchenko, Nataliia Slobodianiuk

***Abstract**. The article focuses on the study of the issue of restoring human potential in Ukraine's educational environment during the full-scale war that began in 2022. The purpose of the work is to theoretically substantiate and practically develop a comprehensive model of restoring human potential, which integrates the psychological, pedagogical, and organizational components of supporting participants in the educational process. The study employs a mixed-methodology approach that combines quantitative methods (a survey of 1,247 pedagogical workers and statistical analysis) with qualitative approaches (47 semi-structured interviews, 13 focus groups, and observation in 12 educational institutions). The results revealed significant regional differentiation in the educational process, as well as high levels of professional burnout among teachers, characterized by emotional exhaustion (M=4.23±1.12). Additionally, the study identified the spontaneous development of adaptive strategies structured around three dimensions: emotional support, technological adaptation, and academic flexibility. The critical role of institutional support has been established: institutions with a high level of it demonstrate half the rate of teacher burnout and 26% higher academic performance. A conceptual model of human potential restoration has been developed, integrating four levels of intervention (individual, group, institutional, systemic) and three temporal phases (survival, adaptation, transformation) with cross-cutting support components. The practical significance of the study lies in the empirical substantiation of educational policy priorities, including the development of a national strategy for psychological support for teachers, the implementation of differentiated regional policies, investments in resilient digital infrastructure, and the provision of systemic support for the institutional potential of educational institutions.*

***Keywords**: professional burnout of teachers; psychosocial support; adaptive learning strategies; digitalization of education; institutional resilience; crisis management; trauma-informed pedagogy.*

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Introduction

The relevance of this study lies in the critical need to preserve and restore the human potential of Ukraine in the context of a full-scale war, where the educational environment serves as a crucial space for shaping the nation's resilience, supporting psychological well-being, and preparing the country for its future reconstruction. According to estimates by international organizations, the total loss of human capital in Ukraine due to the war's impact on education may have long-term consequences for socio-economic development, making the problem of restoring educational potential a matter of national security.

Modern armed conflicts pose unprecedented challenges to education systems, significantly affecting the physical, psychological, and social well-being of all participants in the educational process. The problem of restoring human potential in war conditions is particularly relevant in the context of preserving the quality of education, providing psychological support, and creating a safe environment for learning and development. According to UNICEF (2025), 4.6 million children in Ukraine face permanent educational barriers, as the fourth school year during the war has begun, making the issue of restoring the educational process one of the priorities of national policy. The scale of the education crisis in Ukraine surpasses the challenges that education systems faced during the COVID-19 pandemic, when, according to UNESCO (2021), more than 1.6 billion students worldwide experienced disruptions to their studies due to school closures.

The global context of the problem of restoring human potential in conflict situations demonstrates the complexity and multidimensionality of this phenomenon. P. Justino (2022), in his study of the vulnerability, resilience, and resistance of the civilian population during the war in Ukraine, emphasizes that the education system becomes a critical factor in preserving social cohesion and human capital in conditions of protracted conflict. The author notes that the destruction of educational infrastructure and the psychological trauma experienced by participants in the educational process pose long-term risks to the country's economic and social development.

The theoretical framework for understanding the role of education in times of crisis has evolved from a utilitarian approach to human capital to a more holistic understanding of human capabilities. A historical review of the role of education (from the concept of human capital to the human capabilities approach) has demonstrated its economic and protective function in times of crisis. At the same time, education performs a supportive psychological well-being and social integration (S. Leoni, 2023). K. Boisvert (2022) develops this idea by analyzing discourses on human capital, human rights, and protection in the context of the educational response to COVID-19. The researcher emphasizes the need for a balance between the economic and humanistic goals of education in times of crisis.

The Ukrainian context of education restoration during the war is characterized by unique challenges and demonstrates different models of adaptation of educational institutions. V. Bugrov *et al.* (2023) described the experience of Taras Shevchenko National University of Kyiv, which navigates educational activities as a frontline during the war, highlighting strategies for ensuring continuity of education, psychological support, and preservation of the academic community. O. Orzhel *et al.* (2023) analyzed the challenges of displaced universities in Ukraine and developed optimal models for their development, emphasizing the importance of flexibility, collaboration, and innovation in conditions of uncertainty.

Digital technologies have become a critical tool for supporting education during wartime, although their implementation is accompanied by numerous challenges. L. Matviichuk *et al.* (2022) investigated the organization and implementation of e-learning in wartime conditions within Ukraine, identifying technical, pedagogical, and psychological barriers to distance education in extreme conditions. Opanasenko and Novikova (2022) compared the experience of distance learning during the COVID-19 pandemic and the war in Ukraine, finding that the war context creates additional challenges related to security, internet connection stability, and the psychological state of participants. Dudar *et al.* (2025) investigated the use of Internet platforms in an open educational environment to organize independent work for students, emphasizing the potential of

digital technologies to support learning autonomy even in conditions of limited access to traditional educational infrastructure.

The experience of organizing education during the COVID-19 pandemic has established a technological foundation and methodological framework for distance learning, which has proven to be critically important in wartime conditions. Nestorenko and Pokusa (2020) conducted a comprehensive analysis of the educational response to the pandemic crisis, revealing both the possibilities of online learning to ensure educational continuity and its limitations in supporting the social and emotional development of students. Carlana and La Ferrara (2021) demonstrated the effectiveness of online tutoring to support students' academic achievements during COVID-19, especially for vulnerable groups, which is confirmed by the experimental study of Gortazar et al. (2024), who established the positive impact of structured online support programs on the success of children from low-income families. However, the war context creates additional challenges associated with the instability of infrastructure, psychological traumatization, and security risks, which require adapting the pandemic experience to the specifics of armed conflict.

The importance of developing self-regulated learning skills in a digital environment is supported by a study by Bernacki et al. (2025), who utilized multimodal learning analytics to validate digital traces of self-regulated learning and predict students' academic performance. The authors demonstrated that students with higher levels of metacognitive skills and self-monitoring exhibited better learning outcomes in an online environment, which is particularly relevant to the Ukrainian situation, where a significant portion of learning occurs remotely with minimal direct supervision from teachers.

The issue of educational quality and inclusivity becomes particularly complex in the context of war. Zayachuk (2025) analyzed the provision of quality higher education in Ukraine during the war, highlighting key challenges: maintaining academic standards, ensuring equitable access to education, adapting curricula, and preserving teaching potential. Diachenko *et al.* (2024) reviewed the state of inclusive education in Ukraine, its achievements, challenges, and prospects, emphasizing that the

war exacerbated the problems of accessibility of education for vulnerable groups and, at the same time, created new opportunities for innovative solutions.

The international experience of post-conflict countries provides important lessons for Ukraine. Milton (2019) examined Syrian higher education during the conflict, revealing the regime's strategies for survival, protection, and security, and demonstrating the complexity of sustaining education systems in the face of prolonged hostilities. Mualla and Mualla (2022) analyzed the challenges and opportunities for higher education in Syria after the war and pandemic, emphasizing the importance of international support and institutional resilience for rebuilding the education system.

Conceptual approaches to education in post-conflict societies are evolving from simple infrastructure restoration to comprehensive peacebuilding strategies. Kester *et al.* (2022) explored the role of higher education in peacebuilding in conflict-affected societies, moving beyond the «good/bad» binary and emphasizing the need for a critical and contextualized approach. Kukhianidze (2022) argued for the importance of peace education in post-conflict settings as a mechanism for trauma transformation and sustainable peacebuilding. Mohamed Yusuf Adan (2025) developed a 4R (rights, responsibilities, representation, recovery) analytical framework to examine the role of peace education in promoting social justice and sustainable peace in post-conflict societies.

The long-term consequences of war for human development and the education system require a systemic understanding. Hameed *et al.* (2024) examined the asymmetric effects of prolonged war on human resource development in Afghanistan using the NARDL approach and found that negative shocks have a deeper and longer-lasting impact than positive changes. Ma *et al.* (2022) argued for the need to restore the potential of university teachers in the post-war context of sustainable development in Ukraine, emphasizing the critical importance of investing in teaching staff as a prerequisite for quality education.

International support for the restoration of Ukraine's education system demonstrates global recognition of the critical

importance of this issue. The European Commission (2024) recognized education reform as a priority area for European integration, despite the war conditions, in its report on Ukraine. The World Bank (2024) announced support for Ukraine's education system through the new LEARN project, with available funding of approximately $415 million, which underscores the strategic importance of education for the country's future recovery. UNESCO (2023) emphasizes in its reports the need to transition from crisis response to strategic education restoration, taking into account long-term development goals.

Despite the growing body of research on education in wartime, the systematic integration of psychological support, pedagogical innovations, and institutional transformations into a unified model for restoring human potential remains a relatively understudied area. The development of contextualized approaches that take into account the specifics of prolonged high-intensity conflict and the simultaneous need to support international educational standards is particularly relevant.

The purpose of the study is to theoretically substantiate and practically develop a comprehensive model of restoring human potential in the educational environment during war, which integrates the psychological, pedagogical, and organizational components of supporting participants in the educational process.

In accordance with the goal, the following research tasks were defined:

1. Analyze international and Ukrainian experience in restoring education systems during armed conflicts and identify effective practices for application.
2. To explore the challenges and strategies for ensuring educational quality, inclusivity, and continuity of learning in wartime.
3. To substantiate the role of digital technologies in supporting the educational process and determine the conditions for their effective implementation.
4. Develop a model of institutional support for educational institutions that ensures the preservation of human potential and psychological well-being of all participants.

5. Determine the directions of post-war restoration of the education system, taking into account the principles of sustainable development and peacebuilding.

The scientific novelty of the study lies in the development of a comprehensive multilevel model of restoring human potential in the educational environment during war, which for the first time integrates individual (psychological support of participants), institutional (adaptation of educational institutions), technological (digital tools), and systemic (educational policy) levels of support into a single interconnected system. Unlike existing fragmentary approaches, the proposed model considers the dynamic nature of the crisis and the prospect of post-war recovery, providing mechanisms for adaptation to changing security conditions and a gradual transition from a survival mode to the strategic development of the educational system.

The research was conducted from 2022 to 2024 and employed a comprehensive interdisciplinary approach that combined theoretical and empirical research methods. The methodological basis was a systematic approach to analyzing educational processes in crisis conditions, a comparative analysis of international experiences, and an activity-based approach to developing practical recommendations.

A systematic literature review was carried out using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology to ensure a comprehensive analysis of scientific publications. The search for sources was conducted in the international Science Research Databases Scopus, Web of Science, ERIC (Education Resources Information Center) and Google Scholar using the keywords: «education in war», «education conflict zones», «educational resilience», «trauma-informed education», «post-conflict education», «Ukraine education war» for the period 2019-2024. The initial search revealed 347 publications, of which 86 scientific papers were selected for analysis after applying the inclusion criteria (relevance to the topic, peer review, English language, full-text access).

Content analysis was used to systematize information from official reports of international organizations (UNESCO, UNICEF, World Bank, European Commission) on the state of education in

Ukraine and other countries affected by military conflicts. Statistical data, strategic documents, and recommendations on supporting education systems in crisis conditions for the period 2022-2024 were analyzed.

Comparative analysis was used to compare the experience of restoring education systems in different countries (Syria, Afghanistan, Yemen, and Ukraine) in order to identify common patterns, specific features, and transferable practices. Strategies for ensuring the continuity of education, mechanisms of psychological support, models of organizing the educational process, and approaches to restoring educational infrastructure were compared.

Modelling was used to develop a conceptual model of restoring human potential in the educational environment, integrating individual, institutional, technological, and systemic levels of support for participants in the educational process during the war.

The research employed empirical methods, specifically a questionnaire survey conducted among teaching staff of general secondary and higher education institutions in Ukraine to identify key challenges, needs, and strategies for adapting the educational process in wartime conditions. Two specialized questionnaires were developed: for teachers (45 questions) and for lecturers of higher education institutions (52 questions), covering blocks of questions on organizational changes, psychological state, methodological approaches, digital tools, and support needs.

The study sample was formed using the stratified random sampling method, taking into account the regional distribution and the type of educational institution. The total sample consisted of 1,247 respondents, comprising 847 teachers from general secondary education institutions (67.9%) and 400 teachers from higher education institutions (32.1%). Regional distribution: Western Ukraine – 31%, Central Ukraine – 28%, Eastern Ukraine – 22%, Southern Ukraine – 12%, internally displaced persons (IDPs) – 7%. The inclusion criteria for the sample were: active pedagogical activity between 2022 and 2024, work in war conditions on the territory of Ukraine or with Ukrainian

students/pupils abroad, and voluntary consent to participate in the study.

Semi-structured interviews were conducted with administrators of educational institutions (rectors, directors, deputies), educational psychologists, and international experts on education in crisis situations. A total of 47 interviews were conducted, each lasting between 45 and 90 minutes. Interview questions focused on strategies for managing an educational institution in conditions of uncertainty, mechanisms for supporting teaching staff and pupils/students, effective practices for adapting the educational process, and visions of recovery prospects. Interviews were recorded (with the consent of the respondents), transcribed, and analyzed using thematic analysis.

Focus groups were organized separately for different categories of participants in the educational process: teachers/lecturers (6 focus groups of 8-12 participants each), students of higher education institutions (4 focus groups of 10-15 participants each), and parents of students (3 focus groups of 8-10 participants each). The duration of each focus group was 90 to 120 minutes. The issues discussed included the psychological challenges of teaching during wartime, the effectiveness of different teaching formats, support needs, and suggestions for improving the educational process.

The included observation was conducted in 12 educational institutions (8 schools and 4 universities) across different regions of Ukraine during the 2023-2024 academic year. The observations focused on the organization of the educational process, the psychological climate in the educational institution, the use of digital technologies, the implementation of security protocols, and strategies for pedagogical support of students. The results of the observations were recorded in field notes and analyzed using a qualitative content analysis approach.

The analysis of documents included the study of internal regulatory documents from educational institutions (regulations on the organization of the educational process in wartime, psychological support plans, and security protocols), educational and methodological materials adapted to wartime conditions, and

reporting documentation on the functioning of institutions from 2022 to 2024.

Methods of data processing and analysis included quantitative and qualitative data. Quantitative data from the questionnaire were processed using the statistical package SPSS Statistics 26.0. Descriptive statistics methods were used (frequency analysis, calculation of average values, standard deviations), Pearson correlation analysis to identify relationships between variables, factor analysis to identify latent structures, and χ^2 criterion to test the statistical significance of differences between groups. The level of statistical significance was set at $p < 0.05$.

Qualitative data from interviews, focus groups, and observations were analyzed using thematic analysis, following the six-step procedure outlined by Braun and Clarke: data review, initial code generation, theme identification, theme review, theme naming, and report preparation. Coding was performed using NVivo 14 software. The reliability of coding was ensured through the double independent coding of 20% of the transcripts by two researchers, followed by the calculation of Cohen's Kappa ($\kappa = 0.82$), indicating a high level of reliability.

Data triangulation was used to increase the validity of the research results by comparing and integrating data obtained using different methods (quantitative and qualitative) and from different sources (educators, administrators, students/pupils, parents, international experts).

The study was conducted in accordance with the ethical principles of the social sciences and was approved by the institutional ethics committee. All study participants provided informed consent to participate after receiving detailed information about the purpose, procedures, and possible use of the study results. Confidentiality and anonymity of the data were ensured; personal information of respondents was not disclosed, and pseudonyms or generalized characteristics were used in the reports. Given the traumatic context of the study, participants were provided with information about available psychological support resources, and during interviews and focus groups, the researchers avoided questions that could cause traumatization.

The study has several limitations that should be taken into account when interpreting the results. First, the sample does not include teachers and students from temporarily occupied territories due to the objective impossibility of access, which limits the completeness of the picture of education in Ukraine during the war. Second, the dynamic nature of the war situation means that the results reflect the state at the time of data collection (2022-2024) and may change as events develop. Third, the predominantly online format of data collection, due to security restrictions, may have created a systematic bias in the sample in favor of individuals with better access to digital technologies. Fourth, the self-reported nature of most data is subject to the risk of social desirability bias and subjective perception.

Research Results

Analysis of the survey data revealed large-scale organizational changes in the educational process of Ukrainian educational institutions. Table 1 shows the distribution of learning formats used during the 2022-2024 academic years.

Table 1

Distribution of learning formats in educational institutions of Ukraine (n=1247)

Training format	*SEI (n=847)*	*HEI (n=400)*	*Total*
Full-time (in-person)	23.4%	31.8%	26.1%
Distance (online)	34.7%	28.5%	32.6%
Blended (hybrid)	38.2%	36.3%	37.6%
Variable (depending on the security situation)	3.7%	3.4%	3.6%

Note: SEI – secondary education institutions,
HEI – higher education institutions. $\chi^2(3) = 8.42$, $p = 0.038$

A statistically significant difference was found between types of institutions ($\chi^2(3) = 8.42$, $p = 0.038$), indicating specific adaptation strategies. Secondary education institutions more often used a distance format (34.7% vs. 28.5%), which is explained by greater safety risks for younger children and the

difficulty of ensuring the protection of school infrastructure. Higher education institutions demonstrated a higher percentage of full-time education (31.8% vs. 23.4%), which aligns with Zayachuk's (2025) data on universities' desire to support the academic community through physical presence despite the challenges.

Regional analysis revealed significant differences in the possibilities of organizing the educational process (Fig. 1).

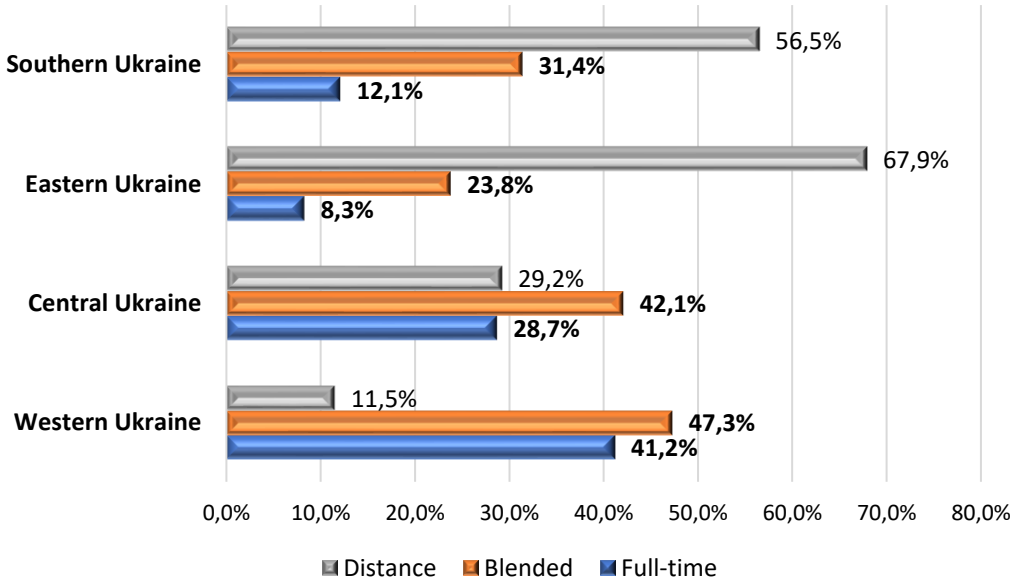

Figure 1. **Distribution *of training formats by regions of Ukraine (%)***

Note: n=1247. Differences between regions are statistically significant ($\chi^2(6) = 347.26$, $p < 0.001$)

The pronounced regional differentiation ($\chi^2(6) = 347.26$, $p < 0.001$) reflects the uneven security situation. The eastern and southern regions, which are experiencing more intense fighting, mainly operate in a distance mode, while the western regions retain the possibility of face-to-face learning. These data are consistent with the European Commission (2024) report on geographical inequalities in access to quality education in Ukraine.

Assessment of the psychological state of teaching staff revealed high levels of stress and professional burnout. Table 2 presents the results of self-report assessment using the adapted Maslach Burnout Inventory (MBI) scale.

Table 2

Indicators of professional burnout of teaching staff (M±SD)

Component	*SEI (n=847)*	*HEI (n=400)*	*t-test*	*p-value*
Emotional exhaustion	4.23±1.12	3.87±1.24	4.62	<0.001
Depersonalization	2.94±1.08	2.76±1.15	2.43	0.015
Reduction in professional achievements	3.51±1.21	3.29±1.18	2.71	0.007

Note: Scale from 1 (never) to 7 (everyday). Values >4.0 indicate high levels of burnout

Correlation analysis revealed significant associations between risk factors and indicators of psychological well-being (Table 3).

Table 3

Correlations between risk factors and psychological well-being of teachers (Pearson's r)

Factor	*Emotional exhaustion*	*Depersonalisation*	*Professional efficiency*
Proximity to the war zone	0.47***	0.34***	-0.41***
Air alarm frequency	0.52***	0.38***	-0.38***
Availability of social support	-0.56***	-0.42***	0.61***
Access to psychological help	-0.39***	-0.28***	0.44***
Internet connection stability	-0.31***	-0.22**	0.36***

*Note: n=1247. **p<0.01, ***p<0.001*

Secondary school teachers demonstrated statistically significantly higher levels of emotional exhaustion ($t(1245)=4.62$, $p<0.001$) compared to higher education teachers. The critically high level of emotional exhaustion ($M = 4.23$) among teachers can be attributed to the additional burden of providing emotional support to children, communicating with anxious parents, and the need to simultaneously perform both pedagogical and psychological functions. These results align with the conclusions of Ma et al. (2022) on the need for targeted support of pedagogical potential to ensure the sustainable development of the education system.

The strongest protective factor (Table 3) was the presence of social support ($r = -0.56$ for emotional exhaustion, $r = 0.61$ for professional efficacy, $p < 0.001$), highlighting the critical importance of supportive pedagogical communities. The frequency of air alarms demonstrated the strongest positive correlation with emotional exhaustion ($r = 0.52$, $p < 0.001$), indicating a cumulative effect of chronic stress resulting from ongoing security threats.

Qualitative analysis of interviews and focus groups revealed a range of adaptive pedagogical strategies that educators spontaneously developed in response to the crisis. Table 4 systematizes the main categories of adaptations and their prevalence.

Table 4

Adaptive pedagogical strategies in wartime (frequency of mention)

Strategy category	*Frequency (%)*	*Examples*
Flexibility in terms and requirements	87.3	Extension of deadlines, alternative forms of assessment
Integration of psychological support	76.4	Psychological moments, relaxation techniques
Adaptation of training content	68.9	Reduction of material, focus on key competencies

Strategy category	*Frequency (%)*	*Examples*
Using digital tools	94.2	Online platforms, video conferences, and asynchronous materials
Individualization of learning	71.8	Personalized tasks, taking into account special circumstances
Creating a support community	82.6	Online groups, regular communication, and peer support

Note: n=1247 survey respondents. Respondents could indicate multiple strategies

The almost universal use of digital tools (94.2%) confirms the findings of Matviichuk et al. (2022) and Dudar et al. (2025) on the critical role of technology in ensuring educational continuity. At the same time, the high prevalence of flexibility strategies (87.3%) and the creation of a community of support (82.6%) indicate a shift from a purely academic to a holistic model of education that integrates learning and psychosocial support.

Factor analysis revealed three main dimensions of adaptive strategies, explaining 68.4% of the variance (Table 5). The development of self-regulated learning has been found to be a crucial component in adapting to distance and hybrid learning formats. Bernacki et al. (2025) demonstrated that digital traces of students' behavior in learning management systems can serve as valid indicators of self-regulated learning and predict academic performance. In the Ukrainian context, where a significant part of learning occurs asynchronously with minimal synchronous contact due to unstable electricity supply, students' ability to independently plan, monitor, and regulate their learning activities becomes even more critical. This requires the targeted development of metacognitive skills and the creation of digital environments that support autonomy without losing pedagogical support (Table 5).

The three-factor structure illustrates the holistic nature of pedagogical adaptation, which occurs simultaneously at the emotional, technological, and academic levels. The largest

contribution of the emotional support factor (28.3% of the variance) emphasizes the priority of psychological well-being over purely academic goals in crisis conditions.

Table 5

Factor structure of adaptive pedagogical strategies

Strategy	*Factor 1: Emotional support*	*Factor 2: Technological adaptation*	*Factor 3: Academic Flexibility*
Psychological interventions	0.83	0.21	0.15
Creating a community	0.79	0.28	0.23
Empathetic communication	0.76	0.19	0.31
Using an LMS	0.24	0.87	0.16
Asynchronous learning	0.18	0.84	0.22
Digital tools	0.29	0.81	0.19
Flexible terms	0.27	0.14	0.82
Content adaptation	0.22	0.25	0.79
Alternative assessment	0.34	0.21	0.76
Eigenvalue	3.42	2.87	2.15
% variance	28.3%	23.6%	16.5%

Note: Factor extraction method: Principal Component Analysis. Rotation: Varimax. KMO=0.89, Bartlett test p<0.001

A detailed analysis of the use of digital platforms revealed a differentiated picture of technological integration. Figure 2 presents the frequency of use of different categories of digital tools. The almost universal use of instant messaging (96.8%) and video conferencing (91.2%) indicates the priority of synchronous communication for maintaining social connections and emotional support. The relatively lower frequency of use of interactive platforms (54.7%) may be explained by the limitations of internet

connectivity in the context of the energy crisis and the technical complexity of integration.

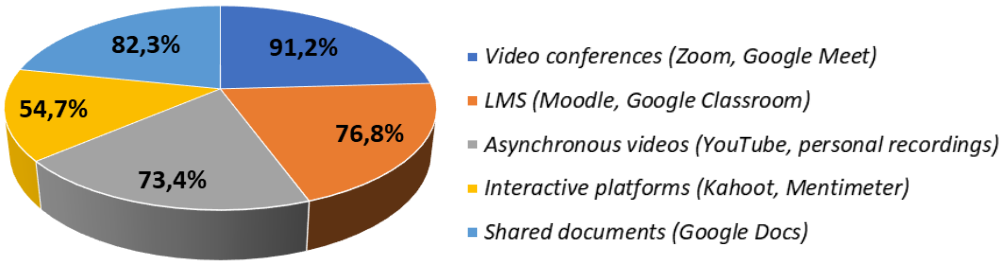

Figure 2. **Frequency of use of digital tools by teachers (%)**

Note: n=1247. Respondents could indicate multiple tools

However, a qualitative analysis of the interviews revealed significant challenges to digitalization. Thematic analysis identified five main barriers (Table 6).

Table 6

Barriers to the effective use of digital technologies

Barrier	*Frequency of mentions in interviews (%)*	*Typical quotes*
Power supply instability	83.0	"The biggest problem is not knowing if there will be light during class."
Insufficient technical support for students	68.1	"Not all children have devices or stable internet."
Limited digital competence	57.4	"Many older teachers have difficulty adapting to technology."
Screen fatigue	74.5	"Students complain about constant computer work."
The complexity of online assessment	61.7	"It is difficult to objectively assess knowledge remotely."

Note: n=47 interviews with administrators of educational institutions

Despite the challenges, research demonstrates the potential effectiveness of online learning when properly organized. Carlana and La Ferrara (2021), based on an analysis of data from over 1,400 Italian students, demonstrated that structured online tutoring programs significantly improved academic performance during the COVID-19 pandemic, particularly for students with low socioeconomic status. These results are confirmed in an experimental study by Gortazar et al. (2024) conducted in Spain, where an online tutoring program for vulnerable children led to statistically significant improvements in mathematics and reading scores (effect size of 0.15-0.18 standard deviations). The Ukrainian context, however, is characterized by additional challenges: while the lack of physical presence was the main constraint during the pandemic, in wartime conditions, unstable power supply, psychological trauma, and security risks become critical, requiring the adaptation of online support models to these specific conditions. These results are also consistent with the findings of Opanasenko and Novikova (2022) about the specific challenges of distance learning in wartime, which go beyond typical technological barriers and include infrastructural constraints caused by the conflict.

A comparative analysis of educational institutions with different levels of institutional support revealed its significant impact on adaptation outcomes. Institutions were classified according to the Institutional Support Index (ISI), which integrated indicators of the availability of psychological assistance, methodological support, technical support, and administrative flexibility (Table 7).

Table 7

Comparison of adaptation indicators by level of institutional support

Indicator	*Low ISI (n=312)*	*Average ISI (n=547)*	*High ISI (n=388)*	*F-statistic*	*p-value*
Teacher satisfaction (1-7)	3.21±1.15	4.58±0.97	5.73±0.82	247.36	<0.001
Emotional exhaustion (1-7)	4.87±1.03	3.96±1.12	2.94±1.08	158.42	<0.001

Indicator	*Low ISI (n=312)*	*Average ISI (n=547)*	*High ISI (n=388)*	*F-statistic*	*p-value*
Academic performance of students (%)	62.3±12.4	71.8±10.2	78.6±8.7	93.67	<0.001
Contingent retention (%)	88.4±6.8	93.2±4.6	96.7±3.2	87.25	<0.001

Note: ISI – Institutional Support Index. Data are presented as M±SD. ANOVA with Tukey HSD post-hoc test

Statistically significant differences across all indicators ($p<0.001$) demonstrate the critical importance of systemic institutional support. Institutions with high ISI demonstrated almost half the levels of emotional exhaustion of teachers (2.94 vs. 4.87) and significantly higher academic performance (78.6% vs. 62.3%). These data confirm the findings of Bugrov et al. (2023) on the importance of proactive institutional management for ensuring the resilience of educational communities.

Based on the integration of quantitative and qualitative data, a conceptual model of human potential restoration in educational environments during wartime has been developed (see Figure 3). The model is structured around four interrelated levels of intervention and three temporal phases.

The model assumes a nonlinear, iterative nature of the recovery process, with the possibility of regression between phases depending on the security situation. It is critical to synchronize interventions at all levels and ensure cross-cutting support components throughout all phases.

The results of the study reveal a complex, multidimensional picture of the restoration of human potential in the educational environment during war, characterized by the simultaneous occurrence of destructive and creative processes, crisis and innovation, trauma and resilience.

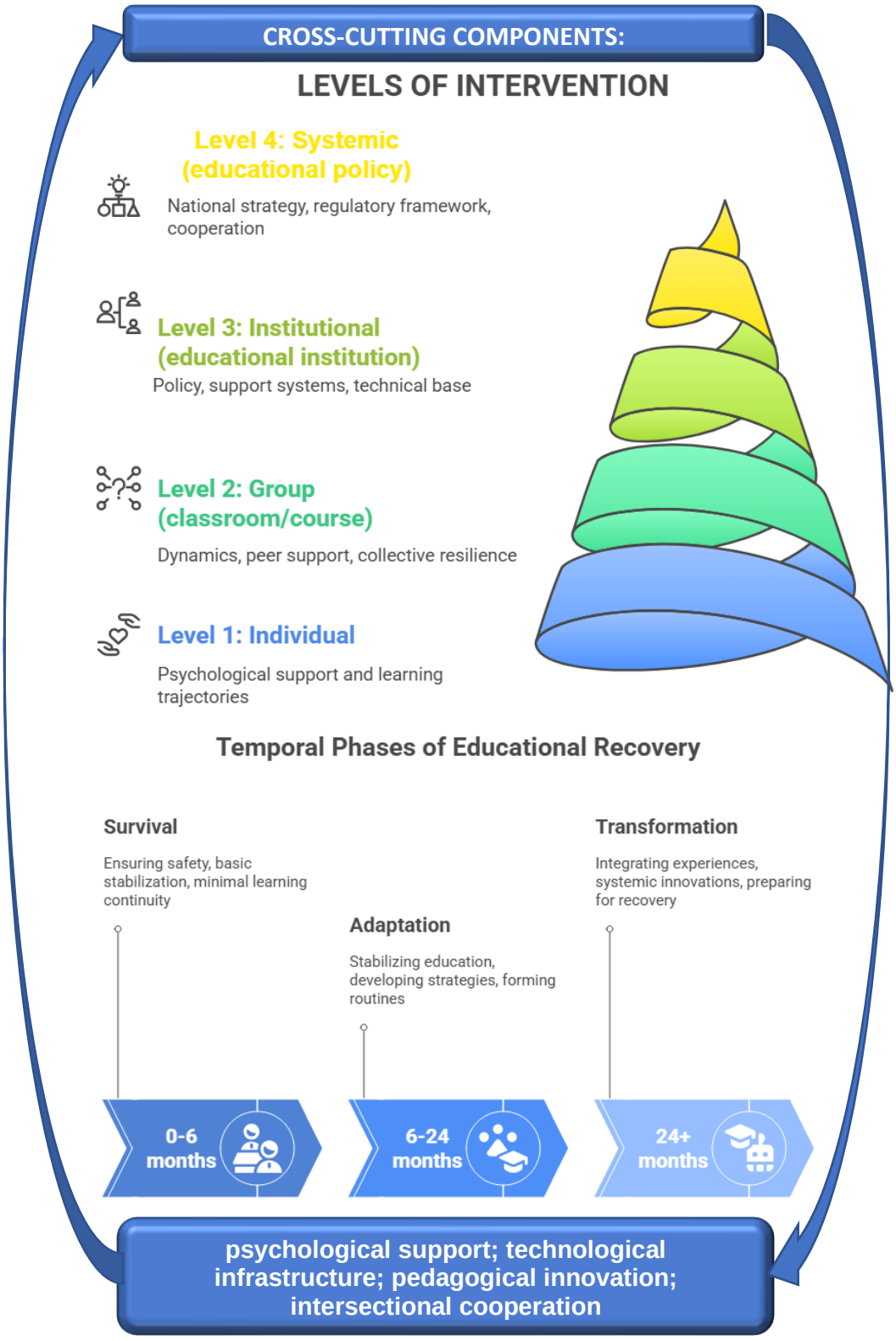

Figure 3. **Conceptual model of restoring human potential in the educational environment during war**

Note: The model is based on the integration of empirical research data and international experience.

High levels of professional burnout among teachers, as measured by emotional exhaustion (M = 4.23 in teachers), are a worrying signal that echoes Ma et al. (2022)'s warnings about the risks of losing pedagogical potential. Compared to studies of teacher burnout in "peaceful" conditions, where the critical level is usually recorded in 15-25% of teachers, the Ukrainian situation demonstrates a significantly higher prevalence of the problem. This requires the urgent development of large-scale programs of psychological support for teachers, which should become a priority of educational policy. Importantly, the presence of social support proved to be the strongest protective factor (r = - 0.56), which is consistent with theoretical models of resilience and emphasizes the need for investment in creating and supporting professional communities of practice.

The spontaneous adaptation of pedagogical practices to wartime conditions demonstrates the impressive creativity and resilience of educators. The identified three-factor structure of adaptations (emotional support, technological adaptation, and academic flexibility) indicates the holistic nature of the professional response to the crisis, which extends beyond the technocratic "transition online." The priority of emotional support (28.3% of the variance) reflects the intuitive understanding of educators of what Boisvert (2022) conceptualizes as the protective function of education in crisis conditions. This fundamentally changes the understanding of the pedagogical role: the teacher/lecturer becomes not only a translator of knowledge, but also a key agent of psychosocial support and the formation of resilience.

The results on the use of digital technologies extend the findings of Matviichuk et al. (2022) and Dudar et al. (2025), demonstrating not only the scale of implementation but also the complexity of the challenges that arise. The almost universal use of messengers (96.8%) along with the lower frequency of specialized educational platforms (54.7% for interactive tools) indicates a gap between technological accessibility and pedagogical integration. The identified barriers, particularly the instability of electricity supply (83.0% of mentions), are specific to the military context and distinguish the Ukrainian situation from the experience of digitalization during the COVID-19 pandemic, as

analyzed by Opanasenko and Novikova (2022). This requires the development of «low-tech» backup strategies and support for hybrid models that can function in conditions of unstable infrastructure.

A systematic review of the educational response to the COVID-19 pandemic (Nestorenko & Pokusa, 2020) identified several critical lessons relevant to the military context: the importance of pre-developed digital infrastructure, the need for rapid adaptation of pedagogical approaches, and the criticality of supporting the psychological well-being of participants in the educational process. However, the pandemic experience has also shown the limitations of distance learning for developing social skills and maintaining motivation, which in wartime is complicated by additional psychological traumatization. The experience of successful interventions during the pandemic, such as online tutoring programs (Carlana & La Ferrara, 2021; Gortazar et al., 2024), can be adapted for the Ukrainian situation, taking into account the specifics of the military context: the need for trauma-informed approaches, the instability of the infrastructure, and the longer duration of the crisis.

The revealed impact of institutional support on adaptation outcomes ($F = 247.36$, $p < 0.001$ for teacher satisfaction) empirically confirms theoretical models of multilevel resilience. Institutions with a high Institutional Support Index not only demonstrate better indicators of teacher well-being but also achieve significantly higher academic success among pupils/students (78.6% vs. 62.3%), indicating a cascading effect of support: teacher well-being is transformed into the quality of teaching. This is consistent with the experience of Kyiv National University, described by Bugrov et al. (2023), where proactive institutional leadership ensured relatively successful adaptation. However, significant differences between institutions (from low to high ISI) indicate uneven institutional capacity and the need for systemic support from central education authorities.

The developed conceptual model of human potential restoration provides an integrative framework that synthesizes international experiences and the specificities of the Ukrainian context. Unlike linear models of post-conflict recovery presented in studies by Milton (2019) on Syria and Mualla and Mualla (2022),

the proposed model accounts for the dynamic nature of a protracted conflict through temporal phases, allowing for regression. The allocation of the survival phase (0-6 months) acknowledges the reality that, in conditions of active hostilities, priority is given to basic security and psychological stabilization, rather than academic achievements. The transition to the adaptation and, potentially, transformation phase requires not only time but also the achievement of a certain level of security and stability.

A key innovation of the model is the integration of four levels of intervention (individual, group, institutional, and systemic) with cross-cutting support components. This responds to the criticism of the fragmentation of approaches to education in crisis, which has been repeatedly expressed in international reports by UNESCO (2023). The model emphasizes that effective support requires synchronized actions at all levels, from individual psychological assistance to systemic educational policies.

The study reveals some paradoxes of the crisis experience. On the one hand, war creates destructive conditions for education: high teacher burnout, psychological traumatization of students, and destruction of infrastructure. On the other hand, the crisis stimulates innovations: large-scale digitalization, which in peacetime could take decades, the development of new pedagogical approaches that integrate learning and psychological support, and the formation of strong professional communities of practice. This is consistent with the concept of "post-traumatic growth" and raises the question of which elements of the crisis experience can be preserved and institutionalized in the post-war period as positive innovations.

Comparison with the experience of other conflicts reveals both commonalities and unique aspects of the Ukrainian situation. Similar to the Syrian experience described by Milton (2019), Ukrainian education is facing large-scale destruction of infrastructure and internal displacement of the population. However, unlike Syria, where the education system has largely collapsed, Ukraine demonstrates a higher level of institutional resilience, which is partly explained by a stronger initial institutional base, international support (World Bank, 2024), and digital infrastructure developed during the COVID-19 pandemic.

The experience of displaced universities, analyzed by Orzhel et al. (2023), demonstrates a unique model of institutional adaptation that has no direct analogues in other conflicts and may constitute a valuable case study for the international community.

The study's results have significant implications for education policy. First, a national strategy for psychological support for teachers, along with the allocation of appropriate resources, is needed, as high professional burnout threatens the long-term capacity of the system. Second, a differentiated regional policy is needed, taking into account the difference between the relatively safe western regions and the intensively affected eastern and southern territories. Third, investments in digital infrastructure should be accompanied by the development of «low-tech» alternatives to ensure resilience in conditions of unstable power supply. Fourth, it is necessary to support the institutional capacity of institutions, especially those that demonstrate low ISI, through the provision of methodological, technical, and financial assistance.

The study also has theoretical implications for understanding education in crisis. It empirically confirms the evolution from an economic concept of human capital to a humanistic approach to human capabilities, described by Leoni (2023), demonstrating that in crisis conditions, education performs multiple functions: not only preparing for future economic activity, but also protecting psychological well-being, preserving social identity, and building hope for the future. This requires a reevaluation of the criteria for assessing the effectiveness of education in crisis conditions: in addition to academic achievements, it is necessary to consider indicators of psychological well-being, social cohesion, and resilience.

The question of the long-term consequences of the war experience on Ukraine's human potential is important. Hameed et al. (2024), using the example of Afghanistan, demonstrated the asymmetric effects of a long war, where negative shocks have a deeper and longer-lasting impact. This caveat is particularly relevant for Ukraine: even after the end of the active phase of the conflict, the psychological consequences, gaps in education, and the loss of teaching staff will have a lasting impact. However, the experience of countries that have successfully recovered from

conflicts demonstrates the critical role of strategic investments in education as a mechanism for long-term recovery. Mohamed Yusuf Adan (2025) emphasizes the potential of peace education for transforming post-conflict societies, which should be taken into account when planning the post-war recovery of the Ukrainian education system.

The study's results open up prospects for further scientific exploration. Longitudinal studies are necessary to track the dynamics of the psychological states of teachers and students over an extended period, allowing us to understand adaptation trajectories better and identify factors of long-term resilience. An in-depth study of the experience of various vulnerable groups (children with special educational needs, internally displaced persons, and children from frontline areas) is important, since this study provides mainly a general picture. The issues of learning and development of preschool children, which remained outside the scope of this study, require attention. A comparative study of the effectiveness of different models of psychological support and pedagogical interventions, conducted through controlled or quasi-experimental designs, is promising.

The limitations of the study, as noted in the Materials and Methods section, require caution in generalizing the results. The lack of data from temporarily occupied territories creates an incomplete picture, and the self-reported nature of most data is susceptible to systematic bias. The dynamic nature of the war situation means that the results reflect a specific temporal slice and may change as events unfold. The predominantly online format of data collection may have created a sampling bias in favor of those with better access to technology, potentially underestimating the challenges faced by the most vulnerable groups.

Despite these limitations, the study makes an important contribution to understanding the restoration of human potential in educational environments during war, providing an empirical basis for policy development and practical interventions. The developed conceptual model offers an integrative framework for systemic support of the educational community, which can be adapted to other crisis contexts. The identified adaptive strategies of educators demonstrate the creativity and resilience of Ukrainian

education, which is a valuable resource for the country's future recovery.

Conclusions

The study revealed a complex picture of the functioning of Ukrainian education in wartime conditions, characterised by the simultaneous manifestation of profound challenges and powerful adaptive mechanisms at three interconnected levels of the educational system.

At the individual level, teachers demonstrate critically high levels of professional burnout, particularly secondary school teachers with indicators of emotional exhaustion, $M = 4.23 \pm 1.12$. At the same time, they spontaneously developed a wide range of adaptive strategies structured around three main dimensions: emotional support, which accounts for 28.3% of the variance in adaptive behaviour, technological adaptation (23.6%), and academic flexibility (16.5%). This highlights the holistic nature of the professional response to the crisis, which extends beyond purely technical solutions and incorporates psychosocial support into the pedagogical process. The strongest protective factor was the presence of social support ($r = -0.56$), highlighting the critical importance of professional communities in maintaining pedagogical potential. Educators have almost universally mastered digital tools, including instant messengers (96.8%) and video conferencing (91.2%), but their effectiveness is limited by specific military challenges, primarily the instability of power supply, which was reported by 83.0% of respondents.

At the institutional level, a cascading effect of support from the institution to individual teacher and student outcomes was found. Institutions with a high Institutional Support Index demonstrated half the levels of teacher emotional exhaustion compared to institutions with a low level of support (2.94 versus 4.87) and significantly higher student academic performance (78.6% versus 62.3%). This pattern confirms that institutional support is not merely an additional resource but a critical factor in the successful adaptation of the entire educational community within the institution. Effective institutions are characterized by three main components: a developed organizational infrastructure

(stable power supply, equipped shelters, technical support), functioning psychological services to support teachers, and managerial flexibility with adaptive work schedules and delegation of authority. These results justify the need to develop national standards for institutional support and targeted funding of the relevant components of institutional infrastructure.

At the systemic level, the educational process exhibits significant regional differentiation, with the prevalence of distance learning higher in the eastern and southern territories (67.9% and 56.5%, respectively) compared to the western regions, where face-to-face learning remains more prevalent (41.2%). This geographical disparity reflects the uneven security situation and creates long-term risks of deepening educational inequalities between regions, which requires the development of differentiated regional policies. For the eastern and southern regions, investments in autonomous power supply systems, mobile learning centers, and enhanced psychological support are critical, while the western regions need to develop capacities for receiving internally displaced students and hybrid learning models. Digital technologies have become a critical tool for ensuring the continuity of education; however, their effectiveness is limited by infrastructural challenges, necessitating the development of resilient digital infrastructure with alternative power sources, local educational servers, and offline versions of learning platforms.

The developed conceptual model of human potential restoration integrates all three levels of intervention through three temporal phases: survival, adaptation, and transformation. In the survival phase, the priority is to ensure basic safety and psychological support needs at the individual level, the functioning of minimal educational services at the institutional level, and emergency funding with regulatory flexibility at the system level. The adaptation phase involves training teachers in adaptive practices, forming professional communities, developing supporting infrastructure within institutions through the introduction of hybrid learning models, and implementing differentiated regional policies with investments in system resilience. The transformation phase focuses on the professional development of teachers through the integration of trauma-informed practices, the transformation of institutions into centers

of pedagogical innovation and inclusiveness, as well as systemic post-war recovery with the integration of the principles of peace education and social justice. The model takes into account the nonlinear nature of the recovery process with the possibility of regression depending on the security situation, which requires flexible response mechanisms at all levels.

Four cross-cutting components integrate all levels and phases of the model: psychological support, ranging from individual therapy to national burnout prevention programs; technological infrastructure, spanning from teachers' personal devices to national educational platforms; pedagogical innovation, from classroom practices to systemic reforms; and intersectoral collaboration, from school partnerships to international initiatives. This integration ensures synergy between the various levels of intervention, amplifying the effect of each component.

The practical significance of the study lies in the empirical substantiation of four priorities of educational policy. First, the development of a national strategy for psychological support for teachers should include the establishment of specialized support centers in each region, mandatory supervision for teachers in high-risk areas, and the integration of support into the system of advanced professional development. Second, implementing a differentiated regional policy with equalization mechanisms through compensation programs, additional funding, and academic mobility is expected to reduce regional gaps by 40%. Third, investments in resilient digital infrastructure with alternative power sources, local servers, and hybrid models that combine high- and low-tech methods. Fourth, systemic support for the institutional potential of institutions can be enhanced through targeted grants for institutions with a low Support Index, the creation of regional support hubs, and updating the regulatory framework for the operation of institutions during times of crisis.

The identified adaptive strategies of teachers can be systematised and disseminated as best practices through a system of professional development, which will allow scaling up successful experience to the entire education system. Indicators of the model's success include a 30% reduction in teachers' emotional exhaustion, an increase in the Institutional Support Index to 7 or more points in 70% of institutions, and a 40%

reduction in regional gaps in educational outcomes. These indicators will provide an objective assessment of the policy implementation's progress.

Prospects for further research include longitudinal tracking of the dynamics of adaptation of participants in the educational process to understand the long-term effects of the crisis and the effectiveness of interventions, in-depth study of the experience of vulnerable groups of students and teachers to develop targeted support programs, comparative analysis of the effectiveness of different models of institutional support to identify best practices, and planning for the post-war restoration of the education system with the integration of the lessons of the crisis period into the long-term transformation of Ukrainian education on the principles of resilience, inclusion, and social justice.

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2.3. DEVELOPING EMOTIONAL INTELLIGENCE AND SOCIAL-EMOTIONAL SKILLS OF FUTURE PROFESSIONALS FOR RESILIENT AND ADAPTIVE EDUCATION DURING WAR AND POST-WAR RECOVERY

Inna Kharchenko, Serhii Kharchenko, Mariia Ostroha

***Abstract**. The article examines the development of social-emotional skills and emotional intelligence of future professionals as a condition for the resilience of education during war and post-war recovery. Theoretical analysis shows that social and emotional learning is closely linked to young people's adaptation to prolonged stress, maintaining academic achievement, and preventing psycho-emotional maladjustment. Emotional intelligence is defined as a resource that combines awareness of one's own experiences, emotional regulation, empathy, and the capacity to develop constructive behavioral strategies in crisis situations. The importance of preparing university teachers to work with the emotional challenges of learners and to manage their own emotional vulnerability is emphasized.*

Drawing on two empirical cases, the article generalizes the experience of integrating social and emotional learning into language and professional training. The first case describes a system of communicative tasks in a language course designed to develop emotional intelligence by analyzing the emotions of characters, engaging in role-play, and participating in inquiry-based situations, as well as through reflective writing and safe group discussions. It is demonstrated that the systematic use of such tasks is associated with increased levels of emotional awareness, empathy, self-regulation, and self-motivation among learners, even in conditions of war-related stress. The second case reveals the relationship between the culture of professional communication of future economists and their level of emotional intelligence, highlighting the role of values, ethical guidelines, and speech strategies in shaping responsible attitudes towards partners, clients, and communities.

Educational practices of support and recovery that have emerged in Ukrainian higher education institutions during the full-scale war are described separately, including reflective writing, training in empathic listening, modeling professional situations, the use of digital emotion diaries, online discussions, and blended

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forms of interaction. It is demonstrated that integrating such practices into the educational process, rather than using them as one-off interventions, promotes the formation of sustainable forms of mutual support, the development of information and media literacy, and prepares future professionals for ethical leadership in the post-war reconstruction process. Recommendations are formulated regarding the inclusion of social and emotional learning modules in educational programs, the improvement of professional development systems for university teachers, and the institutional anchoring of care for emotional well-being as a component of higher education quality.

***Keywords**: emotional intelligence; social-emotional skills; learners; crisis education; post-war recovery; culture of professional communication; infomedia literacy; digital support practices; resilience of education.*

Introduction

The war has made obvious what previously often remained at the periphery of attention: the strength of professional training is determined not only by the quality of acquired knowledge and skills, but also by a person's ability to withstand prolonged tension, cope with emotional shocks, support others, and preserve a sense of professional meaning under conditions of instability. The educational process has found itself "on the edge" between the need to perform its functions and the constant impact of war-related threats, losses, and forced mobility. In this reality, social-emotional skills and emotional intelligence become not an addition to professional competence, but a resource without which the resilience of a future professional is, in fact, impossible.

It is useful to distinguish between several related but distinct concepts. Emotional intelligence can be viewed as an individual's capacity to be aware of their own emotions, understand the emotional states of others, regulate their own reactions, and use emotional information in decision-making. Social-emotional skills are the already formed abilities to act on the basis of these capacities: recognizing and naming emotions, negotiating, resolving conflicts, cooperating, and choosing behavioral strategies responsibly. Social and emotional learning, in turn, refers to a purposeful pedagogical activity within which these skills are systematically formed and assessed, similar to academic outcomes (Kabakci & Owen, 2010; Primi et al., 2016).

In contemporary research, various approaches to interpreting emotional intelligence are distinguished; however, for education, the decisive issue is not the theoretical opposition of models, but rather the practical question of what can be developed in learners and how to measure change. The development of tools for measuring social-emotional skills in adolescents and young people indicates that these are not innate traits, but rather a set of skills that can be taught, assessed, and improved (Primi et al., 2016; Pancorbo et al., 2020; Kulikova & Orel, 2021). This brings the social-emotional sphere closer to other components of professional training and opens up possibilities for integrating work on emotions into regular disciplines, rather than confining it to specialized psychological courses.

The social-emotional skills of a future professional can be understood as a learner's ability to be aware of their own emotional states, regulate them in accordance with the situation, recognize the experiences of other people, build constructive relationships, and follow ethical guidelines in complex communicative situations. For the learner, this means being able not to "get lost" in a wave of anxiety, anger, or powerlessness, but to see what is happening to them and to seek ways of support. For the future professional, this becomes a tool of professional activity: the teacher works with children and adolescents who carry their own traumatic experience; the economist participates in financial decisions that have consequences for people and communities; the manager is responsible for teams that have lived through combat, occupation, or forced displacement.

In such conditions, professional resilience emerges as the ability to act without denying one's own vulnerability. It is not about emotional "numbness", but about the ability to hold emotional tension in a way that does not destroy either the individual or the community. For a future teacher, this means being able to support a learner who fears air-raid sirens, has lost loved ones, or has spent a long time under occupation, without projecting onto them one's own unspoken anxiety. For a future economist, professional resilience manifests itself in the ability to conduct negotiations in an unstable post-war economy, where jobs, family livelihoods, and the development of local communities are at stake. In each case, social-emotional skills become the

"bridge" that connects professional knowledge with the ethical dimension of decision-making.

The war has also highlighted another crucial aspect of social-emotional skills. A learner is simultaneously the subject of educational activity and a person who experiences loss, separation, and uncertainty. Their ability to participate in the educational process directly depends on how well they can recognize their own states, seek help, and avoid breaking ties with the group, even in situations of forced migration. Where these skills are poorly developed, any external stress quickly transforms into learning problems: absenteeism, missed deadlines, conflicts, and feelings of exclusion. Where they are supported, the group becomes a resource of mutual assistance rather than merely an "attendance list".

Social-emotional skills also have a clearly defined dimension of future professional leadership. Post-war reconstruction will require professionals who can not only manage processes, but also understand the emotional dimension of change: how decisions affect people who are already living under prolonged tension; which forms of communication strengthen trust and which, conversely, erode it; and how to avoid re-traumatization in the public sphere. In this sense, emotional intelligence becomes a prerequisite for ethical leadership, and social and emotional learning becomes a means of developing such leaders within the university.

For the higher education system, this implies the need to move from episodic support initiatives to a structured approach to social-emotional skills. In particular, this involves embedding relevant tasks into professional training and utilizing reflective writing, discussions of challenging situations, and analyses of professional cases that acknowledge the emotional dimension. As international research on SEL demonstrates, precisely such an approach enables the social-emotional sphere to be transformed from a "hidden curriculum" into a conscious focus of pedagogical work and educational activity (Kabakci & Owen, 2010; Primi et al., 2016; Lalomia & Cascales-Martinez, 2023).

Thus, social-emotional skills and emotional intelligence should be considered integral to a future professional's readiness.

They ensure that education remains alive and humane on the edge between war and peace, helping learners not to fall out of the educational process, but to re-interpret their experiences and use them for personal and professional growth. The following subsections of the chapter demonstrate how these skills can be developed through communicative tasks, the culture of professional communication, and various educational practices that support and facilitate recovery in crisis and post-war education.

Review of recent research

An analysis of contemporary studies reveals that social-emotional skills and emotional education are being increasingly examined through the lens of crisis, ranging from local traumatic events to long-term social upheavals. In research on social and emotional learning in children, adolescents, and young adults a recurrent pattern is consistently observed: the psycho-emotional state of participants in education is shaped not by isolated stressful episodes but by the prolonged impact of instability, uncertainty, and a sense of danger, which directly affects learning quality and the capacity for self-development (Kabakci & Owen, 2010; Primi et al., 2016; Kulikova & Orel, 2021). Under such conditions, social-emotional skills and emotional intelligence cease to be secondary characteristics and are viewed as essential conditions for maintaining the viability of educational systems.

International research on SEL (social and emotional learning) consistently demonstrates that social-emotional skills are directly linked to young people's ability to adapt to change, cope with emotional challenges, and maintain academic achievement. The development of large-scale SEL assessment tools, such as the SELSS scale for adolescents (Kabakci & Owen, 2010), the SENNA 1.0 inventory for youth in Brazil (Primi et al., 2016), rubrics for formative assessment of self-management and openness in school settings (Pancorbo et al., 2020), and tools for monitoring social-emotional skills in secondary school (Kulikova & Orel, 2021), reflects a drive to provide social-emotional development with an evidence base comparable to that of academic achievement. For Ukrainian higher education

institutions, where learning takes place during a full-scale war, this line of work is particularly significant, as it provides benchmarks for developing their own assessment and support systems.

Parallel to this, a growing body of research exists on intervention programs designed to develop social-emotional skills through specially organized activities. Studies of programs for adolescents have shown that a positive social climate, systematic work on interpersonal relationships, and exercises focused on cooperation and empathy can help reduce emotional and behavioral problems, as well as improve school adaptation (Peculea & Bocos, 2013; Benitez Munoz et al., 2007). In early and pre-school ages, portfolio-oriented learning, which makes it possible to track the progress of social-emotional development (Yus et al., 2017), as well as play-based and educational solutions for parents aimed at developing sensitive caregiving, interaction, and support for children's emotional expression (Costa et al., 2022), prove effective. Experience with school programs in Denmark shows that systematic work on the emotional skills of children and adults, reliance on observation, involving teachers in shared learning, and attention to the mental health of all participants in education create a safer and more supportive environment even in the presence of numerous social challenges (Lalomia & Cascales-Martinez, 2023).

A separate group of studies views emotional intelligence directly as a resource for coping with crisis consequences. In research on mental health during the COVID-19 pandemic, EI is described as a mechanism that mitigates the impact of stress on the development of depressive symptoms: people with higher emotional clarity and better emotion-regulation skills are more likely to use resilient coping strategies and less likely to become "stuck" in maladaptive thinking patterns (Merchan-Clavellino et al., 2023). As an internal reserve of strength, emotional intelligence functions through several mechanisms: the ability to differentiate one's own states, to apply adaptive coping strategies, to seek support, and, through empathy, which strengthens social bonds and facilitates mutual aid. In studies of leadership under crisis conditions, EI is described as a resource at the organizational level: leaders with high emotional intelligence are better at

recognizing the emotional climate in their teams, responding in a timely way to anxiety, uncertainty, and fatigue, and communicating difficult decisions in a way that preserves trust and a sense of belonging among staff (Kantor et al., 2020). For higher education, these conclusions apply directly to the roles of the teacher, academic advisor, and program director.

The emotional well-being of students in crisis conditions is also evident in studies examining the interplay between emotional intelligence, identity crises, and strategies for psychological health in college. It has been demonstrated that the ability to be aware of and make sense of one's own emotions, and to recognize connections between experiences and life strategy choices, is associated with more constructive navigation of identity crises and a lower risk of psychological maladjustment (Huang & Lin, 2025). For Ukrainian learners, wartime often coincides with a phase of professional and personal self-determination, which intensifies tension and makes the development of emotional intelligence a necessary condition for preserving learning motivation.

At the same time, there is a growing number of works in which education is considered a sphere undergoing a protracted crisis of its own: a crisis of public reason, trust in rationality and democratic foundations, massification, and ideological pressure on universities (Bartolomei, 2025; Gaviria & Duarte, 2023; Tight, 2024; Macfarlane, 2024). Studies on emotional education under such conditions emphasize that the development of emotional intelligence should be part of teacher education and university staff development, as these individuals are either intensifying systemic pressure on learners or, conversely, creating a supportive space for them (Lopez-Cassa & Alzina, 2024). Research on emergency remote education, which describes the phases and scale of the shift to distance learning during the pandemic, highlights that forced distance, the rupture of face-to-face contacts, and uncertainty about the future of education exacerbate the sense of isolation and anxiety among both learners and teachers (Stewart & Lowenthal, 2023).

Against this backdrop, the Ukrainian body of research constitutes an important field in which the social-emotional, cognitive, and informational dimensions of educational resilience are examined in conjunction with one another. Several works

focus on developing young people's capacity to resist information influences and building information and media literacy, which is directly linked to emotional resilience under conditions of hybrid warfare. Studies on the impact of specially organized classes and trainings on students' ability to recognize manipulative messages, critically evaluate sources, and avoid being emotionally drawn into toxic information flows (Rudenko et al., 2023) show that infomedia literacy functions as an "external contour" of emotional protection. Research on the formation of infomedia literacy through media tournaments (Yachmenyk et al., 2023) and within the "learners – parents – teachers" triad (Yachmenyk et al., 2024) demonstrates that the development of these skills in joint activity with adults strengthens trust and mutual support in families and educational communities.

A key area of research focuses on the impact of team competitions, non-formal education, and STEM activities on the development of young people's soft skills. It has been shown that participation in team competitions promotes better communication, responsibility, cooperation, and stress resilience (Yurchenko et al., 2024), while analyses of non-formal educational activities aimed at developing infomedia literacy emphasize their role in fostering self-organization, critical thinking, and intrinsic motivation to learn (Drushlyak et al., 2025). Articles on modeling the choice of online courses in information hygiene using the Saaty method (Rudenko et al., 2024) emphasize the need for structured solutions that help learners make informed educational and life choices in an emotionally charged, information-saturated environment.

Another line of Ukrainian research explicitly links digital technologies with the development of emotional intelligence and social-emotional skills. A study on the use of digital tools in the teaching of mathematical analysis highlights that in new crisis conditions, digital platforms, visualizations, and interactive tools can not only facilitate the mastering of complex material but also create conditions for developing emotional intelligence through reflection, mutual assistance, and a sense of achievement in tackling difficult topics (Shyshenko et al., 2024). A study on the use of dashboards to develop students' analytical thinking shows that visualizing one's own progress contributes to the formation of

self-regulation skills and responsibility for learning, which clearly intersects with the social-emotional sphere (Rudenko et al., 2025). Research on the educational potential of ChatGPT from students' perspectives reveals the ambivalence of attitudes to artificial intelligence: on the one hand, as a support tool; on the other, as a factor that demands greater criticality, responsibility, and ethical sensitivity (Drushlyak & Semenikhina, 2025).

Research on developing emotional intelligence in the "teacher – learner – language training" system, grounded in a communicative approach, is directly related to the topic of this chapter. It has been shown that purposeful use of communicative tasks, role-play situations, and analysis of the emotional content of texts in language preparation can produce significant increases in learners' EI scores even under war-related stress (Semenog et al., 2024). Parallel work on the culture of professional communication among future economists and on factors of teacher competitiveness reveals that emotional stability, empathy, and the ability to build partnership-based relationships in digital environments are consistently identified as important characteristics of a modern professional (Semenikhina & Udovychenko, 2024; Kharchenko & Semenikhina, 2023). Studies on partnership pedagogy and the Pygmalion effect in digital educational environments emphasize the significance of fostering positive expectations, trust, and support in realizing learners' potential, which is directly linked to their emotional resilience (Rudenko et al., 2025).

Research on broader psycho-emotional factors of learning should also be mentioned. An international analysis of age and gender differences in the manifestations of mathematics anxiety in six Asian countries reveals the significant influence of the emotional component on attitudes toward mathematics and learning outcomes (Sarfo et al., 2025). Ukrainian efforts in popularizing STEM education, including through mobile planetariums and other innovative formats (Drushlyak et al., 2025), also address the emotional dimension. Creating an environment of curiosity, fascination, and a sense of belonging to the scientific community reduces anxiety and strengthens intrinsic motivation.

Taken together, the contemporary corpus of international and Ukrainian publications suggests several conclusions that are important for our study. First, at all levels of education, social-emotional skills and emotional intelligence are viewed as a fundamental condition for learners' well-being and success rather than as an additional "psychological bonus" (Primi et al., 2016; Pancorbo et al., 2020; Lalomia & Cascales-Martinez, 2023). Second, under conditions of various crises – sanitary, economic, political, and, in the Ukrainian context, military – it is emotional intelligence that enables individuals to withstand pressure more steadily, reduce the risks of depression and burnout, and maintain the ability to learn and grow professionally (Merchan-Clavellino et al., 2023; Kantor et al., 2020; Lopez-Cassa & Alzina, 2024). Third, there is growing recognition that without preparing teachers to address emotional, informational, and value-related challenges, education will be unable to fulfill its stabilizing and restorative functions in society. Under these conditions, Ukrainian studies on the development of emotional intelligence, information media literacy, soft skills, and partnership-oriented interaction not only fit into the global research discourse but also sharpen it by demonstrating how these approaches operate in the context of a protracted war. Against this background, the further analysis will focus on the emotional challenges faced by learners and teachers during wartime and on how social and emotional learning can become a resource for support and recovery.

Materials and Methods

The generalization of the aforementioned studies enables the delineation of a framework within which it is appropriate to consider the Ukrainian experience of developing emotional intelligence and social-emotional skills in future professionals under war conditions. The following sections present the results of a reflection on a set of interrelated educational practices implemented in Ukrainian higher education institutions: the introduction of communicative tasks into the language training of future professionals, the organization of work on the culture of professional communication of future economists, and elements of social-emotional support in the educational process. The description is based on a combination of previously obtained

empirical data, the results of standardized surveys, pedagogical observation, analysis of learners' reflective statements, and the experience of teachers working in a mode of "education on the edge". This approach makes it possible not so much to reproduce a full statistical snapshot as to identify substantive lines, forms of work, and conditions that have proved most productive for the development of social-emotional skills in crisis and post-war education.

Results

Communicative tasks as a means of developing learners' emotional intelligence

In the study by Semenog et al. (2023), learners' emotional intelligence is viewed not as a static trait but as a dynamic characteristic that can be purposefully developed during language preparation through specially designed communicative tasks. The researchers proceed from the assumption that a language course for future professionals can and should perform a dual function: ensure the mastery of vocabulary, grammar, and genres of communication, and at the same time create conditions for making sense of one's own emotions, training empathy, and developing the capacity for reflection and self-regulation.

The logic of the pedagogical experiment in this study was built on a comparison between two groups of learners. In the control group, traditional methods of working with texts and oral speech predominated, including reproductive exercises, answering questions, retelling, and standard dialogues. In the experimental group, these forms were supplemented by a system of various types of communicative tasks that were consistently embedded in each class. Over a specified period, learners in both groups underwent three rounds of emotional intelligence diagnostics using N. Hall's method, which enabled the tracking of the dynamics of five EI components: emotional awareness, the ability to manage one's own emotions, self-motivation, empathy, and recognition of other people's emotions. Statistical analysis of the results revealed that the most pronounced positive changes across all parameters were observed in the experimental group, where communicative tasks were an integral part of each lesson. In

contrast, shifts in the control group were weaker and more uneven (Semenog et al., 2023).

The communicative tasks proposed by the authors had a clearly problem-analytical and reflective character. The first block consisted of open-ended tasks based on specially selected texts, including literary, journalistic, and professionally oriented texts. The learner was expected not simply to reproduce the content of the text, but to analyze the motives behind the characters' behavior, identify their emotional states, relate these states to their own experiences, and evaluate the consequences of the decisions made. The task required moving from the level of "what happened" to the levels of "how it is experienced" and "what follows from this". Such tasks activated emotional awareness, stimulated internal dialogue, and fostered skills of written and oral reflection.

The second block consisted of analytical tasks focusing on specific real-life or modeled situations. The learner received a description of an event involving several actors – for example, a conflict between colleagues, a moral dilemma in professional activity, or a risky decision-making situation – and had to determine which emotions the participants experienced, what provoked them, and which behavioral strategies were constructive or destructive. Importantly, this involved not only recognizing other people's emotions but also relating them to one's own reactions: whether the learner tends to react in a similar way, which internal mechanisms are triggered in similar situations, and which alternatives they see. In such tasks, the ability to understand the emotional logic of others' behavior, rather than reducing assessment to superficial judgments, was particularly strengthened.

The third block was associated with role-play and inquiry-based communicative tasks. Learners "tried on" various roles – participants in professional dialogue, representatives of different sides of a conflict, teacher and learner, manager and client – and had to argue their position, conduct negotiations, seek compromise, and propose scenarios for further developments from these roles. This format simultaneously engaged learners' linguistic, cognitive, and emotional resources. The need to maintain a role, keep track of the character's emotional

consistency, and respond in real time to an opponent's remarks stimulated the development of empathy, perspective-taking, flexible thinking, and self-motivation for problem-solving (Semenog et al., 2023).

It is possible to identify an approximate correspondence between types of communicative tasks and the EI components they primarily activate. Open-ended tasks that involve working with texts and personal experiences contribute to the development of emotional awareness and reflection, fostering the ability to name and structure one's experiences. Situational analyses that require identifying others' emotions and evaluating their actions enhance empathy and the capacity for more accurate emotion recognition. Role-play exercises and modelling communicative situations particularly influence self-regulation skills, as they require holding back one's own impulses, aligning emotional expression with the professional role, and maintaining a constructive tone in communication.

The study emphasizes that the effectiveness of communicative tasks largely depends on how they are designed and integrated into the class structure. The authors highlight several principles. First, tasks must be sufficiently substantive and emotionally rich to elicit internal resonance, yet formulated in such a way that the learner does not feel compelled to excessive self-disclosure. Second, clear interaction rules are necessary: respect for others' statements, a ban on personal attacks, and the right to decline commenting on one's own experiences. Third, the teacher must act as a moderator who helps "unpack" the emotional content of tasks, asks clarifying questions, but does not impose ready-made judgements.

Under wartime conditions, the importance of such communicative tasks increases manifold. They provide an opportunity to discuss difficult topics related to experiences of loss, danger, and injustice in a safe way, without provoking direct re-traumatization. Discussions of literary, journalistic, or modelled situations effectively give the learner the right to tell their story indirectly, helping to structure emotional impressions and find meaning in them. In this sense, communicative tasks act as a "buffer" between raw traumatic experience and the possibility of speaking about it in an educational environment.

At the same time, the task format itself requires compliance with certain communication rules: listening to the end, refraining from interrupting, presenting one's position, considering another point of view, and separating the person from their actions. When these rules are consistently supported by the teacher, the group gradually assimilates a culture of respectful dialogue and learns to tolerate emotional differences without destroying relationships. For a future teacher, in particular, this is a direct experience of constructive interaction that will later be transferred to professional practice.

Thus, communicative tasks in language training can be viewed as a controlled "emotional simulator" for the future professional. Within this simulator, the learner repeatedly goes through cycles of recognizing their own and others' emotions, verbalizing them, choosing response strategies, and analyzing consequences. Regular implementation of such tasks creates a rhythm in which cognitive and emotional activity combine, and the development of emotional intelligence gradually becomes integrated into language and professional training. The experience described by Semenog et al. (2023) demonstrates that even under conditions of war and high stress, it is possible to create an educational space where communication not only conveys knowledge but also serves as a resource for emotional resilience, mutual support, and professional growth among learners.

Culture of professional communication and emotional intelligence of future professionals

The culture of professional communication for a future professional, particularly an economist, is an integral characteristic that combines values, interaction norms, speech strategies, and ethical guidelines of a specialist working in the economic sphere. Studies on the training of economists regard it as a component of professional culture without which effective relationships in business, finance, management, and services are impossible (Kharchenko, 2019). It is not limited to mastery of professional terminology or genres of business correspondence. The culture of professional communication includes the ability to build relationships that are simultaneously trusting and business-

like, to consider the psychological characteristics of the interlocutor, to adhere to moral and ethical norms, and to maintain a balance between the interests of one's own organization and the needs of partners, clients, and the community.

The structure of this culture, as described by Kharchenko (2019), consists of several interrelated dimensions. The worldview dimension includes the humanistic, cultural, aesthetic, and ethical foundations that underlie the economist's attitude toward people, work, business, and society. If future professionals proceed from the view that people are merely "resources", even formally correct communication will be devoid of respect and empathy. If, on the contrary, human dignity and responsibility for the common good are central, communicative behavior is built accordingly. In this dimension, the orientations are laid that later determine how a future economist will understand the concepts of "success", "profit", and "efficiency" in the post-war economy.

The personal dimension of professional communication culture integrates the cognitive, motivational, reflective, emotional, and volitional characteristics of the future economist. This includes the level of general development, the ability to think critically and systematically, an inner willingness to listen to others, self-control in tense situations, and the ability to analyze one's own behavior. Here lies the "point of contact" with emotional intelligence: without developed reflection and emotional awareness, it is impossible to adequately assess one's own reactions and understand how they affect the interlocutor. The personal dimension determines whether the learner perceives communication as a space of domination and "victory" over others, or as a field of cooperation and search for mutually acceptable solutions.

The psychological dimension is related to individual differences in thinking, perception, and communicative stance. Some learners tend to react impulsively, while others avoid conflict topics; some require more time to reflect and formulate their position. Developing a culture of professional communication in this dimension involves, on the one hand, being aware of one's strengths and vulnerabilities, and, on the other, developing flexibility and the ability to adapt one's communication style to the situation and interlocutor. Emotional intelligence manifests itself

here in the ability to "read" one's own automatic reactions and to slow down or adjust them in time.

The technical dimension concerns mastery of linguistic means, genres, modes of oral and written interaction, and methods of argumentation and counter-argumentation. A future economist needs to be able to formulate ideas clearly, construct logically consistent utterances, select tone and style according to the situation, and work with different types of texts – from emails to analytical reports. However, technical skill without emotional sensitivity can become an instrument of manipulation. This is why the combination of technical and personal dimensions in communication culture must be accompanied by the development of empathy, responsibility, and awareness of the limits of acceptable influence on others.

The professional dimension sets the level of professional communicative competence in the narrow sense. It includes mastery of specialized terminology, genres of business and professional discourse, skills in negotiation, the ability to prepare analytical conclusions, and to present the organization's position to different audiences (Kharchenko, 2019). In this dimension, the supporting role of emotional intelligence in communication is particularly evident: the ability to notice a shift in mood in a negotiation room, to sense when a partner is tired or irritated, to see when a pause is needed, and to deliver sensitive information in a way that does not undermine trust.

Another study (Kharchenko & Semenikhina, 2023) demonstrates that the culture of professional communication is not a neutral backdrop for the manifestation of emotional intelligence, but rather exists in a clear reciprocal relationship with it. The authors analyze the results of repeated measurements of future economists' emotional intelligence using N. Hall's method in the context of implementing a system of tasks designed to develop a culture of professional communication. They document increases in scores for emotional awareness, self-motivation, empathy, and the ability to manage one's own emotions precisely among those learners who are systematically engaged in analyzing communicative situations, practicing constructive communication strategies, and internalizing ethical norms of professional interaction.

Special attention is paid to how the development of a culture of professional communication promotes the growth of empathy and the capacity to recognize others' emotions. The study shows that fostering attentive attitudes toward interlocutors, the ability to "read" non-verbal cues, to preserve the interlocutor's dignity, and to avoid verbal aggression and manipulation is associated with increased learners' ability to be aware of their own states, regulate emotional reactions, and maintain emotional stability in tense situations (Kharchenko & Semenikhina, 2023). Emotional resilience is formed primarily through the personal dimension of communication culture – the ability to reflect on one's own words and actions, understand how they affect others, and take responsibility for them.

In the post-war economy, the combination of developed emotional intelligence and a high level of professional communication culture has direct practical implications for economists' work. Decisions are made under conditions of risk and uncertainty, where financial indicators are tightly intertwined with human dimensions. The way the economist communicates affects not only the success of a deal or project but also client trust, organizational reputation, perceptions of fairness in the team, and the broader social consequences for the community. An emotionally competent professional who understands the ethical norms of business communication can foresee which decisions may be perceived as traumatic and which as fair and transparent, and can adapt the form and content of communication accordingly.

Conditions of post-war reconstruction intensify the demand for such a combination. Economists work with enterprises rebuilding after destruction, with communities that have experienced occupation, fighting, and infrastructure loss, and with people whose life histories include severe traumatic events. In this context, emotional intelligence enables professionals to see human stories behind numbers, recognize interlocutors' vulnerability, and understand which topics require particularly delicate handling. The culture of professional communication, in turn, sets ethical boundaries: what is acceptable in negotiations, how to discuss downsizing, restructuring, or changes in

cooperation conditions without turning economic decisions into an additional source of trauma for people.

Therefore, the interconnected development of emotional intelligence and the culture of professional communication in the training of future professionals should be seen as a prerequisite not only for their personal success but also for ethical leadership in Ukraine's post-war economy. Such a professional is able to combine pragmatic business goals with a responsibility towards people and communities, can discuss difficult issues in ways that preserve trust, and builds professional activity on the basis of respect, empathy, and honesty.

Educational practices of support and recovery: integrating social and emotional learning into crisis and post-war education

The generalization of experience from Ukrainian higher education institutions and the findings of the studies discussed above make it possible to identify a set of practices that have become real pillars for learners during the war and that have the potential to become a stable component of post-war educational programs. These practices combine educational and supportive functions, including reflective writing, group discussions in safe formats, training in empathic listening, modeling professional communication in various situations, as well as digital forms of interaction that enable emotional connection under conditions of danger and group dispersal.

Under wartime conditions, reflective writing gains particular importance. It gives the learner an opportunity to pause and attempt to "translate" inner experiences into words. A typical task is an invitation to describe a situation that made a strong impression, focusing not on the external course of events but on what was happening inside: which emotions arose, how they changed, what helped to withstand the tension, and what, on the contrary, increased feelings of helplessness. It is essential that such texts do not need to be shared in full. The learner may keep some of them private or share only those fragments they are ready to bring to the group. This reduces the risk of re-traumatization while supporting the development of emotional

awareness. In professional and language training, such tasks enable the combination of work on written text structure, argumentation, and style with the development of skills in distinguishing fact from evaluation and emotional response, as well as identifying links between thoughts, emotions, and actions.

Group discussions of traumatic events in safe formats fulfil a different but equally important function. They create a space in which learners can hear that their experiences are neither unique nor "wrong". Such discussions are based on clear rules of mutual respect, confidentiality, and the right to remain silent, as well as the right not to share what a person is not yet ready to disclose. The focus of conversation is often not on personal stories but on texts, documentary testimonies, film fragments, works of fiction, or modelled situations. This allows participants to talk about difficult emotions indirectly, without forcing anyone into excessive disclosure. The teacher's role is to maintain the safety framework, ensure that the discussion does not turn into a competition of traumas or mutual accusations, and help learners notice different ways of responding to the same event and understand that similar outward reactions may stem from different histories. Over time, this practice fosters empathy, the ability to listen to others, tolerance for diverse emotional expressions, and the ability to express disagreement without degrading the interlocutor.

A separate group consists of training in empathic listening and sessions built around modelling professional communicative situations. These are particularly important for future teachers, economists, managers, social workers, and medical professionals – those whose work is directly linked to people who may be emotionally exhausted, traumatized, angry, or distrustful of institutions. In such sessions, learners practice listening without rushed advice or judgments, paraphrasing what they have heard to check their understanding, asking clarifying questions, and attending to non-verbal cues. These skills are then transferred to modelled professional situations. Scenarios for negotiations in post-war reconstruction, difficult conversations with clients and partners who have suffered losses, and pedagogical situations involving children who have experienced trauma are discussed. Learners observe how the course of a situation changes depending on whether the interlocutor had an opportunity to speak, whether

their feelings were respected, and whether they received clear and honest explanations of decisions. Such scenarios show that empathy and attentiveness to another person's emotional state do not contradict rationality and rigor, but directly influence the quality of decisions, conflict prevention, and the maintenance of trust.

Digital and distance formats of interaction play a crucial role in maintaining emotional connections under conditions of danger, forced migration, and frequent changes in educational formats. Online discussions, grounded in agreed-upon rules and careful moderation, enable learners to maintain a sense of group belonging even when they are located in different cities or countries, live in different time zones, and have unequal access to resources. Short video reflections, in which learners share thoughts and feelings related to a particular topic or task, open up opportunities for self-expression for those who find it difficult to speak in class or on camera in real-time. Digital emotion diaries maintained in secure environments support the habit of regularly assessing one's emotional state, noticing changes, linking them to daily events, and choosing healthier self-help strategies instead of, for example, emotional "shut-down" or immersion in destructive information flows. Such tools do not replace in-person communication, but they allow the social and emotional learning process to continue during periods when classroom teaching becomes impossible or dangerous.

Experience gained during the war in using digital formats has shown that they can serve not only as an "emergency exit" but also as an element of a new university culture. Online meetings in smaller groups, asynchronous discussions on forums, and platforms for reflective posts integrated into courses help build horizontal ties and foster a sense of belonging to the academic community, even when learners are physically distant. From a post-war perspective, these formats can be seen as a means to make social and emotional learning more accessible and flexible, thereby making them suitable for hybrid and blended learning models.

For the recovery and development of the higher education system, it is important that the practices described above do not remain a temporary "anti-crisis patch". They should be embedded

into educational programs as stable elements supporting learners' emotional well-being and professional resilience. This implies, first, purposeful design of courses in language training, professional communication, pedagogy, and management that explicitly incorporate social-emotional components. Reflective tasks, discussions of the emotional and ethical dimensions of professional situations, and modeling complex communicative scenarios should be included in course syllabi rather than relying on the goodwill of individual teachers.

Second, teacher preparation for working with learners' emotional states and their own emotional vulnerability is essential. Practice shows that even the best-designed tasks do not produce the expected effect if the teacher lacks basic skills in empathic listening, does not know how to set boundaries, and has no support for their own emotional recovery. Therefore, professional development programs should include modules on teachers' emotional intelligence, self-care strategies, and techniques for working with groups under prolonged stress. This does not imply turning teachers into psychotherapists, but rather providing them with tools to organize educational spaces that support rather than harm.

Third, the sustainability of these practices depends on the extent to which university administration, program directors, and student self-governance bodies are prepared to treat emotional well-being as a component of educational quality. When reflective tasks, discussions of difficult topics, communication skills training, and digital support formats are enshrined in regulations and methodological recommendations and allocated time and resources, they cease to be "experiments of a few enthusiasts" and gradually shape a different university culture. In such a culture, success is measured not only by academic indicators but also by the community's capacity to withstand prolonged challenges, preserve humanity, and recover after losses.

Thus, the integration of social and emotional learning into crisis and post-war education can be seen as one of the directions of a long-term strategy for sustainable development. Educational practices that support and foster recovery, emerging in response to wartime challenges, have the potential to become the foundation for shaping a generation of professionals who combine

professional competence with a high level of emotional maturity, empathy, and responsibility for the people and communities with whom they will work.

Discussion

The findings on the use of communicative tasks, the development of a culture of professional communication, and the implementation of social-emotional support practices show that learners' emotional intelligence is indeed dynamic and amenable to pedagogical influence, provided that work with emotions is integrated into course content rather than relegated to separate, isolated trainings (Semenog et al., 2023; Kharchenko & Semenikhina, 2023). Where the emotional dimension of learning becomes part of an ordinary class – through communicative tasks, reflective writing, and discussions of professional situations – increases in emotional awareness, self-motivation, empathy, and the ability to manage emotions are not episodic but durable. This is well aligned with the conclusions of international research on social and emotional learning, which emphasize that the most effective programs are those that are "woven into" the educational process and supported by the daily practice of interaction in the classroom (Kabakci & Owen, 2010; Primi et al., 2016; Pancorbo et al., 2020).

Comparison with large-scale projects, such as SENNA 1.0 in Brazil (Primi et al., 2016), and monitoring tools for social-emotional skills in secondary schools (Kulikova & Orel, 2021), reveals methodological affinities between Ukrainian developments and global trends. This concerns the combination of standardized scales designed to measure specific components of emotional intelligence with analyses of actual educational practices. In our case, the "sites of action" are language and professionally oriented courses, where communicative tasks, work with texts, role-play situations, and discussions of professional cases are purposefully used to develop EI. At the same time, Ukrainian studies add an important additional dimension to this field – testing the effectiveness of such approaches under prolonged conditions of war-related stress, when learning takes place against a backdrop of threats to life, loss, forced mobility, and constant uncertainty.

International work on SEL intervention programs consistently shows that systematic work with emotions and relationships contributes to reduced emotional and behavioral difficulties, better adaptation, stronger cooperation, and improved learning outcomes (Peculea & Bocos, 2013; Benitez Munoz et al., 2007; Yus et al., 2017; Costa et al., 2022). The generalizations we have obtained demonstrate similar dynamics, but under conditions of much greater external pressure. Learners who are regularly involved in reflective writing, safe group discussions, and role-play and inquiry-based tasks with explicit emotional content demonstrate a higher ability to verbalize their own states, recognize others' emotions, and sustain mutual support within the group. In practice, a "micro-community of support" is formed in the university classroom, where social-emotional skills develop through real joint activity rather than mere declarations. This resonates with the Danish experience of school-based social-emotional education programs, where an emphasis is placed on the joint learning of children and adults, the development of observation and participation practices, and the care of the mental health of all participants in the educational process (Lalomia & Cascales-Martinez, 2023).

The dimension of emotional resilience and coping with crisis consequences is particularly revealing when compared with international research. In the study by Merchan-Clavellino and co-authors, it was shown that emotional intelligence, in particular emotional clarity, moderates the relationship between resilient coping strategies and depressive symptoms during a strict lockdown: people with higher EI levels are more likely to use adaptive strategies and less likely to display pronounced depressive symptoms (Merchan-Clavellino et al., 2023). In our materials, communicative practices serve as a "buffer" against negative experiences, enabling learners to recognize and articulate emotions, explore more constructive ways of responding, and seek support from the group and the teacher. Thus, it can be argued that integrated forms of working with emotions within education create conditions for more adaptive processing of crisis events. The affinity in the logic of these processes with international findings is evident; however, the depth and duration of the crisis context, characterized by full-scale

war, increase the value of the Ukrainian experience for the global discussion.

The results related to the culture of professional communication of future economists correlate well with international developments on the relationship between emotional intelligence, leadership, and the quality of managerial decisions in crisis situations. In the study by Kantor and co-authors, it was demonstrated that leaders' emotional intelligence supports staff, reduces stress within teams, increases readiness for change, and enables unpopular yet necessary decisions to be implemented without compromising trust (Kantor et al., 2020). Comparison with our data points to a similar logic: a future economist who combines well-developed emotional intelligence with a high level of culture of professional communication copes better with tasks that require taking into account the emotional state of partners, clients, and colleagues, as well as the possible social consequences of decisions for the community (Kharchenko & Semenikhina, 2023). In the Ukrainian situation, these abilities are directly linked to the ethics of reconstruction. The economist works with businesses, communities, and individuals whose experience includes loss and trauma, so inflexible, purely technocratic models of communication become not only ineffective but also potentially traumatizing.

Another important aspect of comparison concerns the role of the teacher. International researchers emphasize that the emotional intelligence of teachers or university instructors has a significant impact on the educational system's ability to perform a supportive function. Studies on emotional education during crises emphasize that working with one's own emotions, developing empathy, self-regulation skills, and awareness of one's "emotional labor" should be part of teacher education and professional development (Lopez-Cassa & Alzina, 2024). Our generalizations add another dimension to this statement: an instructor who leads a group in wartime is themselves in a high-risk field, yet must maintain for learners a space of relative safety. Implementing reflective writing, group discussions, digital emotion diaries, and role-play tasks requires high sensitivity to the group's state, readiness to adjust course plans, and the ability to align course content with the emotional "capacity" of the classroom. This brings

Ukrainian experience closer to international discussions about the emotional burden on educators, while also highlighting a significantly higher level of tension in which this work is carried out.

Digital and distance formats, which in international publications are described as a response to the challenges of the pandemic and other "episodic" crises (Stewart & Lowenthal, 2023), in our practices assume the function of sustaining community life under conditions of constant danger. Online discussions, video reflections, and digital emotion diaries serve as "bridges" connecting groups scattered by the war, allowing for uninterrupted learning and social-emotional development when in-person presence becomes impossible or dangerous. Unlike classical models of crisis distance education, which primarily focus on a temporary transition to online modes, the Ukrainian experience demonstrates a prolonged wave-like alternation of modes, combining in-person, distance, and blended forms. In such a situation, digital tools are used not only to deliver course content but also to sustain the emotional connectedness of the group and preserve the sense of belonging to the university community.

It is also important to acknowledge the limitations of the generalizations presented. As in many international studies on SEL and emotional intelligence, a significant part of our data relies on self-report scales and questionnaires (Primi et al., 2016; Kulikova & Orel, 2021). This calls for caution in interpretation and requires quantitative results to be complemented by qualitative observations, analyses of learners' work products, and in-depth interviews with instructors. In addition, most of the practices described have been implemented within individual courses and institutions, which raises questions about their scalability and adaptation to other specialists, regions, and levels of education. Another limitation is that the studies were conducted under emergency conditions, making it difficult to control many variables. At the same time, the orientation of these approaches – integrating social and emotional learning into disciplinary preparation, relying on reflection, dialogue, and joint analysis practices – aligns with global trends in SEL development, which makes it possible to speak of their potential for wider dissemination.

Thus, comparison of Ukrainian results with international research indicates a certain convergence of approaches. Social and emotional learning proves effective when it is integrated into disciplinary preparation, rests on systematic practices of reflection, dialogue, and joint analysis of complex situations, and is supported by the emotional intelligence of educators. The specificity of the Ukrainian experience lies in the fact that these approaches are being tested under conditions of full-scale war and are aimed not only at the individual well-being of the learner but also at preparing future professionals capable of acting responsibly during the post-war recovery of society and the economy. This is what lends Ukrainian practices of developing emotional intelligence and social-emotional skills additional weight in the international discourse on the resilience of education in the face of multidimensional crises.

Conclusions and recommendations on developing future professionals' social-emotional skills

The generalization of theoretical approaches and the findings from the two empirical cases demonstrate that the development of emotional intelligence and social-emotional skills is one of the primary pillars of educational resilience on the edge between war and recovery, rather than an optional supplement to professional training. Where work with emotions is episodic and limited to one-off "anti-crisis" measures, the educational process proves vulnerable to any external escalation. Conversely, the systematic integration of social and emotional learning into language, professional, and communication courses strengthens learners' ability to withstand prolonged tension, remain engaged in learning, support one another, and transfer acquired interaction patterns into professional activity.

A comparative analysis of the case of using communicative tasks to develop emotional intelligence and the case of forming a culture of professional communication among future economists convincingly shows that increases in EI are achievable within ordinary university courses, provided that their content and methodology are purposefully rethought. In the first case, language training is enriched with open-ended tasks, character

analyses, and role-play and inquiry-based situations that create a space for practicing emotional awareness, empathy, and self-regulation. In the second case, the culture of professional communication of future economists is built as a system of values, norms, speech strategies, and ethical guidelines that directly correlates with increases in emotional intelligence scores. Both examples demonstrate that fields with different profiles can rely on similar mechanisms: incorporating emotionally rich situations, organizing reflection, and analyzing communicative decisions and their consequences for people and communities.

A significant finding is the recognition of the dual effect of such practices. At the personal level, learners' resilience increases as they develop the ability to recognize their own states, name them, seek support, choose more constructive strategies for coping with stress, and take responsibility for their own decisions. A person gradually moves from being a passive object of events to becoming a subject who sees their scope for influence, even when external circumstances remain extremely difficult. At the professional level, a different stance towards interaction with people is formed: the emotional dimension of activity is not ignored but is understood as a component of responsible attitudes to those with whom the specialist works. For teachers, this means the ability to support learners in wartime without devaluing their experiences and without abandoning educational goals. For economists, it means being ready to work in the post-war economy, considering the emotional states of partners, clients, and teams, while avoiding manipulation and destructive conflicts, and focusing on decisions that align with the ethics of reconstruction.

At the level of educational programs, the findings make it possible to argue for the need to embed social and emotional learning into the structure of courses rather than create parallel "psychological add-ons". It is advisable to include modules that directly develop emotional awareness, empathy, self-regulation, and constructive conflict-resolution skills within language and professional training. These may be thematic blocks integrated into courses on language preparation, professional communication, pedagogy, and management, where social-emotional goals are realized through communicative tasks,

analyses of professional cases, reflective writing, and group discussions. For economists, teachers, and other professionals, it is essential to foster a culture of professional communication that treats the linguistic, ethical, and emotional aspects of interaction as an integrated whole, rather than as separate skills.

Special emphasis is needed on teacher preparation. The generalizations show that even methodologically impeccable tasks lose their effectiveness if the instructor is not ready to work with the group's emotional states and their own vulnerability. Therefore, professional development programs should include modules on teachers' emotional intelligence, techniques of empathic listening, self-preservation strategies, and organizing a safe educational environment. The instructor must receive not only sets of tasks but also tools for supporting themselves and the group, including ways of setting boundaries, algorithms for responding to manifestations of traumatic experiences, and options for adjusting course plans depending on the emotional "capacity" of the classroom. This enables the maintenance of a balance between support and high expectations, between care for the individual and the preservation of training standards.

A third important level of recommendations concerns designing educational programs that take into account the wartime and post-war experience of learners and instructors. This involves not only including relevant themes in course content but also rethinking forms and formats of work: using digital tools to support emotional connection in dispersed groups, providing space for reflection on lived events, and introducing tasks that model professional situations of reconstruction, interaction with traumatized communities, and decision-making in education, business, and governance. In such a configuration, social and emotional learning ceases to be a situational response to crisis and becomes part of a long-term educational development strategy oriented towards human dignity and community restoration.

It is essential that these changes be supported not only by individual enthusiasts but also at the institutional policy level. Educational programs that prepare individuals for action under conditions of uncertainty and crisis should clearly define learning outcomes related to emotional intelligence and social-emotional skills, and provide appropriate means for their achievement and

assessment. Universities can introduce internal documents and practices that enshrine care for emotional well-being as part of educational quality: from systems of mentoring and supervision for instructors to support for student initiatives related to mutual aid, volunteering, and reflective communities.

Thus, the development of future professionals' emotional intelligence and social-emotional skills should be viewed as one of the key directions for transforming higher education in Ukraine during the war and in the post-war recovery period. Such an approach enables the combination of professional training with care for the emotional well-being of learners and instructors, thereby shaping a generation of professionals capable of acting responsibly, empathetically, and effectively in the face of prolonged social challenges. In this perspective, social and emotional learning appears not as a "soft" option but as a necessary condition for a resilient, ethically oriented, and humane higher education system.

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2.4. CREATIVE ACTIVITY AS A MEANS OF COUNTERACTING THE CRISIS AND EXTREME FACTORS OF HUMAN EXISTENCE

Alexander Voznyuk

***Abstract**. The purpose of the interdisciplinary research is to analyze the creative activity as a means of counteracting the crisis and extreme factors of human existence. This analysis is based on an interdisciplinary study of the systemic foundations of creativity. Six aspects of creativity studies have been outlined, covering: 1) The emergent nature of creativity in the context of explosive/bifurcation generation of the creativity process and its connection with chaos, uncertainty. 2) The process of creativity as "creativity for creativity's sake", revealing its non-pragmatic/non-targeted nature. 3) Motivation of the creative process. 4) The spatial creativity that presupposes the ability of a person to combine different and opposing things, thus expressing the self-referent, non-adaptive nature of creativity. 5) The material, "bodily" creativity, associated with the human organism, shows the connection of creativity with human health, thus counteracting the crisis and extreme factors of human existence. 6) The chronal nature of creativity, revealing its linear-evolutionary, developmental nature.*

***Keywords**: human brain; synergetic approach; non-adaptive activity; diplasty; bisociation; talent; giftedness; infantilization; team spirit; extreme factors.*

Introduction

In modern civilization, with its crisis of the personality, the rise of technocratic thinking, and the necessity to counteract the negative social phenomena (one of which is the crisis and extreme factors of human existence), the criteria for creativity have undergone changes. The qualities of creative individuals that enable them to realize their potential, cultivate creative activity,

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and ultimately enhance the social environment and interpersonal relationships are now valued.

Developed spirituality is evidently one of the key social demands for creative individuals capable of addressing the current social issues. Creative individuals, being the guardians of beauty and harmony in culture and nature, are characterized by an open personality stance, which includes a positive attitude toward themselves and the world, a suprapersonal/ nonpragmatic system of values, selfless interest in the world and others, and non-pragmatic motivation for activity (Corbett, 2018). This open personality attitude towards natural and social environment, connected with such qualities as activity, freedom, self-transcendence, and spirituality, may serve as a factor of creative activity and creative thinking being prerequisites for the realization of cognitive and other abilities through a superpersonal/non-adaptive orientation of interests and a profound curiosity about the phenomena of the world (Eysenck, 2003; Ryan & Deci, 2000).

Creativity is a vast concept in modern science, being one of the most prioritized areas of scientific research. Thousands upon thousands of scientific papers devoted to this research have been published for the last 100 years, revealing 12 major topics, covering such aspects as the psychology of creativity, organizational creativity, creative industries, business and management, etc., being studied in the contexts of digitalization, interdisciplinarity, multiculturalism, etc. 36 trends in creative study reveal a great variety of topics, from the discussions of cultural psychology, distributed creativity, religious meditation, creative happiness to the role that virtual reality plays in producing the creative outputs (Mejia et al, 2021; Runco & Jaeger, 2012; Glăveanu, 2014).

Current state of the issue

Analysis of the current socio-cultural situation has shown that creativity and cognate categories (giftedness, talent, genius, lateral thinking, etc.) are becoming key concepts in modern psychological and pedagogical sciences, aimed at revealing the fundamental foundations of effective educational activity. This, in

turn, leads to a deeper understanding of the problems related to the intellectual and creative development of young people, which is reflected in research focusing on the psychophysiological and psychophysical, cognitive and psychological, as well as philosophical and metaphysical foundations of creativity and its mechanisms.

The in-depth research into phenomenon of creativity enables it to be considered not only as the driver of human progress and the life of future human race/generations (Csikszentmihalyi, 1996), the essence and meaning of human life/existence, the fundamental aim of human development, the corner goal of educational activity, but also as the major tool/means of these activity and development. Creativity can be understood as an absolute entity – self-determined and self-referent "thing in itself", existing for itself, thus embodying the esthetic ideal "art for art's sake". Creativity can also be examined as a generating source (factor, force) of the world, as H. Bergson showed in his teaching on "creative evolution" (Bergson, 2005; Montebello & Lapidus, 2007; Gabora & Kaufman, 2010; Gruber, 1988).

Creativity, being, to some extent, a paradoxical entity (Lambert, 2020), can be defined as a person's capacity to produce work that is original and useful (Runco & Jaeger, 2012), revealing the basic characteristic/function of creativity as a *complex adaptive system* (Lambert, 2020). Creativity have been and are being studied in the plane of the cognitive mechanisms that facilitate creative thinking (Acar & Runco, 2015; Beaty et al., 2014; Haase et al., 2023; Heilman et al., 2003; Lloyd-Cox et al., 2023; Sweller, 2009), in the virtual sphere of creative incubation (Patrick, 1986; Soma & Joydeep, 2025) and daydreaming (Zedelius et al, 2021), within the ranges of associative effects (Bendetowicz et al, 2018) and bisociation (Koestler, 1964), as psychiatric deviations/accentuations (Csikszentmihalyi, 1996), the behavioral instrument of life success (Lambert, 2020; Simonton, 1984), leadership and managerial decision making (Simonton, 1984; Ford, Gioia, 2000), social processes (Perry-Smith & Shalley, 2003), and group creativity (Paulus et al, 1999; Jason & Hedrick, 2016), the healing factor of human organism (Sawyer, 2012; Zausner, 1998), revealing the mechanism of

person's psychological and somatic health and being the colossal resource for counteracting the crisis and extreme factors of human existence (Barron, 1963; Sanaz, Voznyuk et al, 2022), taking into consideration the hemisphere functions peculiarities of creativity (Rotenberg, 1993), et cetera.

Creativity, organizing the balance (through "middle way" strategy of thinking and behavior (Schooler et al, 2014)) within polar concepts and psychological states is realized "not by operating at a mid-point along a continuum, but by operating at and blending two more-extreme positions" (Lambert, 2020), thus revealing the transcendental character of creative process (Citko, 2019; Frankl, 1966; Garberich, 2008; Hartelius et al, 2007; Kharkhurin, 2015; Lajoie, Shapiro, 1992; Pronyakin, 2001; Sánchez-Capdequi & Beriain, 2023; Summa, 2017).

In the scientific explorations, increasing attention is being paid to problems of creativity and giftedness in their connection with the paradigm shift in modern education (Lo & Porath, 2017; Renzulli, 2000; Winner, 2000; Ziegler et al, 2012; Tae et al, 2018; Voznyuk et al, 2021).

The most interesting and innovative, as well as important and revolutionary, are the researches using the interdisciplinary cybernetic and synergetic approach (Penrose, 2016; Rotenberg, Arshavsky**,** 1991), expositing such aspects of creativity and the prospects of its study as "the order-chaos dynamic of creativity" (Lambert, 2020), "the self-organized criticality", "creativity and chaos theory" (Zausner, 1998), "chaos, creativity, and Guilford's structure of intellect model" (Richards, 2001), "the emergence of creativity" (Sawyer, 1999), "chaos, creativity, and community" (Richards, 1996).

Due to urgent need to fathom the fundamental basis of the Universe (Moreland, 2001; Voznyuk, 2025), and to understand the nature of creativity, being in some important aspects rather an enigma for scientific community, the systemic approach to studying human brain (Anokhin, 1963) and creativity is gaining momentum (Csíkszentmihályi, 1996; Guastello, 2011; Lichtenstein, 2000; Montuori, 2011; Poutanen, 2013; Puccio, Cabra, 2010; Saunders, 2011; Suwala, 2017).

We believe that due to our systematic research in the wide range of scientific areas (Voznyuk et al, 2021; Voznyuk, 2025), the study of creativity would reach new scientific pinnacles, including the understanding of the creative activity as a means of counteracting the crisis and extreme factors of human existence (Miroshnychenko & Voznyuk, 2025).

The **purpose** of our research is to analyze the creative activity as a fundamental counteraction to the crisis and extreme factors of human existence through an interdisciplinary study of the systemic foundations of creativity.

Materials and methods

Our interdisciplinary study in addition to the theoretical analysis of the problem field of creativity studies, the concept of functional asymmetry of the hemispheres of human brain (Voznyuk, 2017; Voznyuk, et al, 2021; Wang, 2023), the theory of stress (Selye, 1974), the information theory of stress (Simonov, 1991), the theory of cognitive dissonance (Festinger, 1962), cognitive schemes (Shickel, 2020), the theory of creativity as non-adaptive activity, that establishes a correlation between a person's internal motivation and their creative activity (Ryan, Deci, 2000), A. Maslow's provisions for the self-actualized personality (Maslow, 1976), the theory of psychological defense (Cramer, 2015), as well as the general systems theory, developed by Yuri Urmantsev (Urmantsev, 1986) and modified and developed by the author of the article, have been used (Voznyuk, 2023, 2025). The research is also based on the theory of frames (Goffman, 1974, 1986; Minsky, 1975; Moskiene, Rackeviciene, 2021; Schank, Abelson, 2013), on the ideas about holographic/fractal organization of the world (Bohm, 2008; Coleman, Pietronerom, 1992; Keel, 2024; Youvan, 2024), as well as on the synergetic approach being an interdisciplinary scientific tool aimed at cognizing the world in its wholeness and unity, with the help of which the researchers seek to build "conceptual bridges" between many scientific areas (Haken, 1995; Grindal, 2009; Massa, Mahony 2021).

Results and discussion

1. Neuropsychological prerequisites of creativity

One of the most important generalizations in the subject sphere of our research, as we believe, is revealed in the concept of the functional asymmetry of the human brain, which shows that the functions of the hemispheres are related to the basic processes of the human being (Voznyuk, 2025; Voznyuk et al, 2021; Wang, 2023). Moreover, the hemispheric asymmetry expresses the general asymmetry of space and time in our Universe (refer to "Gibson's law of right-side stimulation" – (Sedgwick, 2021; Voznyuk, Hogobets, 2023).

In general, the hemispheres employ the left–rational and right–irrational strategies of cognition and world mastery, which must be integrated for an accurate reflection of reality and a true picture of the world. V. L. Deglin, studying the hemispheric features of the reflection of the surrounding world, and in particular its spatial characteristics, came to the conclusion that both hemispheres refract space in an erroneous way, but these errors have a directly opposite nature, when the left hemisphere is characterized by the expansion of space, and the right – by the approach of separate elements to the observer. That is, the left hemisphere strives to distance a person from the environment, while the right hemisphere strives to integrate a person into it. However, the functional coherence of the hemispheres, the compromise between them leads to the alignment of spatial deformation, that is, the adequacy of the perception of volumetric space on the plane of the retina is achieved, when the volumetric and the planar, being geometric antagonists (which is demonstrated by the dichotomy of the geometries of Euclid and N.I. Lobachevsky), are harmonized and brought to a common sensory and cognitive "denominator" (Chernigovskaya, Deglin, 1986).

The human development proceeds from the right-hemisphere aspect of the psyche (in an infant, both hemispheres show the lowest index of asymmetry and function as a single whole, mainly according to the principle of the right hemisphere) to the left-hemisphere, and from it to the state of functional synthesis of the hemispheres (Voznyuk et al, 2021; Wang, 2023).

Thus, we have the philosophic scheme/algorithm of development revealing the triadic and dialectic character: (1) theses → (2) antitheses → (3) synthesis. According to this algorithm, we can understand the development of forms of activity in ontogeny and phylogenesis:

(1) *Play* (right hemispheric spontaneous activity that is not aimed at achieving pragmatic goals and exists for its own sake, similar to "art for art's sake"). In most ancient (primitive) communities, there was no sharp boundary between work and leisure.

(2) *Work* (left hemispheric purposeful activity aimed at achieving certain pragmatic goals). Only during the Industrial Revolution did we observe the differentiation of work and leisure, when the latter began to be associated with non-working time.

(3) *Creativity* (the inter-hemispheric activity that reiterates the play, but at a higher level of development, since it has the characteristics of both play (spontaneous, self-determined activity), and work (the activity that manifests a certain practical result). In creativity, work and leisure are combined and intertwined.

Under such conditions, the onto- and phylogenetic dynamics of the hemispheres realizes the movement from the subconscious (right hemispheric) to the conscious (left hemispheric) aspect of psychic activity, and from the latter – to their functional synthesis revealing the superconscious entity (Simonov, 1991) as a creative status of a person (as evidenced by encephalographic studies, the hemispheres are functionally synchronized in a meditative and creativity state (Murphy et al., 1997)), which characterizes the state of unity of opposites, which at the level of mental reflection of reality is realized in the fundamental phenomenon – *the diplasty* – not characteristic of animals the fundamental ability of a human being to combine opposite attitudes, concepts, psychophysiological states in one integral/paradoxical context (Valček, 2009; Shteba, 2020; Yesayan, Naghdyan, 2023), revealing the epistemological/social phenomena of absurdity, paradox, chaos, ambiguity. And the diplasty, as a psychological state, represents the mental/cognitive strategy to decrease the

level of entropy in nervous processes (Rotenberg & Arshavsky, 1991).

The diplasty, considered to be the main/fundamental factor of evolution of the *Homo sapiens* (Porshnev, 1976), is a phenomenon of integration of two elements that exclude each other (for example, in linguistics this is the oxymoron – a figure of speech combining contradictory, mutually excluding complex concepts/words with opposing meanings, like "living dead", "old news, "genius stupidity", "deafening silence," "strong weakness", "organized chaos"), which activates *bisociation* (the simultaneous mental association of an idea or object with two fields ordinarily not regarded as related (Koestler, 1964)) – a synergistic mechanism of human creative activity, since contrary to associative connection of concepts, which appear under the influence of deeply rooted schemes of experience (that is, based on the reiteration of concepts arising in time and space and being associated with similarity, contiguity or contrast), the bisociations appear as a result of combining ideas that do not have an obvious commonality and connection between them, being objectively new and sometimes seem unnatural, chaotic, paradoxical, contradictory and hence – creative (Dubitzky et al, 2012; Zeng, 2013).

The hemispheric synthesis involves the full unfolding/realization of the resources of the "right", creative aspect of the psyche (the essence of which lies in the ability to think holistically, polysemantically, combining and integrating facts and realities belonging to different and even polar spheres of our world), and therefore the educationalists should not rush to replace the activity of the right hemisphere with the left one. Thus, the mind of a person in whom direct perception of the surrounding world and visual-figurative thinking were not properly formed in childhood may later receive one-sided development, acquiring an excessively abstracted mode. Some researchers believe that such purely one-sided left-hemispheric thinking leads to the formation of a schizoid type of person, characterized by an unambiguous "black and white" worldview (Raine, 1988).

The conclusion that creativity is realized in the plane of paradoxical synthesis of the functions of the right and left hemispheres is confirmed by studies of creative individuals who

are characterized by mutually exclusive features: 1) Creative individuals have, on the one hand, enormous physical energy, and on the other hand, they are often in a state of calm and rest; 2) They are both strict and naive; 3) Within the framework of their personality, playfulness, frivolity and strict discipline, responsibility or irresponsibility are combined; 4) Their fantasy and sense of reality are integrated; 5) They manifest themselves as both extroverts and introverts; 6) They are modest and at the same time proud; 7) They avoid stereotypes in the field of gender roles; 8) They show both a rebellious spirit and conservatism; 9) while seeking physical peace, they simultaneously demonstrate a true passion for work, and they also objectively evaluate their work; 10) The openness and sensitivity of creative people often leads them to empathize with suffering and pain of others; on the one hand, they seek comfort, and on the other, they are able to sacrifice it for the sake of an idea (Csíkszentmihályi, 1996).

Three more personality characteristics are associated with originality of thinking: dominance, sensitivity to emotions, manifestation of femininity in men, and the connection between creative abilities and such personality traits as narcissism. In this, creative individuals often identify with others and easily adopt new social roles. Other qualities of creative people are as follows: self-discipline in work; ability to postpone material pleasures; resistance to frustration; independence of judgments, high level of autonomy; tolerance, openness to uncertainty, paradox, absurdity, propensity to risk, high level of self-initiation, and desire to perform tasks as best as possible. They also demonstrate the ability for broad categorization and idiosyncrasy (increased sensitivity to some non-specific stimuli/signals), to establish non-obvious patterns. It is noted that creative people have the highest "I" strength, which is positively correlated with average neuroticism (Barron, 1963; Eysenck, 2003; Rogers, 1961).

2. The systemic composition of creativity

As has been noted, our research on creativity is based on modified general systems theory (Voznyuk, 2025). Let us present a synopsis of the modified General Systems Theory.

Due to the integral character of the Universe, the existence of the latter is regulated by some fundamental/universal laws/principles, which in the context of Yuri Urmantsev's general systems theory are revealed in the "law of system rearrangements", being a systemic universal/frame that presupposes seven possible fundamental types of systems, when any systemic entity can be transformed/rebuilt in seven ways: by changing relationship, quantity and quality, being designated as: A (relationship), B (quantity), C (quality). Due to them, we have seven basic combinations: A, B, C, AB, AC, BC, and ABC, representing the basic types of systems (Figure 1) (Urmantsev, 1986; Voznyuk, 2025).

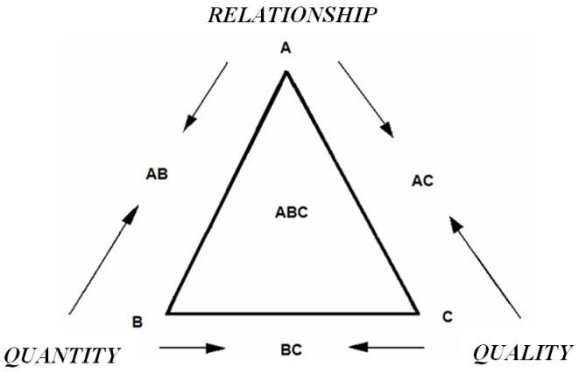

Figure 1. **The representation of reality according to the general systems theory**

Let us present some more triangles. The triangles of L. R. Hubbard (1976): the top triangle represents the KRC triangle – knowledge, responsibility, and control. The lower triangle consists of the ARC triangle – affinity, reality, and communication (these elements are united in understanding). Also interesting is Sternberg's triangular theory of love (Sternberg, 1986). According to R. Sternberg, perfect love involves a form of love that can be represented as a triangle that consists of three basic dimensions: passion, intimacy, and commitment.

The color representation of the systemic organization of reality serves as a visual demonstration and definitive proof of the basic model of general systems theory (Figure 2).

Figure 2. **Color interpretation of the systemic organization of reality**

If the elements of the model "relationship", "quantity", and "quality" are understood as fundamental categories of human cognition, then in the structure of the systemic triangle, these categories determine additional fundamental categories – "measure", "sign", and "interaction". So we have the main logical-ontological categories (universals) of reality (Figure 3).

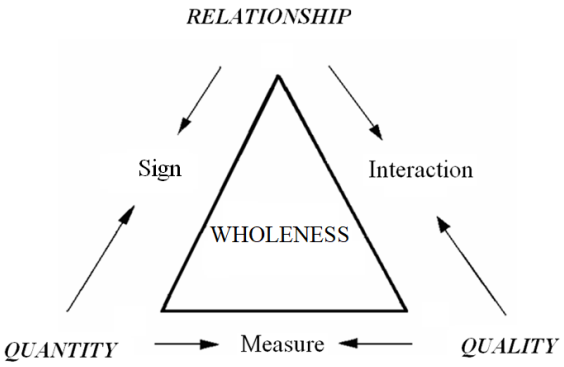

Figure 3. A fundamental model of reality, demonstrating the coordination of its major logical and ontological categories/universals

At large, the presented fundamental model of reality, revealing its principally systemic nature, can be considered as one of the fundamental models of creativity, stemming from the *philosophical universals* the ancient philosophers were eager to reveal (Moreland, 2001), finding their way to modern science in the forms of *frames* (Goffman, 1974, 1986; Minsky, 1975; Moskiene, Rackeviciene, 2021; Schank, Abelson, 2013), *holographic, fractal structures* (Bohm, 2008; Coleman, Pietronerom, 1992; Keel, 2024; Youvan, 2024), and the like which embody the attempts to find/built certain interdisciplinary universals/laws (Voznyuk, 2025).

As is known, "measure" is a philosophical category that expresses the integral and organic unity of quantitative and qualitative certainty of an object/phenomenon; accordingly, in the systemic triangle, the category of measure is actualized in the focus of the correlation between *quality* and *quantity*. In the context of types and forms of matter, "*measure*" being indifferent to specific physical characteristics can be put in correlation with "*space*", being also an "indifferent entity" that can be understood as an extension, a certain container where the objects of reality are located, and the events of our world take place.

The correlation/connection of "*quantity*" and "*relationship*" enable to appear the concept of "*sign*" being the category that captures the formal-logical relationships of abstract quantitative values, giving us an idea of quantitative gradation/dichotomy of different values (such as "more – less", etc.), and revealing the process of changing the parameters of the elements of this gradation. And this forms an idea of a *sign* and of quantitative changes, which, in turn, forms a conception of "*time*" being the formal and logical scale of quantitative changes taking place in the objects and phenomena of reality (a short moment → a second → a minute → an hour → a day → a week → a month → a year → a century → a millennium → an eternity).

The correlation of "*quality*" and "*relationship*" gives us the idea of "*interaction*" actualized as a result of the qualitative heterogeneity of our world. Thus, we have the relationship of qualitative values that form the idea of a qualitative gradation of values (such as "better – worse", "strong – weak", "large – small", etc.), as well as the idea of changing parameters of the objects on the scale of this gradation forming the concept of "*motion/interaction*" that lead to qualitative changes of the objects.

At the same time, the category "*relationship*" in the systemic triangle correlates with such a form of matter as the physical vacuum, expressing according to its nature a relationship in its pure, real form, because *the physical vacuum* can be understood as an environment of the relations of virtual particles, being the material basis of the Universe.

The "*quantity*" in the systemic triangle correlates with such a form of matter as "substance", which, due to its discrete/structural composition, reveals discrete (numerical) characteristics.

The "*quality* in the systemic triangle correlates with such a form of matter as "*field*", being realized as a qualitative entity in the process of interaction of material objects (Figure 4).

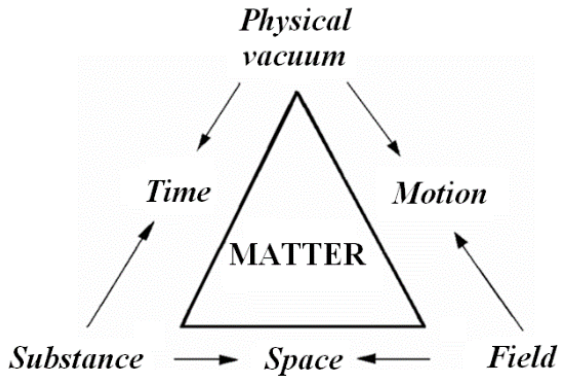

Figure 4. **The systemic composition of the matter**

The world exists, as the materialistic philosophy states, according to *the four philosophical principles* (1. general connection of objects and phenomena of our world, 2. unity, integrity of the world, 3. generality of motion and development), 4. system and structural organization of the world), and *the three laws of dialectics* (1. interpenetration of the opposites, 2. negation of the negation, 3. transformation of quantity into quality).

These determine the major *tools of conceptual thinking*: *the diplasty* (being the ability of a person to unite opposite psychological states and polar logical contents of the notions), *the analysis* (being the ability of a person to differentiate the constituent parts or features of objects and phenomena), *the synthesis* (being the ability of a person to create the combination of components or elements to form a connected whole), *the comparison* (being the ability of a person to compare the phenomena or events with each other), *the abstraction* (being the ability of a person to isolate the major features and to operate them outside the specific situation), *the generalization* (being the

ability of a person to bring to reduction of various concepts into a single category), *the systematization* (being the ability of a person to bring to reduction of some categories into a logical system).

For us, it is crucial to situate the peculiarities of human intellectual development within a systemic context. J. Piaget understood the intellect as a system of logical operations, representing the realization of mental actions, possessing the property of reversibility, which allows the main properties of objects to be preserved. J. Piaget defined the process of intellectual development in terms of different stages, similar to the mathematical concept of groups. The grouping is understood by J. Piaget as a closed and reversible system, being a logical/axiomatic model that the scholar can use to interpret certain facts. All operations in the grouping are organized according to certain criteria (Piaget, 1950; Voznyuk, 2025):

1. Combinability/transitivity.

2. Reversibility.

3. Associativity.

4. Identity.

5. Tautology.

Further, we have two additional criteria.

6. *Reflexivity* expresses a person's ability to correlate the logical actions with themselves.

7. *Universality* of thinking tends to exhaustive coverage of all logical/mental cases, both in the sphere of actual and potential reality.

Let us correlate the major aspects of creativity studies (most of them have been mentioned above) with the composition (types and forms) of the matter (Figure 5).

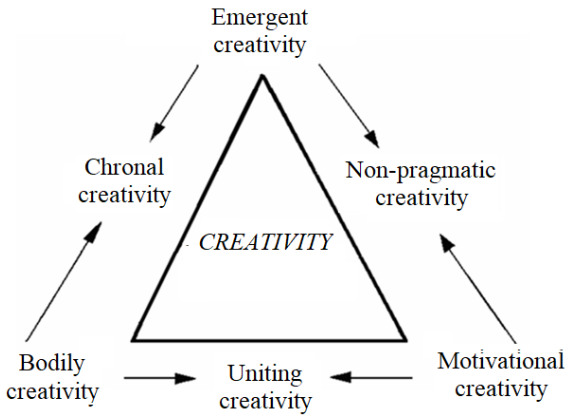

Figure 5. **The systemic composition of creativity**

Physical vacuum: The emergent nature of creativity in the context of explosive/bifurcation generation of creativity and its connection with chaos, uncertainty, suprasituationality, and transcendentality. *Emergent creativity*.

Motion: The process of creativity as "creativity for creativity's sake", it's non-pragmatic/non-targeted. *Non-pragmatic creativity*.

Field: Motivation of the creative process, which involves field- or motivational-based effects. *Motivational creativity.*

Space: The space of creativity that presupposes the ability of a person to combine different and opposing things, revealing the self-referent, non-adaptive nature of creativity. *Uniting creativity*.

Substance: The material "body" of creativity, associated with the human organism, which reveals the connection of creativity with harmony and human health. *Bodily creativity.*

Time: The chronal nature of creativity, revealing its linear-evolutionary, developmental nature. *Chronal creativity*.

The analyzed entities can be correlated systematically (Table 1).

Table 1.

Systemic correlation of important entities of philosophy and natural science, as well as the major aspects of creativity studies (Voznyuk, 2025)

Forms and types of matter	Logical and ontological universals	Principles and laws of dialectics	Criteria of cognitive operations	Conceptual thinking tools	Major aspects of creativity studies
Physical vacuum	Relationship	Interpenetration of opposites	Identity (inversion)	Diplasty	Emergent creativity
Substance	Quantity	Structural organization of the world	Reversibility	Analysis	Bodily creativity
Field	Quality	Generality of movement	Tautology	Synthesis	Motivational creativity
Motion	Interaction	Transformation of quantity into quality	Associativity	Comparison	Non-pragmatic creativity
Time	Sign	Negation of the negation	Reflexivity	Abstraction	Chronal creativity
Space	Measure	Integrity and unity of the world	Combinability (transitivity, composition)	Systematization	Uniting creativity
Matter	Wholeness	General ties/ connections of objects and phenomena	Universality	Generalization	Creativity

3. The chronal and emergent nature of creativity

Creativity, revealing the developmental/ evolutionary aspects, encompasses a range of cognate categories, including giftedness, talent, genius, and lateral thinking (Bono, 1977), among others. The evolutionary algorithm of this development can be illustrated by the Japanese proverb (quoted by Masahiro Yokotani), according to which "When you're ten, they call you a prodigy. When you're fifteen, they call you a *genius*. But once you hit *twenty*, you're just a normal *person*" (refer to Rotenberg, 1993).

In this regard, the data of psychological research are interesting: children under the age of five give up to 90% of original answers when tested, seven-year-olds – up to 20%, and

adults – only 2% (Guilford, 1973; Torrance, 1963). E. Torrance, studying the characteristics of creative thinking in different segments of the population, showed that creativity has a peak at the age of 3.5 to 4.5 years, and also grows in the first three years of schooling, decreases in the next few years, and then can receive an impetus for development (Torrance, 1963; Csikszentmihalyi, 1996).

At large, we can trace the general way of creativity development passing from virtual ("potential-possible) to actual (actual-existing) state of creativity as it is. *The teleological paradox, or the paradox of development* consists in the fact that the new arises from the old (as really new) and at the same time not from the old, for in this case the difference between the new and the old disappears: If the new arose from the old, then it, accordingly, has been contained in it in a potential-virtual state and is not fundamentally new. At the same time, if the old arises from itself, that is, exists eternally, then this contradicts the axioms of the temporal order (French et al, 2010) and leads human consciousness to an epistemological "dead end" (Ringen, 1985).

In Darwin's works, a new species arises from the old and at the same time not from it. Saint Augustine expressed the essence of this paradox in the following words: "Every past is no longer existing, and every future is no longer existing; therefore, both the past and the future are shortcomings in the being". As Arthur Schopenhauer put it in the book "The World as Will and Representation", "No one ever lived in the past, no one will have to live in the future; the present is the form of life".

It can be said that the goal of development is present in it as a potential (virtual, ideal) factor: since the process of development of any object and phenomenon of our world is aimed at a specific, and not at any result, the goal of the development of systemic entities is present at the beginning of their development, when the question of how the process of this development can be determined by a factor that does not yet exist as an objective reality can only be answered in one way – ideally) (Ringen, 1985) allows us to assume that the development of a system in the direction of increasing its complexity is ensured by control from the future – ideal and perfect state of the system, which in the

future will reach the highest possible level of its evolutionary complexity/perfection (refer to the phenomenon of "retrocausality" in physics (Simon, Evans, 2023; Rhawn, 2020; Meijer, 2012; Vedral, 2023) and psychology (Bem, 2011; Ÿuravljev, 2006; Anokhin, 1963).

Thus, the process of development of any system is controlled by its future virtual state during the transition from hierarchization to dehierarchization through the neutral zone of dynamic chaos, where the system is open to ultra-weak (informational) signals that originate from its future virtual state and act as evolutionary attractors of this system: In the context of synergistic knowledge, the development/change of objects can be presented in the form of a synergistic scheme of alternating hierarchical and dehierarchical phases of systems development, when systems pass the neutral (boundary, transformation, bifurcation) point of their development (Voznyuk, 2025).

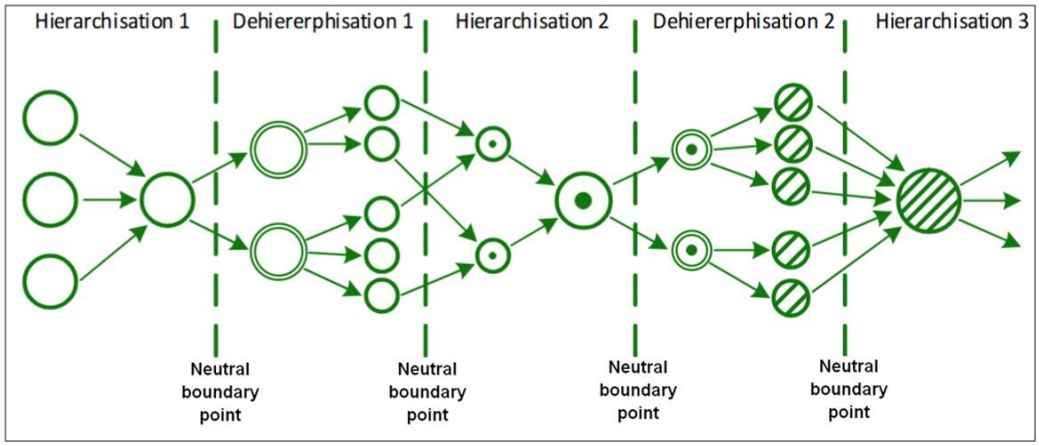

Figure 6. **Alternating processes of changing the system's hierarchization and dehierarchization states through the neutral boundary point (bifurcation point): a synergistic "bead game."**

This algorithm of creativity development reveals the emergent nature of creativity in the context of explosive/bifurcation generation of creativity and its connection with chaos, uncertainty, suprasituationality, and transcendentality (Figure 6).

The emergent nature of creativity underscores the importance of studying creativity development, which begins with the analysis of cognate categories, the first of which is *the category of giftedness* (Lo & Porath, 2017; Renzulli, 2000; Winner, 2000).

The study of gifted children allows us to conclude that giftedness can be understood as a fundamental concept (construct, paradigm) of modern education. At the same time, the issue of giftedness has many aspects. On the one hand, some researchers believe that a child's giftedness in a particular area of their life activity is inherent in every child.

On the other hand, some scientists argue that not all children are gifted. Giftedness can be considered both an actual characteristic of a child, visible on the surface of its activities, and a potential quality that needs to be "awakened", "freed", "unfolded", expanded, actualized, and developed.

While some researchers believe this process can occur at any stage of a person's life, others argue that giftedness is easier to actualize during specific (critical) points or phases in a person's developmental trajectory.

In this context, examples like the "Mowgli children," who were raised by animals at an early age, illustrate that such individuals, having missed sensitive developmental phases and being placed in a civilized environment, often remained at a primitive level of development. However, even primitive social environments provide subtle informational signals that can unlock the child's potential for humanity, which is likely to be further developed through specific environmental stimuli. A well-documented case involved a little boy kept by her parents in a closet until the age of six with minimal social interaction. Once released and placed in a civilized environment, he quickly caught up with his peers in development.

Another case describes a primitive and nomadic tribe in Paraguay, the Guayqui. J. Vellard, a French ethnographer, found a two-year-old girl abandoned at a campsite. He brought her to France, where she was raised in a modern environment. By the age of 20, she was indistinguishable in intellect and social integration from educated European women, having become an

ethnographer and mastered several languages. It is clear that if a girl who was "immersed" in modern human civilization were not 2 years old (when the most intensive process of maturation of the relevant mechanisms of the human psyche occurs), but 8-10 years old, the results of her upbringing would not be as brilliant. Such evidence highlights the potential resources of giftedness inherent in *Homo sapiens*, which are revealed and developed in suitable social environments. Furthermore, it emphasizes the role of sensitive periods, or "informational windows," in the development of living beings, particularly when they are open to specific environmental influences.

It should be noted that some researchers believe that giftedness is preserved in the mental structure of a person for a long period of their life in a "dormant" state; others believe that a person loses the characteristics associated with giftedness with age if they were not demanded by the educational/social system and actualized by this system (Lo, Porath, 2017; Renzulli, 2000; Winner, 2000).

Under such conditions, giftedness, in a certain sense, is associated with such characteristics of a person as genius, creativity, talent, etc., which can be differentiated in the plane of the dichotomy "actual-existing" (being present) – "potential-possible" (being in the perspective) (Table 2 below).

The analysis of the problem of children's giftedness reveals that a child is a multifaceted gifted individual, characterized by predominantly right-hemispheric brain development (up to 5-6 years old), a plastic psyche, vast emotional and sensory resources, highly dynamic mental processes, and a highly dynamic metabolism. It is possible to "unlock" giftedness, as an emergent entity (a systemic property of the whole, according to the synergetics view of the problem), through specific educational/developmental procedures. The principle of "talent as a synthesis of talents" suggests that various abilities of a child coexist within the psyche in a state of synergetic unity. The development of one talent is facilitated and potentiated through the development of others.

Table 2.

Correlations of essential human characteristics in the context of the dichotomy "actual-existing" – "potential-possible."

Potential-Possible	*Actual-Existing*
Right-hemisphere psyche	Left-hemisphere psyche
Cyclothymia	Schizothymia
Genetic inheritance	Epigenetic inheritance
Mind	Intelligence
Creativity	Creative artistry
Giftedness	Talent
Talent	Genius
Abilities/skills	Knowledge
Upbringing/"nature"	Education/"narture"

Childhood itself can have a profoundly positive influence on an adult, enabling them to reawaken this state. This was demonstrated in a psychological and pedagogical experiment conducted in 2020 at Zhytomyr Ivan Franko State University. During the first class with first-year students specializing in "performing arts," each of the 14 students was asked to read aloud a short English text with the aim of analyzing their English language proficiency. Errors in reading were not corrected. After that, the students were asked to imagine themselves as 5- or 6-year-old children and reread the same text as if they were in that age group. The number of pronunciation errors decreased significantly.

This phenomenon supports the *method of infantilization* being a psychologically positive regression into childhood. It is common knowledge in educational practice that memorizing large volumes of material often involves physical tension, resulting in a "micro-stress" and vegetative changes in a person's body. In such a state, learners appear "active", reminiscent of a pre-start position in a race. Classical pedagogy views this as an illustration of traditional principles of active learning. However, the research

by the Institute of Suggestology in Sofia (Bulgaria) confirmed that effective memorization may be accompanied by apparent passivity rather than physical tension. Infantilization encourages a relaxed state that facilitates hyper-memory processes (Sharlin & Polansky, 1972).

In this context, we can mention the phenomenon of "*basal genius*" of each child, which A. Maslow described as the "*principle of sacredness*," being inherent in all children and manifesting itself as their drive to achieve great goals (Maslow, 1976; Liedloff, 2008).

Under such conditions, it is important to note that the "release" of the child's sacredness complex in an adult can occur in critical conditions/life situations. Let us give an example.

In 1939, 25-year-old George Dantzig, a student, was studying at the University of California. One day, he was 20 minutes late for a statistics lecture. He quietly entered, sat down at his desk, and tried to understand what he had missed. The data for two math problems were written on the board. J. Danzig took these conditions as homework for the next class, copying the problems into a notebook. At home, he regretted being late for class, as the problems were very difficult. J. Danzig thought that he must have missed something important for solving them. After several days of hard work, he finally solved these problems. Satisfied with the result achieved, he rushed to the professor and gave him the notebook. The professor, Jerzy Neumann, inattentively accepted the solved problems; he somehow could not immediately remember that he had not given students such problems. When he later reviewed what the student had brought him, he was stunned: he remembered that at the beginning of one of his lectures, he had revealed to the students the conditions of these two problems – two unsolvable problems that the outstanding mathematicians of the time could not solve.

The realization of sacredness largely depends on the structure and content of the socio-pedagogical environment where the child grows. Let us give an example

In one experiment, the students with average intelligence levels were divided into two groups. One teacher was told that his students were exceptionally intelligent, while the other teacher

(with the same level of qualification) was told that his class consisted of low achievers. At the end of the year, testing showed significantly higher results among the "intelligent" group, even though the students initially had the same intellectual level as the students of the second teacher.

In standard psychology courses, R. Rosenthal and K. Fode instructed students to train rats to navigate mazes. Half were told their rats were specially bred for superior problem-solving, while the other half believed their rats were incapable. The "gifted" rats outperformed the "unintelligent" ones, proving how expectations shape results (Rosenthal & Fode, 1963).

In a genetics experiment described by Y. Gippenreiter in the book "*Introduction to General Psychology*", a series of experiments aimed at understanding the connection between environment and heredity is described. In the experiment, "smart" (successful) and "stupid" (unsuccessful) rats were selected and bred based on their ability to quickly find a bait in a maze with a changing configuration. Crossings were carried out within each group, and this procedure was repeated for six generations. As a result of these experiments, convincing evidence was obtained regarding the effect of genetic predisposition on successful learning. However, if the conditions of the experiment were changed, the result also changed: the selected generation of “smart” rats was raised in an impoverished environment, where they were deprived of various impressions and the opportunity to actively act. As a result, it turned out that such rats during training in the maze acted only at the level of "stupid" animals raised in natural conditions. Opposing experiments with raising "dumb" rats in an enriched environment showed results approximately the same as those of "smart" rats raised in normal conditions.

These studies confirm the importance of upbringing conditions in the formation of abilities. The general conclusion that can be drawn from them is more significant: environmental factors have a weight comparable to hereditary factors, and can sometimes completely compensate for or, conversely, neutralize the effect of the latter.

Based on the aforementioned facts and other studies, we formulated a pedagogical axiom that is part of our developed

corpus of pedagogical axioms: *"The educator's perception (and overall personality characteristics) of the object of pedagogical influence can have a decisive impact on the educational process and its outcome."*

Thus, a child in early childhood can be considered a multifaceted (and even genius) gifted being. An example of this can be seen in the history of one Hungarian family.

People who came of age in the 1980s and 1990s might remember the meteoric rise of the Polgar sisters – Zsuzsa, Sofia, and Judit. Not only did they make it into the Guinness World Records, but these once "simple child prodigies" went on to become professional chess grandmasters. These girls boldly competed against male grandmasters and regularly defeated them, demonstrating that female chess players are as capable as their male counterparts. The upbringing of these prodigies might never have occurred without their father, Hungarian educator and psychologist Laszlo Polgar, who set out to prove to the world that raising geniuses is entirely achievable.

This case clearly demonstrates that the experiment of raising genius children, conceived by Laszlo Polgar, was a success. Despite certain challenges, the family managed to nurture extraordinary athletes who not only triumphed in prestigious tournaments but also defeated nearly all prominent male chess players. The youngest sister, Judit, became the youngest grandmaster in the world, surpassing Bobby Fischer's record by one month.

Undoubtedly, Laszlo Polgar was a talented or even genius educator, exceptionally consistent in pursuing his goal. He passed his talent to his children within the framework of so-called *epigenetic inheritance*. In this context, it can be argued that *human behavior and genetic information are mutually complementary: upbringing/educational influences the genome, and epigenetic changes can be inherited.*

In connection with the indicated type of heredity, we can say that human behavior and genetic information about a person (the human organism) are in a mutually complementary relationship, as upbringing affects the genome. At the same time, epigenetic changes can be inherited, when the genotype determines not

behavior as such, but rather the general principles of building the neural circuits responsible for processing incoming information and making decisions. These "computing devices" are capable of learning and are constantly rebuilt throughout life.

The absence of a direct and definitive correspondence between genes and behavior does not contradict the fact that specific mutations can alter behavior in a predictable way. A behavioral trait that initially appeared repeatedly as a result of learning can eventually become instinctive (innate), and this change can be "written" into the human genotype (Gene et al, 2008).

In this light, it can be stated that *developmental and pedagogical influences on the neural structure of the human brain can leave imprints on genetic structures*. These changes may be passed down to future generations, influencing heredity at the genetic level.

Experimental studies by researchers from the University of California have shown that a person’s intention to perform any action not only changes the brain’s biochemistry but also alters its size and structure. Mice placed in conditions requiring increased physical activity over several generations developed distinct skeletal and brain structures and exhibited a more intense metabolism compared to their less active counterparts (Kelly et al., 2012; Kolb et al., 2013; Waters et al., 2013).

This finding applies not only to positive but also to negative (stress-induced) changes. Negative events can trigger chemical reactions that fundamentally alter the way the neural networks in the brain interact, thereby reshaping their structure (Zerbi et al, 2019).

It is worth noting that genetic and epigenetic factors can sometimes *conflict with each other*. To illustrate this conclusion, we can cite a pedagogical fact reported by Robert R. Blake in 1997, which left a lasting impression on him. A boy, the son of a shoemaker, was ashamed of his social status. Determined to change his life, he studied diligently. After completing school with honors, he traveled to London to pursue a career as a lawyer. He worked and studied tirelessly, achieving fame and wealth. Years later, during a vacation, he returned to his parents and, for

nostalgia, began helping his father in the workshop. Immersing himself in simple physical labor – hammering nails and repairing soles – he realized he felt truly happy only in his father's workshop. He never returned to London, explaining that this primitive yet fulfilling work brought him genuine contentment.

The potential of unlocking a child's genius can be seen in various contexts, such as through *initiation-based learning* (Taylor et al, 2006). This sociocultural phenomenon, often associated with rites of passage, not only signifies social transition but also imparts transformative education to the initiated. Sometimes, initiation involves mystical procedures capable of fundamentally altering the psychological state of the participants, resembling A. Makarenko's "explosion method." Hypnotic states can also significantly enhance intellectual and creative potential. For instance, research indicates that a novice chess player can drastically improve their skills through trance techniques, which are also applicable to other areas of human activity (Hoye, 2013; Szmaglinska et al., 2023; Youvan & Duglas, 2024; Zahedi et al., 2024). Suggestopedic and other unconventional/innovative methods, aimed at activating altered states of consciousness, can result in extraordinary abilities (Lozanov, 1978). Examples include individuals gaining near-instantaneous calculation abilities (e.g., a farmer struck by lightning developing complex mathematical skills) or becoming polyglots (Frank, 1907).

One notable case is that of W. Melnikov, a contemporary polyglot, and another involves an American man, Michael Thomas Boatwright, who inexplicably began speaking Swedish after regaining consciousness. After the incident where sixty-year-old Boatwright lost his consciousness, he could only communicate in Swedish with doctors through an interpreter and failed to recognize himself in a mirror. Although he had visited Sweden several times, he was a U.S. citizen who had spent a decade teaching English in Japan.

So**,** giftedness should be regarded as a paradigm of modern education. A child under the age of 5-6, being predominantly right-hemispheric with a plastic psyche, possesses immense emotional and sensory resources, dynamic mental processes, and a rapid metabolism, representing a multifaceted gifted human being. Giftedness, understood as an emergent property

(a systemic characteristic of the whole, according to the synergetic perspective), can be "unlocked" and actualized through specific developmental/educational procedures.

In this context, one can discuss the concept of "basal genius," inherent in every child, which A. Maslow associates with the "principle of sacredness." This principle aligns with the children's social values and orients them toward higher goals – aspiring to achieve profound values. The realization of this principle depends significantly on the structure and content of the socio-pedagogical environment in which the child lives and develops. The "release" of this sacredness in adulthood often occurs during critical life conditions or situations.

Giftedness correlates with such characteristics as genius, creativity, talent, and wisdom, which can be differentiated through the dichotomy of "actual-existing" (present-oriented) and "potential-possible" (future-oriented).

There is a high possibility that childhood itself has a positive influence on adults who are capable of reactivating this state during their lives. In this regard, *the method of infantilization* – a psychologically positive regression into childhood (traditionally this phenomenon is studied within the negative educational trends and can be found in cross-cultural context (Sharlin, Polansky, 1972)) – can be used to enhance the educational process significantly.

Analyzing the relationship between giftedness/genius and their connection with genetic traits leads us to the conclusion that developmental and pedagogical influences shape the neural structure of the human brain. These effects may be "encoded" into a person's genetic structures and transmitted to future generations through heredity.

In the context of analyzing the problems of giftedness and creativity as its realization in the connection with human genetic characteristics, a conclusion can be made about the developmental and pedagogical impact of upbringing and education on the neural structure of the human brain, and the results of this impact can be "imprinted" in human genetic structures, which at the level of heredity can be transmitted to future generations of people. In this respect, the perspective of

our research may be focused on further investigation into the interplay between genetics, education, and neural plasticity to support and nurture human potential across generations.

4. The bodily, motivational, non-pragmatic, uniting nature of creativity

In this context, it is important to study the connection between human creativity (as a key factor of people's spiritual and intellectual development) and human health (Voznyuk, 2017).

Human health is one of the key values in our lives, and the study of health phenomena is a priority in modern science. It can be said that health, as the most complex and important object for cognition, exhibits an interdisciplinary nature, since only in the context of the efforts of various sciences can a holistic understanding of this phenomenon be achieved. Therefore, as the analysis of scientific sources has shown, there are more than 300 definitions of health (Boruchovitch, Mednick, 2002). It is advisable to focus these definitions on major health concepts, which can be reduced to such, as medical (presupposes medical signs and characteristics of health, being understood as the absence of diseases and their symptoms), biomedical (health is considered as absence of subjective feelings of ill health and organic disorders), biosocial (medical and social factors of health are considered in unity, with priority given to social factors), value-social (health is understood as a person's personal value).

Health is becoming a cornerstone value of human life. Accordingly, the study of the conditions for actualizing and maintaining people's health is an important task of modern human sciences, which constitute an interdisciplinary resource of our research.

Analysis of scientific literature on various aspects of health allows us to draw a conclusion that has the character of a postulate: health as a psychophysiological entity most fully characterizes the state of functional and somatic integrity of the human organism, which ensures the completeness and diversity of the entire set of processes of this organism (Voznyuk, 2020).

Loss of health by the human organism is realized as its loss of the above-mentioned state of integrity/coherence as a result of certain actions on the organism by the external and/or internal environment, which, according to the second law of thermodynamics, leads to an increase in entropy, that is, to the activation of the processes of decay of the organism due to the inconsistency of biorhythms and functions of its cells, organs and systems.

In the context of health problems, the integrity of the human body is also reflected in the fact that the body responds to any negative stimulus from the external environment with a single adaptive reaction – stress, the result of which can lead to various diseases (Selye, 1974). Stress, as a psychophysiological process, manifests as a holistic state because it is accompanied by a stable set of nonspecific bodily reactions common to most, if not all, diseases.

The above phenomenon suggests that at the root of many diseases lies a narrow set of causes focused around a single factor that leads to a weakening of the organism's vitality, narrowing its "space" of existence. This, in turn, leads to a distortion of the normal functioning of one of the "weak" links in the organism, which reveals a certain disease that is overcome by a single factor – immunity, the weakening of which is now considered the primary factor in any disease.

In general, stress, as the most common phenomenon of the modern social world, is, first of all, an information process, since it is a psychophysiological "shock" of the human body, caused to a lesser extent by negative/stressful effects of the external environment, and to a greater extent by the psychological and worldview negativism of the person himself. That is, the somatic reactions of the organism to a particular stimulus (irritant) of the external environment, due to the presence of large resources of the homeostasis mechanism (which implements the dialectical stability of the internal environment of living systems), as a rule, cannot lead to illness (here we do not consider the extreme conditions of existence of a living being).

In this context, illness occurs when the human body cannot adequately respond to external stimuli, primarily due to

psychological and cognitive distortions. The latter acts as a condition for the development of a multitude of harmful/negative psychological settings, social attitudes, emotional states, and value orientations, which, in turn, generate/actualize illnesses. Therefore, many specialists in various fields of knowledge conclude that the cause of many, if not all, human illnesses, being an adaptive reaction (Davydovskij, 1963), is related to a person's mental organization and, ultimately, to their spiritual, value-based, and worldview orientations (Hamer, 2000; Maslow, 1976).

The process of treating any disease is, in a certain sense, simple. It involves harmonizing a person's mental and spiritual worlds, thereby aligning their consciousness.

It should be noted that stress at the level of the main psychophysiological reactions of a person manifests itself in the form of emotions, which are an integral characteristic of the human organism, as evidenced by *the information theory of emotions* of P.V. Simonov, according to which an emotion is a person's reaction to a lack of relevant information: if a person feels a lack of information about a certain event that is relevant to them, then this emotional state forms an emotional and search reaction, in which the whole organism is involved. Thus, it has been experimentally demonstrated that emotion is a function of information, where emotion is realized as an organism's reaction to a lack of information about a particular life situation related to the future process of satisfying a person's needs (Simonov, 1991). As A.M. Svyadoshch wrote in his book "*Neuroses and Their Treatment*", a mental trauma is usually not something that is addressed only to the past, but something that threatens the future, creates uncertainty, and therefore requires a decision on what to do in the future. For example, even if the disease is a reaction to an event that seemingly just happened – the loss of a loved one, the departure of one of the spouses from the family, or an insult received – the psychotraumatic effect is largely determined by the significance of these events for the future.

Based on the information theory of emotions, it can be argued that a lack of information about the external world is an expression of situational uncertainty and ambiguity, which creates a stressful state of uncertainty in a person's future life.

At the same time, stress as a fundamental cause of diseases is realized not only in the process of emotional response to stimuli from the external and internal environment (which expresses the adaptive aspect of stress), but also as the process of impossibility/inability of such a response (which acts as a factor of disadaptation, distress).

The most complete psycho-energetic-behavioral component of health was studied by the Institute of Kinesiology (USA), the results of which research are presented in the books by P. Weinzweig and D. Diamond, the director of this institute (Weinzweig, 1988). Scientists have concluded that a positive mood and a positive attitude towards the world are a decisive factor in increasing a person's vitality and strengthening their immunity, with all the social and medical-biological consequences that follow.

Therefore, human health is an entity that expresses the peculiarities and level of integration of organisms into the environment, which in the language of synergetics is defined as the process of dissipation – the openness of the organism to the external world, with which it exchanges energy and information, reducing the level of its entropy and gaining access to the energy resources of the external environment. Under such conditions, health is a variable – a functional value that characterizes the body's ability to restore and maintain its homeostatic equilibrium unchanged. In this regard, health, which is characterized by a certain level of adaptation energy, can be expressed as the reciprocal of the amount of energy that the body is forced to spend to restore homeostasis after it is brought out of equilibrium (Hirt et al, 2016).

The disease, which is caused by a decrease in the vital (energy) tone of the human body, is triggered by stresses that act as an informational phenomenon and are a consequence of the informational uncertainty surrounding events important to a person. Thus, the decline in the body's energy tone is caused by stresses that have both external (such as weather conditions, intense physical exertion, or malnutrition) and internal causes.

Internal causes (dialectically related to external causes) include a "inharmonious" worldview and thinking of a person,

which can lead to the development of an "inharmonious", "pathological" attitude to life through the development of destructive psychological attitudes. This, in turn, leads to the depletion of vital energy. As experiments have shown, the decline in a person's vital energy occurs as a result of their negative attitude towards themselves and the environment, which is confirmed by the study of cancer and other diseases (Greer & Watson, 1985; Shekelle et al, 1981; Argyle, 1987): The cause of both cancer and other diseases is long-term, ingrained negative stress states/reactions of a person (hatred, anger, resentment, jealousy, etc.). On the contrary, a person's positive attitude towards life and the world increases the body's energy tone (Weinzweig, 1988).

There is an effective mechanism for completely reducing the information uncertainty of a person's social environment, not associated with numerous mechanisms of psychological defenses – faith in the Higher Mind (Absolute) as a person's conviction in the existence of God – the creative harmonious beginning of reality (James, 2008): as scientific research shows, believing people get sick less and live longer (Frankl, 1992; Abdel-Khalek, 2006; Li X et al, 2019; Yeager et al, 2014; Comstock & Partridge, 1972).

In light of the conclusion that stress is a primary cause of human diseases, let us examine the fundamental mechanism underlying the existence of modern humans, which is associated with the formation of psychological defenses as universal adaptive reactions of individuals to a stressful social environment.

The most comprehensive mechanisms of psychological defense have been studied within the context of the theory of cognitive dissonance, which demonstrates that we do not process information impartially, but rather distort it in a way that satisfies our previously acquired ideas (Aronson & Aronson, 2004; Festinger, 1962). At the moment of cognitive dissonance, a person seeks to free themselves from an ambivalent (double) paradoxical cognitive situation by distorting reality (which can be illustrated by Aesop's fable of "Sour grapes").

For example, when we bought some very expensive thing, which later turned out to be unnecessary, that is, not worth the

money paid for it, then we reveal two opposing cognitions (assumptions): either the thing is really valuable and worth the money spent, or we turned out to be "losers".

These two opposing cognitions, firstly, cannot peacefully coexist within the "black and white" consciousness of a person who possesses a binary "yes-no" logic of thinking. It is for this person that the above-mentioned problem associated with cognitive dissonance arises. Secondly, for a person characterized by "black and white" thinking, admitting to oneself a failure can be very problematic, as this can lead to a loss of self-esteem.

Thus, a person, characterized by a black and white, discrete-linear perception of reality, cannot overcome the contradictions between two opposing ideas (events). As a result of such discrete-linear information processing, a person loses an adequate perception of reality, which is, in fact, a fundamentally holistic, nonlinear entity, within which opposites coexist peacefully and merge into one another.

Social psychology has revealed many similar examples of cognitive dissonance, when in a problem situation, due to the emergence of cognitive discomfort in the event of a collision of two polar ideas (psychological states, life situations), a person rejects one of the ideas (psychological states, situation), since he/she is not able to "flirt with the absurd": As A. Camus noted, such people are beings who spend their lives convincing themselves that the reality is not absurd. However, openness to the absurd is characteristic of creative people being able to think in a paradoxical-multiple-meaning way, thus easily overcoming the cognitive ambivalence (duality) by combining polar cognitions (and psychological states) in a third intermediate cognition, being a neutral paradoxical entity. This is due to the openness of creative people to the absurd and paradox, thanks to creative paradoxical and metamorphic thinking and worldview, which reveals diplasty.

It should be noted that the process of cognitive dissonance occurs not only at the logical-behavioral, psychological, and worldview levels, but also at the psychophysiological and somatic levels of the organism, which, as we believe, is the cause of many diseases – psychic, psychosomatic, and somatic. The analysis of A.M. Svyadoshch's book "*Neuroses and Their Treatment*", enables

to conclude, that the cognitive dissonance, appearing in the form of "confusion of motives" (a conflict of two opposite and equally strong motives of behavior), is a condition for the occurrence of neuroses, which are experimentally caused by strong excitation of the hypothalamus (in which both its departments are simultaneously activated), as well as in the process of the struggle of contradictory aspirations/motives in a person.

A person who acts as an open system and who perceives the world with complete trust, combining its polar aspects, is a creative personality who can better associate concepts with opposite meanings than with similar ones. Creative people can maintain a state of uncertainty for a long time, revealing their ability to reflect on and utilize multiple opposing ideas, concepts, representations, psychological, and psychophysiological states simultaneously. As a result, creative people can perceive and explore such relationships and connections that are inaccessible to those who are inclined toward clarity and unambiguousness (Rotenberg, 2020).

Here it should also be said that creativity as a process of integrating contrasting and contradictory entities and creating new integrities (meanings) is the main feature of the evolutionary mechanism. As F. Klix writes, the most important prerequisite for the emergence of a new quality is formed when two systems that have independently arisen to perform different functions enter into interaction with each other. This interaction generates a new quality, while the two initial structures are preserved in the new functional unity as its partial subsystems, which are unambiguous in nature (Klix, 1993). (Refer also to Simpson’s paradox in psychological science: Kievit et al., 2013.)

As an entity that combines opposites, a creative person, according to some studies, is generally more psychopathic, psychotic (Eysenck, 1995), and creativity can be considered a compensatory mechanism for psychoticism, which becomes a factor in harmonizing a person.

If a creative personality is the strategic aim of human development, then the same aim of development is the creative person’s fundamental property, which consists in the ability to include polar aspects of the world into a single conceptual and

ontological context, that is, to perceive the world as something holistic, integral and at the same time paradoxical/absurd (refer to the direction in pedagogical theory and practice "*The Pedagogical Paradoxology*" which have been developed in our works (Voznyuk, 2021).

It is this state that characterizes a creative person who possesses multi-valued, paradoxical, and nonlinear thinking, being free from stress as a result of "black and white," unambiguous, linear, and "sick" thinking, perception, and mastering reality.

Thus, we can make some conclusions concerning *the bodily and uniting creativity*.

Energy, as a measure of motion and changes in the organism, acts as a function of the biorhythmic integration of its parts due to the functional coherence of its cells, organs, and systems (Putilov, 2021; Zimecki, 2006), and also realizes its openness to the external environment, from which the organism draws energy resources. The loss of energy by the organism leads to a decrease in its vitality and immunity, as the process of disintegration within the organism occurs, increasing its entropy, or chaos in its internal environment. This state can be reasonably considered a disease.

The factor that leads to the disintegration of the organism is distress, a psychophysiological "shock" of the organism. Stress, in its most general form, can be interpreted as an emotional state associated with information uncertainty that a person experiences while attempting to satisfy certain needs. This emotional state of information uncertainty is manifested as negative mental reactions in a person and is triggered by negative emotional states, inferior psychological settings, and social attitudes, as well as anti-spiritual mental and worldview value orientations. This leads to a decline in vitality and weakens the body's immunity, thereby increasing the likelihood of certain diseases.

Negative states are overcome through a person's confidence in the harmonious order of the world. Another means of achieving human health is overcoming negative states through creativity as the ability to unite opposites, which crystallizes wholeness, revealing the synergistic phenomenon of the systemic properties

of the whole, which reduces the entropy of environments and systems, increases a person's vitality, and strengthens their immunity/ health (Rotenberg, Arshavsky, 1991, 1993), thus creating anti-entropy. Erwin Schrödinger, the Nobel-laureate, in 1944 stimulated the research in the field of entropy (as the state of uncertainty, as well as the level of systems' chaos when in a closed system, disorder increases) the physical foundation of which was laid by Rudolf Clausius (1865), Ludwig Boltzmann (1877), Claude Shannon (1948), and others.

In his book, E. Schrödinger originally stated that life feeds on negative entropy, or negentropy/anti-entropy (living organisms maintain order by drawing "negative entropy" from their environment); in a later edition, he corrected himself and stated that the true source of negentropy is free energy (Schrödinger,1992). Thus, the stream of life, the evolutionary process, selects for "anti-entropic" adaptations that expend energy in order to maintain homeostasis.

As scientific research has shown, homeostatic psychological phenomena can be understood as "anti-entropic" adaptations that direct energy towards maintaining biopsychosocial order (Tooby et al., 2003). "Entropy refers to the amount of uncertainty, and in physiology and psychology this state of uncertainty is connected with person's experience of anxiety being linked to activation of anxiety-related brain circuits". Moreover, "For an organism to adapt to a complex, ever-changing environment, it is necessary for it to possess flexible cognitive and behavioral frameworks" (Hirsh et al, 2012, p. 310).

Any homeostatic psychological phenomenon "owes its existence to a precise configuration that wards off entropy, consuming energy to maintain its form in an open system relationship with the outside world... That is why the Second Law of Thermodynamics is the First Law of Psychology" (Tooby et al, 2003) that corresponds both 1) to the information theory of stress and emotions (Simonov, 1991) stemming from disorder and ambiguity of the environment and 2) to the mechanism of diplastic perception of reality (Rotenberg, Arshavsky, 1991).

The First Law of Psychology is realized in the behavioral sphere, revealing the fundamental goals of human life – achieving

happiness through pleasure, joy, delight, enjoyment, etc. However, many people are dissatisfied with a routine lifestyle, believing it does not provide a sense of well-being. At the same time, any positive stimulus received from the external environment can be defined as anti-entropic, counteracting entropy, which can express a certain degree of chaos. People who are unable to enjoy life are defined as suffering from an anti-entropy deficiency, which can lead to psychopathy or illness. Anti-entropy deficiency can be caused by genetic or acquired dysfunctions of the brain mechanisms that ensure feelings of well-being, pleasure, and happiness within a routine lifestyle. As a compensatory mechanism, people suffering from an anti-entropy deficiency may create psychological defense mechanisms that can sometimes be harmful to themselves or their surroundings (Aminoff, 2014).

Anti-entropy in creative activity presupposes the act of generating order and complexity from chaos. At the behavioral level, it requires focusing energy and intention. Creativity is considered an anti-entropic process since it presupposes organizing dispersed energy and information into an ordered, structured, and more complex state, such as the creation of art or a scientific hypothesis. This process counteracts the natural tendency of physical and mental systems to move toward disorder and ambiguity (Westbrook, 2021; Kajtez, 2023; Hills, Kenett, 2025; Fox, 2024).

In the context of thermodynamics, the openness of creative people to uncertainty means they are receptive to a system whose structure is highly complex, and the measure of its diversity approaches infinity. Under such conditions, a creative person with an understanding of thermodynamics is, in fact, a highly complex system, and in the context of cybernetics, they appear as a system capable of controlling everything (Bogg, 2024), thus resembling a god-like system. This conclusion is explained by the "cybernetic" proof of God's existence, developed by the clergyman Alexander Men, who considered God to be a supercomplex and most perfect systemic Being. If God is the rarest phenomenon in the Universe (as it is said in the New Testament, "No one has ever seen God…" – (John 1: 18), then from the point of view of information theory, God contains information reaching infinity. Information, according

to one of its definitions, reflects the structural diversity and the measure of complexity of systems (Floridi, 2010). Therefore, God as a system is the most diverse and perfect/complex entity (refer to Kalanov, 2010).

Uniting nature of creativity is realized in the field of inter-hemispheric activity (the synthesis of the right and left hemisphere functions of the human brain), revealed in the form of diplasty, that enables a person to be open to chaos, uncertainty, paradox, absurd, to actualize the process of sense crystallization through the integration and mutual transformation of an abstract sign and a concrete object, a word and an image, synthesizing the single and the general, the concrete and the abstract.

On the level of thinking and logical process diplasty is expressed in the paradoxical oriental (i.e. Buddhist and Indian) logic of four alternatives (Jayatilleke, 1967), where in the sphere of the relations of logical terms – assertion and negation – four logically equivalent alternatives take place: 1) either assertion (first); 2) or negation (second); 3) both (first and second at the same time); 4) neither the first nor the second.

Let us demonstrate thinking in the context of four alternatives: The answer to the fundamental question of philosophy (which is primary, matter or mind, material or ideal?) contains four logically equivalent answers: 1) matter is primary; 2) mind is primary; 3) both matter and mind are primary; 4) neither matter nor mind is primary. The fourth alternative is illustrated by the statement of David Bohm, who believes that matter and mind are embedded projections of a higher, fundamental essence, which is neither matter nor mind in its pure form (Bohm, 2008; Pylkkänen, 2016).

In general, the analysis of the logical content of the mechanism of diplasty allows us to speak of *two levels* of it, when at the first level of thinking a person is able to bring to unity the opposites ("both matter and mind are primary"), and at the second level of thinking ("neither matter nor mind are primary") not only the opposites are understood as separate entities, but each of them, in the language of philosophy, is transformed/reduced into something third (higher), which in the context of synergetics can be understood as an emergent

(systemic) property of the whole, which has been demonstrated with the help of D. Bohm's statement.

Under such conditions, thinking at the second level of diplasty allows a human being to think not only in an abstract-logical, unambiguous way, but also in a paradoxical, multiple-meaning way, which helps to carry out logical operations of systematization and generalization, thus fixing creative (direct and reverse) cause-and-effect dependencies/connections. In general, all cognitive operations, as well as tools of creative thinking, are implemented using thinking at the second level of diplasty, which appears as a system-forming factor for these operations and tools.

Uniting nature of creativity is realized not only through the ability of creative persons to unite the different and polar entities (psychological states/settings, social attitudes, value orientations, bodily states, concepts, etc.), but also it is revealed in the systemic and synergetic effect "the whole is more/greater than the sum of its parts" (Richter et al, 2010; Upton et al, 2014).

In the context of social processes this effect/principle can be found in such phenomenon, as "the spirit of the sports team" (Halldorsson, 2018), being revealed in the collective subject/game of activity (Koval, 2022; Nakonechna, 2018); the group creativity (Paulus et al, 1999; Jason, Hedrick, 2016), the joint activity (Voznyuk, A. et al. 2022); the organizational identity (Cheney & Christensen, 2001); the psychological climate (Ancona & Caldwell, 1992); the team roles (Belbin, 1993); the group mental states (S. Moscovici) (Moliner, Bovina, 2020); the virtual teams (Szewc, 2014), the team (cooperative) work/management/ learning/teaching (Fisher, 1994; Whitfield, 1995; Clifford & Sohal, 1998; Parker, 1994; Lazarus et al, 2016; Mesmer-Magnus & DeChurch, 2009; Leithwood, 1998; Leplat, 1994; Begg & Davids, 2009), the brain storm, the professional spirituality (Hunt, 2021), Makarenko's temporary working teams (Cunningham, 2021), the self-directed temporal target business/management teams (when specialists from diverse subdivisions gather together for solving specific problems (Laage-Hellman, 2002), etc.

The motivational creativity is expressed in the fact that a creative person is characterized by the development of *internal*

motivation as a state of self-determination and self-sufficiency. As psychological research has shown, internal motivation as a psychological mechanism of human self-control and free will is realized in the so-called supra-situational creative activity (as a way of overcoming and transcending the existing life situation "here and now"). That is, internal motivation, which liberates a person from the determination of external environment, realizes a creative act, which appears as an activity free from external influences, a non-pragmatic activity for the sake of the activity itself, similar to "art for art's sake" (Ryan & Deci, 2000).

Internal motivation is formed on the path of non-pragmatic/creative activity (Corbett, 2018): Richard de Charmes' experiments showed that if a person receives a reward for work that he/she does according to their free will, then the internal motivation for this activity will weaken; and if a person is not rewarded for an uninteresting activity undertaken solely for the sake of reward, then internal motivation for it may paradoxically increase (de Charms, 1983). This serves as an illustration of the mechanism of free will, which acts in the same way as bodies behave in a non-inertial world (their movement slows down in front of an obstacle, and accelerates outside of an obstacle), and is described by so-called imaginary numbers, similar to the square root of minus one (Simonov, 1991). This concept of free will was also explored in the works of scientists who spent time in concentration camps (Bettelheim, 1960).

Edward Dicey has shown that a person's sense of themselves as a competent doer and a self-determined personality reveals their basic needs. On the other hand, the satisfaction of these basic needs in a particular activity implements the mechanism of formation of internal motivation for this activity, just as the latter becomes a factor in the realization of the specified basic needs, with which another basic need is closely related – the need for meaningful relationships.

The above data allowed E. Dicey and R. Ryan to substantiate the theory of cognitive assessment, according to which a person in the process of a particular activity evaluates three parameters: *causal* (when a person seeks to find out the reason for their actions), *competence* (associated with finding out the effectiveness of the activity), and *social* (when a person involved

in the activity seeks to find out how much their activity contributes to the maintenance of meaningful interpersonal relationships) (Ryan & Deci, 2000; Miroshnychenko & Voznyuk, 2023).

Researchers believe that in conditions where a person confidently localizes the cause of their actions within themselves, considering themselves competent and integrated into the social system of significant relationships, such a person is characterized by internal motivation of their activity (behavior), and the activity itself acquires creative features, bringing the person success and psychological well-being. The latter includes the experience of happiness, a sense of meaningfulness and completeness in one's existence, a sense of self-actualization (Ryan & Deci, 2000), high vitality, and "the feeling of flying" (Maslow, 1976).

While the external motivation is realized with the help of rewarding actions concerning the mechanism of conditioned reflexes, according to H. Heckhausen, R. Ryan, E. Dici and some other researches, the internal motivation reveals the person’s needs for self-development and personality growth; freedom of purpose and consequences of actions/behavior; willingness to "dissolve" in activity; joyful dedication to one's work, "flow effect" – complete immersion of a person in activity (Ryan & Deci, 2000; Maslow, 1976).

Here we reveal the god-likeness of a creative personality that is also explained by the fact that a creative person is characterized by non-adaptive, supra-situational behavior, since creative activity, in a certain sense, is not stimulated by external factors or the influence of internal assessments (behavioral factors), but is characterized by transcendence – going beyond the boundaries of a given goal (Ryan & Deci, 2000).

5. Some pedagogical implications of the systemic and synergetic understanding of creative activity

The systemic and synergetic nature of creativity reveals important educational extrapolations. One of these is the new educational direction – *The Pedagogical Paradoxology*, which is being developed in our work, opening new vistas to a holistic,

synergetic, and paradoxical paradigm of education (Voznyuk, 2020a, 2021a; Voznyuk & Manolov, 2019).

The pedagogical paradoxology is aimed at developing creative, non-linear, diplastic, paradoxical thinking in subjects in the educational process, implementing "the principle of cognition of the world as a holistic world, which is an intellectual and vital necessity. This universal problem will emerge in the future, as our fragmented, scattered disciplinary knowledge is deeply inadequate for understanding the increasingly global, transformational, multidimensional, polydisciplinary, and planetary realities and problems. Due to this multidimensionality, the Global, Multidimensional, Complex becomes invisible" (Morin, 1999, p. 19).

The mentioned dialectical and paradoxical thinking reveals the epistemological and social phenomena of absurdity, paradox, chaos, and ambiguity as educational tools of pedagogical paradoxology.

Within the realm of pedagogical paradoxology, we have developed a new algorithm for influencing participants in the educational process, which is one of the fundamental revelations of contemporary education and pedagogy.

This algorithm (that reflects the life scenario of human development in onto- and phylogenesis, implementing the movement from the right hemisphere (RH) to the left hemisphere (LH), and from the latter – to the synchronization of hemispheric functions (RH+LH)) has been substantiated in our article '*Upbringing process as a paradoxical phenomenon: the main aspects of a new paradigm of education'* (Voznyuk, 2021a) (Figure 7).

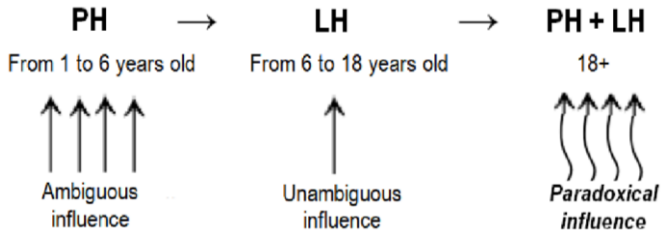

Figure 7. **The algorithm of pedagogical influence on participants in the educational process reveals the psychomental, behavioral, and emotional scenarios of human development/evolution in ontogenesis and phylogenesis.**

At the first stage of human development (up to 6 years), a small child, due to the predominance of PH processes in their emotional and mental spectrum, is open to ambiguous, ambivalent influences that are not mutually consistent and can even be contradictory.

At the second stage of human development, the left hemisphere's capacity for unambiguous, abstract, and logical thinking is developed, which enables a human being to navigate the field of causal relationships in reality. At this stage, it is advisable to establish a system of unambiguous socio-pedagogical influences on persons that do not contradict each other.

At the third stage of human development, due to the meditative-paradoxical nature of mental processes at this stage, the influences on persons can be varied, it can be both consistent with each other, and contradicting each other, because here a human being is open to any influences (both ambiguous and non-ambiguous) without harm to their mental, physical, and spiritual health.

The presented algorithm explains several scientific enigmas: 1) it resolves the paradox of the Cambridge-Somerville project (McCord, 2007; Voznyuk, 2021a) (when young people of the experimental group due to the positive socialization influences were forced to exist in an ambivalent socio-pedagogical environment, which led to a combination of criminalized/antisocial and pedagogical environments; as a result, young people have not been able to fully develop productive mechanisms for entering adulthood); 2) it clears up the dilemma "*ambiguous/unambiguous impact on the child*" in the sphere of which a "*splitting effect*" is possible. On the other hand, an unambiguous *impact* on the child can lead to the formation of paranoid affect, as written by Karl Leonhardt in his book "*Accentuated personalities*". On the other hand, the splitting effect on the child, according to Ronald David Laing (refer to his book *The Voice of Experience, 1982*) and Gregory Bateson (refer to his book *Steps to An Ecology of Mind, 1972*), can lead to a situation of "double clamp" ("double connection"), which can initiate the development of schizophrenia: a child is in a situation of double clamp when it receives from parents, from the environment the messages that contradict each other on behavioral, verbal and nonverbal levels.

At the same time, the algorithm of pedagogical influence can be applied in crisis and extreme conditions of human life, as any crisis can be understood as a synergetic state of a system's bifurcation (neutral/chaotic) point (Figure 6) where systems are open to weak influences/signals (Haken, 1995; Grindal, 2009; Massa &Mahony, 2021).

Conclusions

Due to interdisciplinary research with the help of the modified general systems theory, the six aspects of creativity studies have been conceptualized and explained: 1) The emergent nature of creativity in the context of explosive/bifurcation generation of the creativity process and its connection with chaos, uncertainty, suprasituationality, and transcendentality. 2) The process of creativity as "creativity for creativity's sake", revealing its non-pragmatic/non-targeted nature. 3) Motivation of the creative process. 4) The spatial creativity that presupposes the ability of a person to combine different and opposing things, thus expressing the self-referent, non-adaptive nature of creativity. 5) The material, "bodily" creativity, associated with the human organism, shows the connection of creativity with harmony and human health. 6) The chronal nature of creativity, revealing its linear-evolutionary, developmental nature.

It has been shown that creativity involves the generation of synergy states of human organism (characterized by the property of *anti-entropy*, i.e., the ability to generate energy being the factor of wholeness), both in terms of epistemology and ontology, which involves the actualization of two polar aspects of culture – spiritual and material.

Creativity is understood as the process of building wholeness states/entities; as the functional unity of the right-hemisphere and left-hemisphere aspects of the individual's mental activity, it is predominantly an intuitive-right-hemisphere figurative-emotional process, which, however, is inconceivable without being filled with left-hemisphere content.

One of the main features of creative people is associated with the ability to paradoxical (multiple-meaning, non-trivial,

original, divergent) thinking, with openness to uncertainty, chaos, paradox, absurdity, with an orientation towards a non-pragmatic perception and mastering of the world; if we take into account that the modern world is entering a state of critical complexity – bifurcation, that is, uncertainty, then creative people in our time should occupy leading positions in socio-economic processes. Taking into account mentioned above, creativity can be analyzed in the context of non-Archimedean geometry in modeling consciousness. In ordinary (Archimedean) geometry, the distance between two points is always expressed by a real number. In non-Archimedean spaces, the "closeness" of points is defined differently: for example, two ideas can be "indistinguishably close" in the non-Archimedean sense, but infinitely distant in ordinary logic. This corresponds to the structure of thinking, where associations can work non-linearly.

Giftedness and creativity are understood as a paradigm of modern education. It is demonstrated that giftedness, in a certain sense, is associated with human characteristics such as genius, creativity, and talent, which can be differentiated in terms of the dichotomy "actual-existing" versus "potential-possible." It is revealed that there is a developmental and pedagogical influence on the neural structure of the human brain, and the results of this influence can be “imprinted” in a person's genetic structure, which, at the level of heredity, can be transmitted to future generations.

Creativity is analyzed as a cornerstone of human health. It is shown that creative people can maintain a psychophysiological emotional-cognitive state of uncertainty for a long time, possessing the property of reflection, using several opposing ideas, concepts, representations, psychophysiological states at the same time, which allows creative people to perceive and explore such logical-informational, cause-and-effect relationships and connections that are often inaccessible to those people who strive to achieve situational clarity and logical unambiguity. Under such conditions, creativity enables a person to overcome negative psychological states and extreme life conditions by integrating opposites, allowing them to form holistic structures that reveal the synergistic effect of the systemic properties of the whole ("the whole is greater than its parts"). This reduces the entropy of living

systems, increasing a person's vitality, strengthening their immunity, and promoting a state of health.

The algorithm of pedagogical influence is grounded, which can be used in crisis and extreme conditions of human life.

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Chapter 3

TEACHERS AND EDUCATIONAL LEADERS: PROFESSIONALISM, COLLABORATION, ETHICS

3.1. PROFESSIONAL RESILIENCE OF EDUCATORS – BURNOUT, SUPPORT, AND THE ROLE OF PROFESSIONAL COMMUNITIES

Olena Semenikhina

In wartime, professional resilience is not an abstract quality but a condition for the survival of educational environments. It encompasses the capacity to sustain teaching and learning under conditions of uncertainty and danger, to maintain professional orientation, to support learners and, at the same time, to avoid destroying one's own life through excessive self-sacrifice. In the previous parts of this monograph, resilience was considered as a multi-level phenomenon, encompassing individual, group, institutional, and system dimensions. In this part, the focus shifts to the role of the educator and educational leader, because it is through their decisions, emotional state, and professional agency that many strategies for sustaining human potential are actually implemented.

War makes the teaching profession particularly vulnerable to burnout. Teachers work simultaneously in several planes: they teach, support, organize, inform, and often act as intermediaries between learners, parents, administrators, volunteers, and public authorities. In addition to their usual professional responsibilities, new demands are added: responding to traumatic narratives from children and adults, teaching in conditions of frequent interruptions due to air raid alarms, constantly revising plans, and being forced to remain flexible in relation to content, formats, and instructional tools. This produces chronic overload and a pervasive

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sense that any reduction of expectations or pace is a betrayal of learners, colleagues, or the country as a whole.

Under such circumstances, burnout becomes not only an individual problem but also an indicator of the organization's educational environment. Emotional exhaustion, cynicism, and a sense of ineffectiveness are closely intertwined with objective factors, including excessive workload, diffuse expectations, the absence of realistic standards for educational quality during wartime, and a lack of structured support. A teacher who constantly works "at the edge" may interpret their fatigue as a personal failure, even though it is rooted in a combination of individual and systemic causes. For this reason, research on professional resilience must address not only psychological mechanisms of coping with stress but also management practices, organizational culture, and patterns of interaction within staff teams.

Different forms of support become key resources for resilience. At the individual level, this involves developing skills of self-regulation, recognizing one's own limits, and seeking help before exhaustion becomes a critical issue. This includes basic practices of self-care and the formation of realistic professional expectations, which acknowledge that, in wartime, it is impossible to perform all functions in the same way as before 2022. Collegial support presupposes a culture of mutual assistance within teaching teams, characterized by a willingness to stand in for a colleague who is temporarily unable to cope, collective discussion of challenging cases, and deliberate redistribution of emotional load, rather than leaving the most demanding tasks by default to a few "strong" staff members.

Professional communities play a particularly important role in sustaining and renewing resilience. These include formal structures (subject associations, methodological groups, professional networks of university lecturers) as well as informal peer-support circles that emerge in messaging apps, social media, or online platforms. Such communities serve several functions: exchanging practical solutions, rapidly circulating effective practices, acknowledging difficulties, articulating ethical dilemmas, and jointly seeking a balance between demands and available resources. In wartime, when institutional teams are

fragmented by relocation and remote formats, horizontal professional ties often form the "scaffolding" that prevents teachers from becoming completely isolated in their problems.

For educational leaders – including school principals, department heads, program directors, and university administrators – professional resilience has a dual dimension. On the one hand, they themselves require support, as they bear responsibility for decisions that affect safety, workload, and the organization of educational processes. On the other hand, their leadership approaches largely determine whether an institution becomes a place where care for people is integrated into daily practice, or, conversely, a space where problems are silenced and directives are implemented only formally. Leaders who acknowledge wartime realities and are prepared, together with their staff, to reconsider priorities, adapt timetables, and seek external resources create conditions for the resilience of the entire community.

Regional differences, such as proximity to the front line, experience of occupation, or the role of the host community, shape professional resilience in distinct ways. In frontline and de-occupied territories, teachers work under constant threat, often with minimal resources, and must combine the roles of instructor, psychologist, and social worker. In comparatively safer regions, outward stability coexists with feelings of guilt and a sense of "distant involvement" in the war. In host communities, the need to integrate large numbers of internally displaced learners adds another layer of tension, including conflicts rooted in divergent wartime experiences and linguistic or cultural differences. Each of these situations requires a particular configuration of support, yet in all of them the teacher remains a central figure.

This chapter does not aim to offer an exhaustive account of professional resilience among educators and educational leaders. Rather, it provides a framework for the subsequent contributions, which will examine specific aspects in more detail: collaborative and communication competences, teachers' moral and ethical responsibilities, models of working with learners who have undergone traumatic experiences, and organizational approaches to staff support. The combination of conceptual reflection with empirical data and case studies will help illustrate how professional

resilience is enacted in practice, which factors foster its development, and which factors gradually erode it from within.

In this sense, the discussion of professional resilience in this part of the monograph is an invitation to examine teachers and university lecturers not only as bearers of subject knowledge or methodological expertise, but also as individuals who support others daily in a context of war and who themselves require multi-level support. The extent to which the education system can integrate this perspective into its decisions will largely determine whether the human potential of education can be maintained and further developed during the war and in the post-war period.

3.2. COLLABORATIVE AND COMMUNICATION COMPETENCE OF PRE-SERVICE STEM TEACHERS AS A RESOURCE FOR RESILIENT AND INNOVATIVE EDUCATION IN WARTIME

Artem Yurchenko

Abstract. *The chapter examines the development of collaborative and communication competence of pre-service STEM teachers as a resource for resilience and innovation in education during the war in Ukraine. It demonstrates that the soft skills of cooperation and communication for a science and mathematics teacher are not a secondary add-on to professional training, but a prerequisite for organizing joint activities of learners, supporting their psychological resilience, and ensuring continuity of the educational process under conditions of danger and uncertainty. The aim of this study is to provide a theoretical justification and empirical verification of a model that combines the potential of non-formal STEM education (team-based intellectual competitions) with formal training of prospective teachers at a higher education institution, targeting the development of collaborative and communication competence. The empirical base consists of two components. The first covers an analysis of the dynamics of five groups of soft skills of participants in FEMMI competitions, with particular attention to the "Communication" and "Teamwork" indicators. The second is represented by a pedagogical experiment with prospective teachers of mathematics, physics, and computer science, in which a traditional model of training was compared with the STEM-oriented model focused on group projects, the use of digital tools, and reflective practices. The results showed a statistically significant increase in the levels of communication and teamwork among competition participants, as well as growth in the motivational, cognitive, praxeological, and reflective components of readiness to implement STEM education among learners in the experimental group. It is demonstrated that collaborative and communication competence are formed most effectively when team-based formats of activity are embedded in the goals, content, and assessment of educational programs, and when every episode of joint work is accompanied by reflection. An integrated model for developing soft skills of prospective STEM teachers is substantiated, which strengthens the resilience of educational communities under wartime conditions and can be used to modernize teacher education and in-service training programs.*

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Keywords: *STEM education; collaborative competence; communication competence; soft skills; STEM teachers; team-based intellectual competitions; educational resilience; war in Ukraine; reflection; professional training.*

Introduction

The full-scale war against Ukraine has radically changed the conditions under which the education system operates, especially in those regions where educational institutions function under constant threat of shelling, forced relocation, and the destabilization of everyday life. For institutions that train prospective science and mathematics teachers, these challenges have a dual nature. On the one hand, they are concerned with ensuring the continuity of the educational process amid permanent danger and recurring shifts between face-to-face, distance, and blended formats. On the other hand, there is an urgent need to cultivate in prospective teachers those qualities that enable them to act as agents of resilience, agency, and innovation for their future learners. Under these conditions, the issue of developing soft skills becomes not an additional, but a foundational dimension of the professional preparation of a STEM teacher (Succi & Canovi, 2020).

International studies emphasize that the ability to collaborate effectively, communicate, think critically, and creatively solve problems is a cornerstone of a teacher's professional competence in a digitally rich STEM environment (OECD, 2018; Voogt et al., 2015). In the context of wartime Ukraine, these qualities assume additional significance, including psychological resilience, readiness to act in uncertain situations, empathy, and the ability to foster supportive interactions within the learning community. The collaborative and communicative competence of prospective STEM teachers becomes a resource that enables them to transform unstable and traumatic circumstances into a space for mutual support, joint problem-solving, and the sustainable development of the educational environment.

Collaborative competence encompasses the readiness and ability to work effectively in a team, distribute roles, take responsibility for shared outcomes, resolve conflicts, and maintain

productive interactions (Johnson & Johnson, 2017). Communication competence presupposes the ability to express ideas clearly and intelligibly, listen actively, provide constructive feedback, and use different channels and formats of communication, including digital ones (Hattie & Clarke, 2019). Taken together, these competences form an important component of soft skills, without which effective interaction in learner groups, organizing STEM projects, and cooperation with parents, colleagues, and local communities cannot be achieved.

Research on the transformation of STEM education indicates that contemporary models of teacher preparation must extend beyond subject specialization and traditional teaching methods, integrating elements such as project-based work, interdisciplinary tasks, the use of digital simulators and laboratories, and participation in contests and competitions (English, 2016; Marginson et al., 2013). Participation of learners in team-based intellectual competitions, Olympiads, hackathons, and tournaments in mathematics, computer science, and other STEM subjects is viewed as an effective tool for developing not only subject-related, but also social and communication skills (Yurchenko et al., 2019). Team-based activity formats with clearly defined deadlines, open-ended problem situations, and the need for rapid interaction create natural conditions for the development of collaboration, leadership, and responsibility for shared outcomes.

Importantly, under wartime conditions, such competitions are increasingly held in distance or blended formats, relying on digital platforms for communication and collaborative work. This, on the one hand, broadens opportunities for learners from different regions, including those who have been forced to relocate or change their place of study. On the other hand, this generates a need to reconsider the roles of organizers, coaches, and mentors, who simultaneously perform the functions of facilitators, tutors, and moderators of digital interactions (Bozkurt et al., 2020). For prospective STEM teachers, participating in such activities as competitors or coordinators becomes a unique experience in which they test their own ability to sustain team dynamics, manage communication, and maintain productivity despite stress factors in practice.

Formal preparation at a higher education institution should therefore not only acknowledge the potential of non-formal education and team competitions, but also integrate their logic into the content of educational components. This may be reflected in the inclusion of STEM-oriented modules in the curriculum, where learners work in small groups on complex tasks, develop mini-projects, conduct experiments, and present their results using digital visualization and communication tools (Semenikhina et al., 2021). Such integration makes it possible to determine whether the development of collaborative and communication competence is indeed not a side-effect or accidental outcome of the educational process, but a consciously planned result.

The monograph in which this chapter appears focuses on the phenomenon of education at the edge, where resilience, adaptation, and innovation are closely intertwined with the experience of war. Within this field, prospective STEM teachers hold a special place, as they are expected to serve as guides in a high-tech, scientifically oriented, yet humane and supportive educational environment. The capacity of schools to ensure continuity of learning, develop twenty-first-century skills in learners, and support their psychological resilience depends on how successfully the preparation of such professionals combines subject-matter depth with the development of soft skills.

Within this logic, the main research question of this chapter concerns how the combination of learners' participation in team-based intellectual competitions and the targeted formal preparation of prospective teachers of science and mathematics influences the development of their collaborative and communication competence as components of soft skills. Accordingly, the analysis focuses on both theoretical models of soft skills and the professional competence of STEM teachers, as well as on empirical data obtained through the implementation of relevant educational programs and experimental studies. The purpose of the chapter is to describe and substantiate, on the basis of an analysis of scholarly publications and empirical findings, a model for developing collaborative and communication competence of prospective STEM teachers as a resource for resilient and innovative education during the war in Ukraine, to identify effective pedagogical conditions for such development,

and to outline prospects for further research and practical solutions for higher education institutions.

Analysis of recent publications

Soft skills in teacher preparation and STEM education

In scholarly discourse, soft skills are described as a group of cross-cutting competencies that ensure effective interaction between a person and others, as well as with a rapidly changing social environment. They typically encompass communication, collaboration, critical thinking, creativity, leadership, self-organization, and readiness for lifelong learning (Mailool et al., 2020). Unlike "hard" professional knowledge, these skills are manifested in the ways a learner acts and interacts with others, rather than in the mastery of a specific set of algorithms or formulas.

In the preparation of prospective teachers, including those in STEM specializations, soft skills are regarded as the foundation of professional competence that makes it possible to combine subject-matter depth with the organization of productive teamwork in the classroom, the creation of a safe atmosphere of mutual support, and the building of dialogue with parents and the local community. Studies conducted in different countries show that employers and educational institutions expect teachers to be able to adapt quickly to change, take responsibility for decisions in uncertain situations, and coordinate interaction in heterogeneous groups that bring together different levels of preparation and life experience (Mailool et al., 2020; Zhukova et al., 2021).

In the STEM field, which develops at the intersection of science, technology, engineering, and mathematics, the importance of soft skills becomes even more pronounced. A teacher who works with project-based tasks, inquiry-based cases, digital simulations, and blended learning formats constantly moderates group interaction, organizes the distribution of roles, and helps learners negotiate ways to solve problems. This requires not only a well-developed methodological culture, but also robust collaborative and communication skills as the basis of professional behavior.

Collaborative and communication competence of prospective STEM teachers

In contemporary research, the collaborative competence of a teacher is described as an integrated capacity to organize and sustain joint activity, define and align goals, distribute functions, establish horizontal interaction, and prevent destructive conflicts. It includes the ability to plan the work of a team, build mutual trust, encourage the involvement of those inclined towards passive participation, and support productive reflection after a task has been completed jointly (Zhukova et al., 2021).

The communication competence of a prospective STEM teacher entails the ability to formulate tasks in ways that are understandable to different age groups, use verbal and non-verbal means of interaction, listen to and clarify the positions of interlocutors, provide constructive feedback, and effectively employ digital tools for both synchronous and asynchronous communication. In hybrid or fully distance work modes, such abilities become crucial for maintaining a sense of "presence" in an online group, coordinating joint activities, and responding in a timely manner to learners' difficulties.

In the preparation of prospective STEM teachers, these two competencies are rarely developed in isolation. They are embedded in project-based work formats, laboratory classes, teaching practicums, participation in research clubs, and intellectual competitions. For this reason, the literature emphasizes the need for a holistic view of soft skills: collaboration and communication mutually reinforce each other and rely on the learner's reflective capacity to analyze their own actions, mistakes, and interaction strategies (Mailool et al., 2020; Zhukova et al., 2021).

Team-based intellectual competitions as a space for developing soft skills

One line of research represented in the sources used concerns the impact of team-based intellectual competitions on the development of soft skills in young people. In the article by A. Yurchenko and co-authors, it is demonstrated that participation in

team contests in informatics and computer graphics results in a significant increase in indicators of collaboration, communication, responsibility for shared results, and readiness to work under time pressure and with incomplete information (Yurchenko et al., 2024).

The researchers emphasize that the very structure of such competitions naturally fosters the development of soft skills. Team participation requires rapid distribution of roles (analyst, programmer, presenter, coordinator), joint discussion of problem-solving strategies, and negotiation of decisions when team members' views diverge. Time constraints underscore the importance of clear communication, the avoidance of redundant information, and the prompt coordination of actions.

The findings obtained in the study indicate that systematic participation in such activities makes it possible not only to develop subject-related skills associated with programming or data analysis, but also to foster a conscious attitude to joint work and one's own role in the team. Young people report improvements in their ability to listen to others, defend their position with arguments, search for compromise solutions, and overcome fear of mistakes, since responsibility for the outcome is shared among all participants. This is particularly important for prospective higher education learners in STEM fields, who will later work in interdisciplinary project teams.

Additionally, during the full-scale war, a significant proportion of competitions were moved to distance or blended formats. This required active use of platforms for online communication, collaborative editing of files, and visualization of solutions, which in turn strengthened the digital dimension of communication competence. Such formats create "model" situations that closely resemble the realities of the educational process during the war, when a teacher must rapidly switch between offline, online, and asynchronous modes of interaction with the class.

Developing soft skills in prospective teachers: international experience and Ukrainian studies

In the study by J. Mailool et al. (2020), which examines lecturers' experience of teaching soft skills in a teacher education program in Indonesia, it is shown that soft skills are developed more effectively not through separate "additional" courses, but through integration into the content of professional disciplines, practicum, and mentoring formats of interaction. The lecturers describe how elements of presentations, group projects, mentoring, and reflective tasks are integrated into courses, serving as tools for fostering responsibility, ethics, communication skills, and teamwork (Mailool et al., 2020).

In the work by O. Zhukova and co-authors (2021), devoted to the development of soft skills in prospective teachers during teaching practice in the pandemic period, the authors emphasize the role of real pedagogical situations in which a prospective teacher has to perform professional tasks and, at the same time, adapt to the constraints of blended or distance formats. They argue that it is precisely the combination of classroom-based preparation with learning "on the job" (in a school, lyceum, or college) that creates conditions for developing reflexivity, flexibility of communication, the ability to regulate emotions, and the capacity to sustain learners' motivation under unstable conditions (Zhukova et al., 2021).

The Ukrainian studies presented in the files, which focus on developing the readiness of prospective science and mathematics teachers to use STEM technologies, reveal a similar tendency. The models being developed aim not only to master the content of STEM but also to form motivational, cognitive, praxeological, and reflective components of readiness. Collaborative and communication skills permeate all four components: a learner needs to be intrinsically motivated to work in a team, possess knowledge about ways of organizing group activity, have practical experience of participating in joint projects, and be able to reflect on their own interaction strategies.

The pedagogical experiment, fragments of which are presented in the second file, demonstrates that the purposeful design of educational modules that incorporate STEM projects,

group work formats, and systems for diagnosing motivation and reflection enables statistically significant improvements in indicators of readiness to implement STEM technologies. Although the main focus of analysis is readiness for STEM, the methods used (motivation questionnaires, tools for assessing the capacity for reflection, and analysis of group tasks) directly relate to soft skills, primarily communication, teamwork, and responsibility for shared results.

Thus, international and Ukrainian studies converge on several important conclusions. First, it is advisable to develop soft skills not as a separate "add-on" to professional preparation, but through integrated models that combine project-based, research, practical, and competitive activities with reflection. Second, real or near-real interaction experience plays a decisive role: teaching practice during a pandemic, participation in team-based intellectual competitions, and working with a class under wartime threats. Third, the development of teachers' soft skills is closely linked to the transformation of the educational environment and professional requirements, and cannot occur in isolation from broader societal changes.

Synthesis of the analysis and formulation of the research problem

The review of publications shows that both international and Ukrainian pedagogical scholarship have already accumulated a substantial theoretical and empirical body of work on soft skills of teachers and learners. Studies devoted to the structure of soft skills enable the determination of the place of collaborative and communication competence within the system of a teacher's professional qualities. Research conducted in teacher education programs demonstrates the effectiveness of integrated models in which soft skills are treated as an integral part of the content and methods of preparation (Mailool et al., 2020). Works focusing on the period of teaching practice emphasize the role of real educational situations as a catalyst for developing reflection, flexible communication, and the ability to act in non-standard conditions (Zhukova et al., 2021). The experience of organizing team-based intellectual competitions reveals that such formats

provide a powerful space for fostering collaboration, communication, leadership, and responsibility in young people (Yurchenko et al., 2024).

Nevertheless, several aspects remain underexplored. First, in studies that analyze team competitions, the focus is most often on school students or learners in non-academic programs, whereas prospective STEM teachers are rarely considered, and their participation in competitions is described only fragmentarily. Second, most research on soft skills in teacher preparation was conducted before the start of the full-scale war in Ukraine or in other crisis conditions (such as the COVID-19 pandemic), but without accounting for the systematic impact of wartime threats on the organization of the educational process. Third, in existing models of preparing teachers of science and mathematics, collaborative and communication competence are usually mentioned briefly, as elements of motivational or reflective components, without a detailed theoretical and empirical analysis of their dynamics.

This gives rise to a research problem: it is necessary to describe and substantiate a model for developing collaborative and communication competence of prospective STEM teachers that combines the potential of formal education in a higher education institution with the opportunities offered by non-formal formats, in particular team-based intellectual competitions, and that takes into account the realities of war as a long-term source of instability. Such a model should clarify which specific elements of content, forms of organizing activity, digital tools, and diagnostic procedures ensure the sustainable growth of soft skills, which in turn serve as a resource for resilient and innovative education in wartime.

This defines the focus of further analysis in this chapter: combining theoretical approaches to understanding soft skills with empirical findings from studies of team competitions and from a pedagogical experiment on preparing prospective teachers of science and mathematics, and identifying those pedagogical conditions under which collaborative and communication competence become a real rather than merely declarative resource for educational resilience.

Methods and materials

This subsection describes the empirical base of a study that combines two complementary strands. The first concerns an analysis of the impact of FEMMI team-based intellectual competitions on the development of participants' soft skills, primarily collaboration and communication (Yurchenko et al., 2019; Yurchenko et al., 2024). The second is related to a pedagogical experiment on developing the readiness of prospective science and mathematics teachers to apply STEM technologies, in which collaborative and communication competence are treated as cross-cutting components of this readiness (Yurchenko, 2025). Both studies share a common logic: they are based on quantitative methods, repeated measurements (before and after the intervention), and the use of statistical tests to confirm the significance of the observed changes.

Overall research design

The research design consisted of two empirical steps. At the first stage, a quantitative analysis was conducted of the dynamics of five groups of soft skills (communication, problem-solving, teamwork, lifelong learning, and leadership) in upper secondary school students who participated in FEMMI team-based intellectual competitions. This made it possible to describe how team-based work formats, problem-focused tasks, and digital support for competitions influence the development of soft skills in young people who are potential future learners in STEM fields at higher education institutions.

At the second stage, a pedagogical experiment was conducted with prospective teachers of mathematics, physics, and computer science. Two trajectories of professional preparation were modelled: a traditional one (control group) and an author's trajectory oriented towards the integration of STEM technologies, group projects, and reflective practices (experimental group). In this experiment, readiness to apply STEM was conceptualized as an integrative characteristic that includes motivational, cognitive, praxeological, and reflective components, while collaborative and communication competence were captured through a set of indicators within each of these components.

Both empirical strands were united by a pre- and post-test logic. Participants completed questionnaires before the start of the competitions or the implementation of the author's preparation model, and again after the respective activities had been completed. This made it possible to assess not only the static level of soft skills, but also their dynamics under the influence of clearly defined educational conditions.

Participants and materials in the FEMMI competition study

The FEMMI team-based intellectual competitions were organized at Sumy State Pedagogical University, named after A. S. Makarenko, and aimed to engage learners in Grades 8–11 of general secondary education institutions in the Sumy region in solving complex tasks in informatics, mathematics, and related fields. The analysis drew on data from 350 participants who participated in the competitions as team members and completed a questionnaire assessing their level of soft skills development.

The competition tasks were predominantly problem-oriented and inquiry-based, requiring participants not only to prepare subject matter but also to negotiate, distribute roles, and explain their own ideas. At certain stages, digital tools were employed – systems for demonstrating solutions, online platforms for submitting answers, and shared digital workspaces. This created an additional arena for demonstrating communication skills in a digital environment.

The materials for analysis included participants' responses to a standardized questionnaire measuring five groups of soft skills, the results of team task performance, and basic socio-demographic information about participants (grade level, place of residence, and previous experience with similar events). In this chapter, particular attention is paid to the "Communication" and "Teamwork" groups, which directly reflect collaborative and communication competence.

Participants and materials in the pedagogical experiment with prospective STEM teachers

The pedagogical experiment was conducted among learners enrolled in "Mathematics", "Physics", and "Computer Science" programs at several Ukrainian higher education institutions. The participants were learners in the final years of their studies who had already completed basic pedagogical disciplines and were undertaking or preparing to undertake teaching practice.

Within the study, two groups were formed: an experimental group and a control group. The experimental group was studied according to an author's preparation model, which provided for the purposeful inclusion of STEM-oriented modules, group projects, the use of digital laboratories and simulators, as well as the organization of reflective sessions in which learners analyzed their own interaction in teams and communication difficulties. The control group studied the content of educational components within a traditional model in which group and project-based formats of work were not systematic, and learners' reflection on their soft skills was largely situational.

The size of the groups was comparable, allowing for statistical comparability of the results. Participants in both groups studied in closely related educational programs, which allowed the impact of the author's model itself to be compared rather than differences in curricula.

The materials for analysis comprised the results of questionnaires, test tasks, and reflective surveys aimed at measuring the four components of prospective teachers' readiness to apply STEM technologies in teaching science and mathematics: motivational, cognitive, praxeological, and reflective. Items concerning group interaction, the effectiveness of communication, the ability to organize collective problem-solving, and the capacity to establish feedback made it possible to indirectly assess the level of collaborative and communication competence.

Diagnostic instruments

In the FEMMI competition study, a modified questionnaire was used, based on previous work by the authors' team

(Yurchenko et al., 2019). The instrument covered five groups of soft skills. For each group, several statements were formulated, with which participants had to agree or disagree. For the "Communication" group, the items concerned readiness to listen to others, enjoyment of questions about one's own explanations, willingness to clarify what was not understood, and a tendency to seek agreed team decisions. Responses were recorded on a scale that allowed for the analysis of both the distribution of levels for each indicator and changes after the competitions had ended.

In the pedagogical experiment, a comprehensive diagnostic toolkit was applied, which included:

- a questionnaire on motivation for success and for using STEM technologies in professional activity;
- test tasks to assess complex interdisciplinary knowledge and understanding of the nature of STEM education;
- specially designed situational tasks that modelled the organization of learners' group work, in which a prospective teacher had to choose a team-working strategy, a mode of communication, and approaches to conflict resolution;
- reflective surveys in which learners assessed their own contribution to teamwork, the difficulties of interaction, and changes in their understanding of the role of communication and collaboration in a STEM lesson.

Each component of readiness was assessed using a set of indicators with quantitative expression. For the motivational component, these included, for example, interest in STEM, willingness to engage in additional educational activities, and orientation towards teamwork. For the praxeological component, they included the ability to plan and implement STEM projects, distribute roles within a group, and use digital tools to coordinate joint activity. The reflective component encompassed the ability to critically evaluate one's own actions, acknowledge mistakes, and adjust communication strategies.

Procedure and statistical analysis

The data collection procedure in the FEMMI study involved two measurements. At the beginning of the competition, participants completed a questionnaire, which enabled the recording of the initial level of development for each group of soft skills. After the final stage of the competitions, the survey was repeated in the same format. The responses obtained were coded, grouped by indicators, and compared. Before applying statistical tests to assess the significance of changes, the normality of the data distribution was checked using Pearson's chi-square test. To identify statistically significant differences between the indicators at the beginning and at the end of the competitions, Student's t-test for dependent samples was used. This made it possible to determine in which groups of skills reliable positive shifts had occurred and whether they were linked to participation in team-based intellectual competitions.

In the pedagogical experiment, the procedure also included three successive stages: baseline (diagnostic), formative, and control. At the baseline stage, an initial diagnosis was conducted to assess the level of readiness of prospective science and mathematics teachers to apply STEM technologies in both the control and experimental groups. This made it possible to verify the absence of statistically significant differences between the groups on key indicators before the implementation of the author's model.

At the formative stage, a set of pedagogical conditions was implemented in the experimental group: integration of STEM components into course content, organization of group projects using digital tools for modelling and visualization, and targeted work on developing collaborative and communication competence (distribution of roles in teams, facilitation of discussions, reflective conversations about interaction difficulties). In the control group, teaching followed the existing curriculum without a systematic emphasis on these aspects.

At the control stage, diagnostics were repeated using the same instruments as at the beginning of the experiment. To analyze changes within each group and to compare the control and experimental groups, a Student's t-test was applied, as well

as a Pearson's chi-square (χ^2) test to assess differences in the distribution of levels of readiness components. The level of statistical significance was set at $p < 0.05$.

This combination of baseline and formative procedures, standardized questionnaires, and statistical methods of analysis made it possible not only to describe specific aspects of the development of collaborative and communication competence but also to provide empirical evidence for the effectiveness of the pedagogical conditions embedded in the preparation model for prospective STEM teachers and in the organization of team-based intellectual competitions. It thus provides a robust foundation for interpreting the results presented in the next subsection.

Results

Baseline level of participants' soft skills and prospective STEM teachers' readiness

The baseline stage of the study made it possible to outline the initial "profile" of participants in both empirical strands. For the school students who took part in the team-based intellectual competitions, mean values were recorded for the five groups of soft skills on a five-point Likert scale. In the "Communication" and "Problem-solving" groups, the mean values fell within the moderate range (approximately 2.6–2.8 points), indicating the presence of basic interaction and problem-solving skills, but without a clear expression of confidence in these abilities. The "Teamwork" indicator was somewhat higher (above 3 points), which suggests that some participants already had experience working in a team and rated their ability to collaborate positively. The "Lifelong learning" and "Leadership" groups showed mean values of approximately 2.7–3.1 points, reflecting a potential for further development rather than fully formed strategies of self-directed learning or leadership behavior.

Overall, this means that before the competitions, most participants relied on intuitive notions of teamwork and communication. They already had experience of participating in joint learning or extracurricular activities, but did not always fully understand their own strengths and weaknesses as team

members. This created favorable conditions for tracking change, as there was a clear "margin" for growth, with no extremely low or maximally high scores observed.

In the pedagogical experiment aimed at developing prospective teachers' readiness to apply STEM technologies in teaching science and mathematics, the baseline data in the control and experimental groups likewise indicated predominantly average levels across all four readiness components. The motivational component was characterized by a combination of general interest in educational innovation and uncertainty about one's own ability to implement STEM in future professional activity. The cognitive component manifested itself in fragmentary ideas about the nature of the STEM approach, isolated examples of interdisciplinary links, and familiarity with basic concepts without a coherent system.

At the start of the experiment, the praxeological component had a limited character: learners could name certain techniques of interactive or project-based teaching, but had not yet gained their own experience of completing a full STEM project cycle, from problem formulation to the presentation of results. The reflective component was also at an average level. Most learners were able to describe their strengths, but rarely analyzed their own behavior in a team, the causes of communication difficulties, or the role of feedback.

Statistical analysis of the baseline data revealed no substantial differences between the control and experimental groups; that is, the groups were comparable prior to the implementation of the author's model. This is important, as it provides grounds for attributing subsequent differences primarily to the influence of the pedagogical conditions embedded in the experiment, rather than to initial inequality between the groups.

Dynamics of soft skills among participants in team-based competitions

After the cycle of competitions had been completed, participants were surveyed again using the same questionnaire. Comparison of the mean values before and after participation

showed a clear positive dynamic for three of the five groups of soft skills.

In the "Communication" group, the mean score increased from approximately 2.78 to 3.46. The difference proved to be statistically significant: Student's t-test exceeded the critical value for $p < 0.05$. This increase reflects shifts in participants' self-assessments of their ability to formulate ideas, ask clarifying questions, participate in collective decision-making, and express their position openly within the team. Qualitative comments recorded during the competitions support this conclusion: participants noted that over time it became easier to "come to an agreement", to hear others' arguments, to avoid everyone speaking at once, and to move towards a more structured exchange of views.

For the "Problem-solving" group, the mean score also increased (from about 2.62 to 3.18), and the t-test revealed a statistically significant difference between the baseline and final measurements. This indicates that participants began to rate their ability to analyze problem conditions, search for non-standard approaches, and combine different solution strategies with greater confidence. Under competition conditions, where the tasks were open-ended and did not always have an "obvious" algorithm, learners were trained to accept uncertainty and to see it as an invitation to creative exploration rather than as a threat.

The "Teamwork" group showed the most pronounced dynamic, with the mean score rising from approximately 3.06 to 3.84 points, and the t-value again exceeded the critical threshold. This result supports the conclusion that there was a strengthening of participants' sense of belonging to the team, their ability to distribute roles, maintain an even level of engagement among all members, and take responsibility for particular functions. In their feedback, participants stressed that the repeated format of the competition stages helped them "adjust to one another", practice strategies of "coordinating rather than dominating", and recognize the value of different types of contribution to the team result.

By contrast, the "Lifelong learning" and "Leadership" groups demonstrated positive but not statistically significant changes. The mean score for "Lifelong learning" increased from about 2.7 to

3.02, and for "Leadership" from 3.14 to 3.42, but the corresponding t-values were below the critical level. This can be explained by several factors. First, the duration of the competitions and the task format were oriented primarily towards team interaction and joint problem-solving, rather than long-term planning of one's educational trajectory or the formation of stable leadership roles. Second, the participants themselves may have perceived leadership as a character trait that does not change rapidly, and therefore adjusted their self-assessment for this indicator more cautiously.

Taken together, the results of this strand show that team-based intellectual competitions are an effective environment for developing, above all, the collaborative and communication dimensions of soft skills. They create situations of intensive interaction in which each participant is required simultaneously to listen to others, propose their own ideas, and coordinate actions under time pressure. These conditions closely align with the realities of a future STEM teacher's work, where they must coordinate group activities among learners engaged in projects or inquiry-based tasks.

Changes in indicators of readiness to use STEM technologies and indirect dynamics of collaborative and communication competence

In the pedagogical experiment, it was important to compare the dynamics of indicators in the control and experimental groups. The aggregated results presented in the corresponding tables and charts show substantially more intensive growth in the experimental group across all four components of readiness.

For the motivational component, the experimental group showed a significant increase in the proportion of learners with high and sufficient motivation to incorporate STEM into their future professional activities. Respondents more frequently reported interest in working with interdisciplinary tasks, willingness to participate in additional STEM projects, and confidence that the use of STEM technologies makes it possible to combine subject-matter knowledge with a creative approach. In the control group, the changes were moderate and mainly concerned a shift of some

respondents from a low to an average level. Statistical analysis revealed that the differences between the groups in the final data were significant and could not be attributed to random fluctuations.

The indicator "Awareness in the field of STEM" was most strongly influenced by the systematic study of the theoretical foundations of STEM education, analysis of models for integrating science, technology, engineering, and mathematics, and discussion of international and Ukrainian practices. Learners in the experimental group demonstrated the ability to clearly articulate the essence of the STEM approach, distinguish between interdisciplinary integration and the simple juxtaposition of materials, and explain the advantages of STEM in developing critical thinking and soft skills in learners. In the control group, these ideas remained more fragmentary.

The indicator "Complex interdisciplinary knowledge" in the experimental group showed a pronounced increase due to systematic work on tasks that required combining mathematical tools, scientific laws, and technological solutions. Learners gradually transitioned from isolated pieces of knowledge to an ability to see the overall structure of a task – for example, connecting analysis of a physical phenomenon with its computer modeling and mathematical description. This created conditions for the natural emergence of teamwork: each person took responsibility for part of the task, but successful completion required integrating all parts into a single solution.

The indicator "Ability to implement STEM" showed the greatest increase precisely in the experimental group. The main contribution to this growth came from forms of work that required active collaboration, including project-based learning, the use of computer simulations, organizing small-group inquiry projects, and public presentations of results followed by discussion. Learners not only practiced designing a STEM lesson, but also constantly interacted with one another while planning, distributing roles, and discussing interim results. This fostered the development of collaborative competence at the level of practical actions rather than mere declarations.

The dynamics of the indicator "Capacity for reflection" are of particular interest. In the experimental group, a clear shift was observed from episodic, situational reflection to a more stable practice of self-analysis. The strongest impact was observed in reflective journals, discussions of difficulties in teamwork, and analyses of specific situations where communication or collaboration had proven ineffective. Learners began not only to note that "it was hard to come to an agreement", but also to search for reasons related to role distribution, communication style, or vague formulation of a shared goal. This is directly linked to the development of communication competence.

In the control group, some positive changes were also observed, which were associated with the natural accumulation of experience and the completion of teaching practice. However, statistical analysis (Student's t-test and Pearson's chi-square test for the distribution of levels) showed that the gains in the experimental group were substantially higher across all components. Thus, the author's model, which systematically combined STEM-oriented modules, project-based activities, and reflective practices, proved effective not only for enhancing indicators of readiness for STEM but also for developing collaborative and communication competence as cross-cutting characteristics.

Collaboration and communication as a resource for educational resilience in wartime

Combining the findings from the FEMMI team-based competitions and the pedagogical experiment suggests that collaborative and communication skills become a genuine resource for the resilience of educational communities under crisis conditions. Participants in the competitions, who had practiced acting as a team in uncertain and time-pressured situations, showed a greater readiness to navigate new forms of interaction, including online environments. Later, as higher education learners, such participants are more likely to engage actively in clubs, projects, and conferences, which support their educational and professional trajectories despite external threats.

For prospective STEM teachers, the ability to organize teamwork and build productive communication proved to be critically important, precisely in wartime conditions. During transitions to blended or fully online formats, interruptions of classes due to air raid alerts, and situations where part of the class is offline and part online, it is collaborative and communication skills that enable the maintenance of the educational process's integrity.

The experimental results show that learners who completed the author's preparation model spoke more confidently about their own ability to sustain group dynamics, adapt forms of work to changing conditions, and use digital tools to support interaction (shared documents, virtual whiteboards, chats for organizing project work). They adopted a more deliberate stance towards creating an environment of mutual support, in which every learner has a voice and space for initiative.

One important outcome concerns the reflective dimension. An increased capacity to analyze one's own behavior in a team, articulate mistakes, and adjust communication strategies indicates that prospective STEM teachers become less vulnerable to emotional burnout. They learn to see difficulties not as personal failure, but as a signal to reconsider how joint activities are organized. This directly supports resilience: under the harsh conditions of war, such an attitude helps maintain professional agency and find resources for continuing one's work.

Integrating findings and outlining a model for developing collaborative and communication competence

An integrated analysis of both empirical strands enables the development of a model for enhancing collaborative and communication competence in prospective STEM teachers, where formal and non-formal education complement each other.

The data obtained in the FEMMI framework show that even relatively short-term participation in a cycle of team-based competitions leads to statistically confirmed gains in the "Communication" and "Teamwork" groups. This supports the rationale for systematically incorporating such formats into the

professional growth trajectory of prospective teachers – both through participation in student team tournaments and through involving learners in organizing competitions for school students. In this way, a prospective teacher masters two roles simultaneously: that of a team member and that of a facilitator of others' teamwork.

The pedagogical experiment implementing the author's preparation model demonstrates that collaborative and communication competence are formed most effectively when they are not isolated in a stand-alone "soft skills course", but permeate the motivational, cognitive, praxeological, and reflective components of readiness for STEM. The motivational component is strengthened through the experience of successful team projects, the cognitive component through discussions of real examples of collective scientific and engineering work, the praxeological component through the systematic performance of group STEM tasks, and the reflective component through the analysis of specific situations involving communication difficulties.

Taken together, the results of the study provide grounds to argue that the collaborative and communication competence of prospective STEM teachers can be developed in a purposeful way under the following conditions:

1. Involving learners in diverse formats of team-based activity (competitions, projects, teaching practicum) with clearly defined shared goals.
2. Using digital tools that support transparent and regular communication, joint planning, and reflection.
3. Ensuring a constant transition from action to analysis, where each episode of collaboration becomes material for reflecting on how interaction is organized and what exactly helps or hinders the team from moving forward.

In wartime conditions, such a model not only enhances the professional readiness of prospective STEM teachers but also equips them to be carriers of resilience within their school communities. Learners who develop collaborative and communication competence alongside STEM-oriented content are able to shape the educational process as a space of mutual

support, joint problem-solving, and responsible engagement with their own development. This directly aligns with the idea of education "at the edge", which not only withstands extreme circumstances but also gives rise to new forms of resilience, adaptation, and innovation.

Discussion

The findings make it possible to view the development of collaborative and communication competence in pre-service STEM teachers as a process in which the effects of formal and non-formal education, digital environments, and wartime challenges are intertwined. Participants in the competitions showed statistically significant increases in the "Communication" and "Teamwork" groups, while prospective science and mathematics teachers in the experimental group demonstrated gains in the motivational, cognitive, praxeological, and reflective components of readiness to implement STEM. This indicates that purposeful immersion of learners in team-oriented learning situations leads to qualitative changes not only in subject knowledge, but also in the ways they interact with others.

Comparison with international studies helps to outline more clearly the specificity of the Ukrainian results. In the work of B. Yildirim (2020), a model of professional development for STEM teachers is proposed in the format of "STEM Teacher Institutes", where the training course is designed as a long-term program with an emphasis on project work, interdisciplinary tasks, and collective lesson planning. The author demonstrates that joint problem-solving, group reflection, and collaboration among teachers of different subjects foster the development of communication and collaborative skills (Yildirim, 2020). Our results support this conclusion, but add a new dimension – the involvement not only of teachers, but also of school students and prospective teachers in team-based intellectual competitions, which in effect function as "mini-institutes" for developing soft skills among a broader group of participants.

In a recent study, B. Yildirim (2024) examines the impact of a "flipped TRIZ-STEM" model on teacher preparation, comparing face-to-face courses and online formats that incorporate elements

of flipped learning and creative problem-solving based on TRIZ. The author demonstrates that an innovative format, in itself, does not automatically guarantee growth in creativity or other soft skills; the effect depends on how consistently tasks, feedback, and group interaction are designed (Yildirim, 2024). A similar pattern can be observed in our experiment: what proves decisive is not only the use of digital tools or project-based formats, but their integration into the logic of repeated collaboration, systematically accompanied by reflection.

The study by K. Tzafilkou, M. Perifanou, and A.A. Economides (2022) focuses on teachers' views on distance STEM teaching, the barriers they encounter, and their training needs. The authors document high levels of tension related to technical difficulties, time constraints, and psychological fatigue, as well as a strong demand for support in digital communication and online interactions (Tzafilkou et al., 2022). Our results partly resonate with these findings, but point to an even sharper dimension of the problem: for Ukrainian prospective teachers, the need for such competences is driven not only by the transition to distance formats, but also by the requirement to work under wartime threats, frequent interruptions of classes, and heterogeneous groups. Collaborative and communication skills, therefore, function not merely as a means of overcoming technical barriers, but as a mechanism for sustaining the community's viability.

In the work of D. Yabas and T. Abanoz (2024), which examines the innovative preparation of early childhood and primary school teachers for integrated STEM teaching, the authors emphasize the importance of specially organized training sessions where educators work in teams on projects, test didactic solutions, and receive mentoring support. They demonstrate that such conditions facilitate the development of a stable sense of self-efficacy, broaden the repertoire of communication strategies, and enhance the capacity to collaborate when planning and conducting STEM lessons (Yabas & Abanoz, 2024). Our experimental course for prospective science and mathematics teachers operates on a similar logic, but with several essential differences. First, it is explicitly oriented towards combining university-based learning with real school conditions under martial law. Second, it places

stronger emphasis on the reflective component, which allows participants not only to acquire new collaboration practices but also to make sense of their own emotional reactions and behavioral strategies in crisis situations.

A series of studies on integrating engineering thinking, design, and digital technologies into the preparation of prospective STEM teachers underscores the importance of deliberately "nudging" learners towards cooperation. B. Wu, Y. Hu, and M. Wang (2019) demonstrate how design thinking in online courses for prospective teachers fosters joint problem exploration, the exchange of ideas, and the collective refinement of solutions. Learners acquire not only the ability to generate options but also to propose changes with arguments, accept critique, and maintain the overall logic of product development (Wu et al., 2019). Our findings – in particular the increase in "Problem-solving" and "Teamwork" indicators in the FEMMI competitions and the growth of the praxeological component in the experimental group – align with these conclusions: collaboration proves most effective when tasks involve multistep collective construction of solutions rather than a set of separate individual actions.

Similar emphases can be traced in studies on educational robotics and immersive technologies in teacher education programs. In the research by A. Rodrigues and colleagues, the impact of an interdisciplinary course in educational robotics on the ability to plan and implement STEM lessons is examined, with part of the solutions being developed by learners in teams (Rodrigues et al., 2024). In the work of F. Díaz and co-authors, the attitudes of prospective teachers towards immersive technologies and their readiness to integrate these into STEM courses are analyzed. The authors note that positive attitudes are stronger when there is experience with joint practicums and labs, rather than only theoretical familiarization. In these studies, deep integration of technologies occurs through shared activity, rather than individual testing of tools. In our model, interactive environments, simulators, and digital platforms are likewise used not as an "add-on" to lectures, but as the core of group projects, strengthening not only technical but also communication skills.

A separate international line of research concerns digital support tools, including artificial intelligence. In the work of Y. Ji

and colleagues (2023), the impact of ChatGPT on achievement and cognitive load among prospective STEM teachers is analyzed. The authors demonstrate that utilizing ChatGPT as a tool for supporting explanations and generating tasks can enhance understanding and alleviate perceived load, provided that the teacher establishes clear boundaries and employs the tool to facilitate discussion rather than replace interaction (Ji et al., 2023). Our study does not focus specifically on AI, but it highlights the importance of the prospective teacher's pedagogical stance as a moderator of digital communication, capable of organizing discussion, critical analysis of solutions, and collaboration on online platforms. This is close to Ji and colleagues' conclusion that the effectiveness of digital tools depends on the extent to which they are embedded in a living process of shared thinking.

International studies on the professional preparation of STEM teachers within university "ecosystems" also confirm the central role of soft skills. Educational ecosystems that combine formal courses, research clubs, innovation centers, digital laboratories, and partnerships with external schools are viewed as environments that naturally foster demand for collaboration, communication, and cognitive flexibility. Ukrainian studies on the professional preparation of STEM teachers through digital technologies in the university environment emphasize that it is precisely interdisciplinary tools, joint projects, and digital platforms for interaction that shape a new "norm" of professional behavior for the future teacher, not as an isolated specialist, but as a member of a community. Our results align with this logic, but highlight that under wartime conditions, the university ecosystem's responsibility for developing collaborative and communication skills becomes particularly significant, as these skills underpin graduates' ability to support school communities in crisis situations.

Another strand of international publications focuses on the link between teacher preparation and sustainable development. A. Scheunpflug and J. Costa (2025) describe education for sustainable development as a space where the leading role belongs not so much to transmitting knowledge about the Sustainable Development Goals as to developing the capacity to act together, participate in collective decision-making, and

recognize the long-term consequences of local actions. In the study by S. Baena-Morales and colleagues (2024), the views of teachers on the Sustainable Development Goals and education for sustainability are analyzed; the authors demonstrate that the integration of sustainability topics into education remains superficial without well-developed soft skills in cooperation, communication, and ethical reflection. Our findings fit this line of reasoning: the collaborative and communication competence of prospective STEM teachers emerges not only as a resource for organizing learning during the war, but also as a precondition for school communities to engage collectively with questions of reconstruction and ecological and social responsibility.

In addition, research on infrastructural innovations, such as blockchain technologies in education (Savelyeva & Park, 2022), underscores the importance of transparency, decentralization, and trust as the foundations of sustainable educational systems. Although our study does not involve blockchain or similar technologies, it shows that these principles can be implemented "at the human level" – through building horizontal ties, mutual support, and shared decision-making in learner groups and among prospective teachers.

In summary, the results of our study are consistent with international trends in STEM teacher preparation, where collaboration and communication are seen as integral components of professional competence. At the same time, the Ukrainian experience adds an important layer to this picture: collaborative and communication competence appears not only as an instrument for improving the quality of teaching, but as a condition for the resilience of education under conditions of protracted war. Participation in team-based intellectual competitions, engagement in STEM projects, and reflective practices within the author's preparation model transform soft skills into a real resource for overcoming crises, supporting educational communities, and moving towards sustainable development. This underscores the need for further research aimed at long-term tracking of graduates' professional trajectories and at disseminating similar models across different regions and countries.

Conclusions

The study was designed to substantiate and empirically test a model for developing the collaborative and communication competence of prospective STEM teachers as a resource for resilient and innovative education during the war in Ukraine. The research question concerned how the combination of learners' participation in team-based intellectual competitions and targeted formal preparation at a higher education institution influences the development of soft skills, such as collaboration and communication, that are necessary to sustain the viability of educational communities under conditions of prolonged uncertainty and danger.

Theoretical analysis of works on soft skills in teacher preparation made it possible to conceptualize collaborative and communication competence as interrelated components of the professional readiness of a STEM teacher. In the scholarly literature, they are described not as auxiliary abilities but as fundamental principles of professional behavior for a teacher who organizes joint activities, facilitates classroom interactions, works with diverse stakeholders in the educational environment, and coordinates blended and distance formats. Reflection on international research and Ukrainian work in the field of STEM education and soft skills development revealed that project-based, inquiry-based, competitive, and reflective formats of work create a natural environment for the development of collaboration and communication. At the same time, the role of the university increasingly consists not only in transmitting knowledge, but also in creating educational ecosystems in which learners tackle real tasks in interaction with others, utilize digital tools, and learn to analyze their own behavior and the roles they assume.

The analysis of FEMMI team-based intellectual competitions showed that such formats are an effective means of developing soft skills in upper secondary school learners and potential applicants to STEM programs. The baseline measurements indicated predominantly average levels in the "Communication", "Teamwork", "Problem-solving", "Lifelong learning", and "Leadership" groups. Following participation in the competition cycle, statistically significant increases were observed in the "Communication" and "Teamwork" groups, as well as a noticeable,

albeit not always statistically significant, improvement in the "Problem-solving" indicator. This suggests that participation in team competitions changes not only the level of confidence in solving problems, but also attitudes towards joint activity: it teaches participants to coordinate actions, listen to others, and take responsibility for shared results. The less pronounced dynamic in the "Lifelong learning" and "Leadership" groups indicates that orientations towards long-term self-development and stable leadership roles require a longer period of formation and a broader range of educational influences.

The second empirical strand, related to the pedagogical experiment on preparing prospective teachers of science and mathematics to use STEM technologies, demonstrated that the author's model, oriented towards the integration of STEM modules, group projects, digital tools, and reflective practices, brings about substantial changes in the structure of learners' professional readiness. In the experimental group, there was a marked increase in the motivational component, as evidenced by a growth in interest in STEM, an increase in the desire to use integrated tasks, and a willingness to participate in additional projects. The cognitive component ceased to be fragmentary: learners defined the essence of STEM more precisely, distinguished between interdisciplinary integration and simple juxtaposition of material, and became aware of the potential of STEM for developing critical thinking and soft skills in school learners.

The praxeological component also undergoes a qualitative change: prospective teachers master not only individual methodological techniques but also the complete cycle of a STEM lesson, including problem formulation, organization of group work, use of digital simulations, and presentation of results. In this dimension, collaborative and communication competence are manifested in the ability to plan and implement joint tasks, distribute roles, and create an environment of trust and mutual support. Growth in the reflective component is expressed in a shift from episodic reflections to a stable practice of analyzing one's own activity: learners learn to identify the causes of communication difficulties, assess the effectiveness of chosen collaboration strategies, and formulate alternative approaches.

A comparison of the control and experimental groups revealed that the observed changes cannot be attributed solely to the natural accumulation of experience or completion of teaching practice. In the control group, positive dynamics were limited and were not accompanied by a systematic reconsideration of learners' views on the role of collaboration and communication in the STEM lesson. This allows us to conclude that it is the deliberately designed preparation model – in which collaboration and communication are embedded in the aims, content, formats, and assessment procedures – that creates conditions for the sustainable development of these competences.

Combining the FEMMI competition data with the findings from the pedagogical experiment enables the development of an integrated model for fostering collaborative and communication competence in prospective STEM teachers. Non-formal education, in the form of team-based intellectual competitions, provides learners with an intensive experience of teamwork, where they feel a genuine sense of responsibility for shared results. They learn to negotiate, act under time pressure, and utilize digital tools to coordinate their work. Formal university-based preparation ensures the duration and systematic character of this experience, making it possible to interpret it, connect it to theoretical models of STEM education and education for sustainable development, and transform separate episodes of collaboration into stable professional practices.

Wartime conditions impose additional demands on this model. The collaborative and communication competence of a prospective STEM teacher becomes not only a condition for effective teaching but also a resource for supporting the resilience of educational communities. A teacher who can build horizontal interaction, maintain continuous contact with the group in blended and distance formats, and effectively organize mutual support among learners serves as an "anchor point" for a class experiencing chronic danger, loss, and migration. The results of this study show that such abilities do not emerge by chance, but can be formed through a carefully designed combination of team-based activities, digital tools, and reflective practices.

Comparative analysis with international studies suggests that the Ukrainian experience is broadly consistent with global

trends in STEM teacher preparation, while adding a specific dimension of wartime challenges. In many countries, emphasis is placed on the fact that developing collaboration and communication is necessary for implementing integrated STEM courses, supporting innovation, and cooperating with various partners. Under Ukrainian conditions, these same competences serve an additional function: they help education withstand the impact of war, maintain continuity of learning, and create a space for learners to share meaning, offer mutual support, and engage responsibly with the future.

At the same time, this study has certain limitations. The sample is restricted to specific regions and higher education institutions that already implement STEM-oriented programs and competitions. A substantial part of the indicators is based on participants' self-assessment. Further longitudinal research is needed to trace how the competences formed manifest themselves in graduates' actual teaching practice, as well as comparative studies in different regions of Ukraine and in other countries experiencing war or other crisis situations.

In summary, the findings allow us to argue that collaborative and communication competence constitute the core of the soft skills of a prospective STEM teacher, without which it is impossible to ensure the resilience, adaptability, and innovativeness of education during war. The combination of non-formal (team-based competitions) and formal (STEM modules, projects, reflective practices) educational formats creates an effective trajectory for developing these competences. The proposed model can serve as a basis for modernizing teacher education programs, designing in-service training schemes, and building partnerships between universities, schools, and organizers of STEM initiatives aimed at supporting the sustainable development of educational communities under challenging historical conditions.

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3.3. TEACHERS' MORAL AND ETHICAL RESPONSIBILITY IN WARTIME

Olena Semenikhina

The historical and pedagogical studies presented in the earlier chapters (including the analysis of Zhukov's work) clearly show that the figure of the teacher has always exceeded the boundaries of a purely professional role. Across different historical periods, the "good teacher" has been understood as someone who can serve as a moral reference point, preserve dignity in difficult political circumstances, and balance loyalty to state requirements with responsibility towards children and the local community. Teaching has been conceived not only as the transmission of subject knowledge and methodology, but also as a vocation that demands a stable value stance and a readiness to resist injustice, especially when it affects the most vulnerable.

The full-scale war has brought these dimensions back into sharp focus. Today, Ukrainian teachers operate in an environment where moral and ethical decisions must be made on a daily basis, often without clear or ready-made answers. This concerns not only codified norms of professional ethics, but also a deeper responsibility for how learners will understand the war, other people, and themselves. Here, an ethics of truth becomes central. Teachers work with children and young people immersed in a field of contradictory messages, propaganda, and traumatic experience. Concealing or oversimplifying complex issues may seem like a way to "protect" a child, but in the long run, it erodes trust. At the same time, an ethics of truth is not equivalent to emotionally overloading learners with shocking details. It requires honest, age-appropriate discussions of events, rejection of hate

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speech, and attentive engagement with both questions and periods of silence.

Closely linked to this is an ethics of mutual support. Historical sources indicate that, in times of crisis, teachers often played a crucial role in holding communities together, organizing not only lessons but also mutual aid, cultural activities, and shared rituals of mourning and remembrance. Today, teachers again stand at the intersection of multiple expectations – from learners, parents, administrators, and local communities. Their moral and ethical responsibility is expressed in the ability to support others without denying their own limits, to foster respectful relationships in the classroom, and to prevent the stigmatization of those whose wartime experiences are "different," who speak another language, or who have recently arrived from de-occupied areas or abroad. An ethics of mutual support implies rejecting competitive hierarchies of suffering and instead cultivating among learners a sense of shared responsibility for a safe and respectful classroom climate.

Working with children and adolescents affected by trauma adds yet another layer. Historical examples show that, after wars and repressions, schools received pupils returning from evacuation, camps, occupation, and bereavement. The current situation in Ukraine revisits these patterns in new forms. Teachers are not psychotherapists, yet they make ethical choices every day: how to respond to regressive behavior, sudden outbursts of aggression, or withdrawal; what can be tolerated in the classroom and what calls for an immediate response; and where to draw the line between pedagogical tolerance for "difficult" reactions and tolerance of violence. Here, moral and ethical positioning involves combining unconditional respect for the child's dignity with a clear refusal to accept humiliation, bullying, or the reproduction of discourses of hatred.

Academic integrity is another crucial aspect of teachers' moral responsibility in wartime. Historical experience suggests that, in periods of crisis, the temptation to "adjust" norms grows: cheating, purely nominal assessment, and manipulation of reporting may appear insignificant when set against questions of life and death. However, it is precisely in such times that attitudes to truth, fairness, and responsibility for one's work are formed.

When teachers routinely overlook systematic violations and justify this by referring to the war, they unintentionally convey the message that rules are valid only in "peaceful" times. Conversely, a consistent yet humane stance on plagiarism, cheating, and merely formal fulfilment of tasks nurtures in young people an understanding that even in crisis, there are boundaries that should not be crossed.

The bridge between historical-pedagogical conclusions and the current situation lies in recognizing the continuity of professional ethics. Political regimes, technologies, and lesson formats have changed, but society's expectation of a teacher who can be trusted remains. In the twentieth century, this often meant preserving humanity under the pressure of ideological and violent forces. In the twenty-first century, under conditions of full-scale war, new dimensions have been added – working in digital environments, countering disinformation, supporting mental health, and upholding ethical standards in blended and distance learning. Yet the core remains the same: attentiveness to vulnerable learners, honesty in relationships, refusal to substitute education with propaganda, and a willingness to be an adult who does not have all the answers but is prepared to seek them together with those they teach.

In this sense, teachers' moral and ethical responsibility in wartime is a sphere where historical memory and contemporary challenges reinforce one another. Historical research makes it clear that teacher ethics has never been neutral or secondary. Today, the extent to which teachers remain committed to an ethics of truth, mutual support, respect for the dignity of traumatized children, and academic integrity will shape not only the quality of education but also the emerging generation's understanding of justice, responsibility, and humanity in a society marked by war.

Chapter 4

INNOVATIVE PRACTICES IN WARTIME: FROM DIGITAL SOLUTIONS TO SUBJECT-SPECIFIC PEDAGOGIES

4.1. DIGITAL INFRASTRUCTURE AND FLEXIBLE LEARNING FORMATS UNDER CONDITIONS OF CONSTANT THREAT

Olena Semenikhina

The full-scale invasion has radically altered the role of digital infrastructure in education. What was recently viewed as a tool for modernization or as a way to make learning more flexible has, in many cases, become a condition for education to continue at all. Learning management systems, video-conferencing services, electronic grade books, cloud storage, and communication channels through messengers and social media now form the backbone of everyday educational practice. At the same time, this digital backbone operates under conditions of permanent threat, unstable electricity and connectivity, and large-scale displacement of both learners and educators. As a result, educational institutions are required not only to utilize technologies but also to develop strategies for resilient adaptation in response to them.

In wartime, digital infrastructure fulfils at least three interrelated functions. First, it provides basic access to learning for those who cannot attend school or university in person due to security risks, evacuation, loss of housing, or disrupted transportation. Second, it helps sustain a sense of community and reduces isolation: online courses, group chats, and shared virtual events allow learners and teachers to remain in a common information space. Third, digital solutions are instruments of organizational flexibility, enabling rapid shifts in format and timetable, as well as combinations of synchronous and asynchronous work, and adjustments to workload and assignment types in response to changing circumstances.

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Distance learning formats that spread during the COVID-19 pandemic have undergone a qualitative transformation in the reality of war. Previously, online courses were often perceived as a temporary necessity, with an implicit expectation of returning to face-to-face teaching. For many learners today, they represent the only stable channel of access to education. Surveys and observations related to the recovery of human potential suggest that for learners in border regions, in de-occupied territories, or abroad, distance courses provide a sense of continuity and ongoing connection to the Ukrainian educational space. For educators, this requires rethinking what a lesson, class, or consultation means: not only a vehicle for content delivery, but also a space for support, for setting realistic expectations, and for creating "islands of normality" in a disrupted daily routine.

Blended learning has taken on a particular form that can be described as "adaptive blended learning". It is not a neatly scripted combination of in-person and online sessions, but a constant readiness on the part of institutions and individual teachers to move between modes in response to the security situation. On days without prolonged power cuts or connection failures, in-person classes may be held, with the option of online participation available for those unable to attend in person. During periods of intensified shelling or frequent air raid alerts, the emphasis shifts to asynchronous work, with the learning platform serving as a space for instructions, tasks, and feedback. This model requires a clearly structured course design, transparent rules for deadlines and work formats, and carefully managed communication to minimize uncertainty for learners.

Unstable electricity supply and internet access are particularly critical issues. In many regions, the continuity of learning depends on blackout schedules, the availability of generators, and the strength of mobile internet. This forces schools and universities to develop flexible timetabling models. Common solutions include "windows of stability", where the most important synchronous sessions are scheduled for hours that are usually less affected by outages; duplicating learning materials in several formats (written instructions, lecture recordings, slide decks) that learners can download in advance; and replacing a strict requirement to attend all live online sessions with

asynchronous forums and messaging that allow for delayed participation.

Under these conditions, digital platforms become more than mere repositories for files. They function as instruments of resilience. They allow for flexible management of course access, support individual learning trajectories, facilitate additional consultations for those who missed classes due to safety reasons, and enable monitoring of progress not only through final grades but also through incremental steps. Importantly, digital tools make it easier to shift the focus from physical presence to achievable engagement, reducing feelings of guilt about missed sessions and framing participation in terms of tasks that can be completed within the available time windows. For educators, this opens possibilities to redesign assessment and support, including a move away from purely summative checks towards more flexible forms of formative assessment.

At the same time, digital infrastructure is not an uncomplicated good. It intensifies inequalities between regions, institutions, and individual learners. Where there is no realistic way to secure at least minimal internet access, distance education remains largely declarative. Some learners lack personal devices, a quiet space at home, or time free from domestic responsibilities and caregiving. For educators, digitalization brings additional workload: mastering new tools, adapting materials, and remaining "constantly reachable", all of which heighten the risk of burnout. Consequently, models of digital use must encompass not only technical but also organizational and psychosocial support.

Research on the restoration of human potential in education underlines that digital formats can either strengthen or undermine resilience. They contribute to resilience when combined with realistic expectations, coherent planning, flexibility in responding to learners' changing life circumstances, and openness to discussing difficulties. They undermine resilience when used to replicate traditional demands online without rethinking content, workload, or interaction patterns, turning platforms into instruments of formal compliance. In this sense, digital infrastructure under conditions of constant threat is less a purely technological issue and more a pedagogical challenge that requires revisiting aims, priorities, and quality criteria.

The prospects for post-war educational development will depend largely on how the experience of flexible digital formats is interpreted and integrated into institutional practice. There is a risk of either trying to "forget" distance and blended approaches as purely emergency measures or of idealizing them as a universal solution for modernization. Both extremes ignore the complexity of the accumulated experience. A more productive stance is to treat digital infrastructure as an integral part of a resilient education system, one that is capable of adapting to various types of disruptions while preserving its human dimension. This will require investment in technical resources, systematic preparation of educators, development of local support practices, and, equally importantly, decisions about workload, assessment, and institutional autonomy.

In sum, digital infrastructure and flexible learning formats under conditions of constant threat have become a central dimension of education's innovative response to war. They enable the maintenance of learning continuity, preservation of connections within dispersed communities, and the opening of new opportunities for differentiation and individualization. At the same time, they impose high demands on organizational culture, educators' professional resilience, and fair allocation of resources. How consciously these challenges are addressed will determine whether the digital experience of wartime becomes a foundation for a more flexible and humane education system or remains a set of fragmented solutions tied exclusively to a period of acute danger.

4.2. PECULIARITIES OF TEACHING MATHEMATICS IN CRISIS CONDITIONS (WORK EXPERIENCE OF A UKRAINIAN UNIVERSITY UNDER MARTIAL LAW)

Anzhela Rozumenko, Anatolii Rozumenko

***Abstract**. Teaching mathematics to students in higher education is a pressing issue in many countries worldwide. A low level of educational motivation and insufficient school preparation cause difficulties in studying mathematics at universities. The situation worsens sharply if crisis conditions are created in the country (pandemics, natural and ecological disasters, military operations). In such situations, students and teachers experience psychological stress, negative emotions, and feelings of anxiety. Ukraine has been at war, but its schools and universities continue to operate. The article describes my own experience of teaching mathematics at the Sumy National Agrarian University (Ukraine) under martial law. An analysis of the educational motivation of students at a higher school in crisis conditions is presented (based on the generalized results of a survey of 90 first-year students), and methods effective in increasing cognitive motivation are described. The article substantiates that the technologies of programmed learning, «flipped classroom,» and visualization of educational material in mathematics are effective in crisis conditions.*

***Keywords**: teaching mathematics; motivation; higher school; crisis conditions; programmed learning; flipped classroom; visualization tools.*

Introduction

Mathematical training of high school students is a significant issue in many countries worldwide. A low level of educational motivation and insufficient school preparation cause difficulties in studying mathematics at universities. The situation worsens sharply if crisis conditions take place in the country (pandemics, natural and ecological disasters, military operations). Students

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and teachers experience psychological stress, negative emotions, and feelings of anxiety in such conditions. Ukraine has been at war, but its schools and universities continue to operate. The article describes our own experience of teaching mathematics at the Sumy National Agrarian University (Ukraine) under martial law.

We analyzed our own experience in two directions: the state of motivation of higher school students in crisis conditions and the organization of mathematics education in universities under martial law.

To determine the level of cognitive motivation among students, a questionnaire was administered. Ninety students from various faculties who study mathematics participated in it. The article describes techniques that are effective for increasing students' cognitive motivation.

The article substantiates that in the conditions of martial law, the scheme of organizing the educational process, which includes three stages «practical lesson – lecture – practical lesson», is effective. It also confirms the effectiveness of the use of elements of the educational technology of the «flipped classroom» in the first stage of this scheme.

The experience of teaching mathematics at the university under martial law confirms the effectiveness of using elements of the educational technology of programmed learning in clarifying the content of the educational material, its structure, and sequence of study, as well as the effectiveness of using visualization tools at the stage of generalization and systematization of the educational material in mathematics.

All the described methodical techniques ensure a sufficient level of assimilation of the mathematics course by university students in crisis conditions and improve the quality of mathematical training of higher school students in normal life conditions.

At the current stage of society's development, schools and universities use various methodical systems of teaching mathematics, which are theoretically grounded and experimentally verified. A schoolteacher and a university teacher

can choose different forms and methods of teaching. Unfortunately, unexpected situations can arise and significantly alter one's usual life. This happened in 2019, when many countries found themselves in the conditions of the COVID-19 pandemic. An unexpected war began in our country on February 24, 2022, and continues to this day. Other countries suffer from natural and environmental disasters (earthquakes, hurricanes, floods, etc.). We call such conditions «crisis». Any country in the world can find itself in such conditions.

Crisis conditions require the state and society to answer the question:

Is it possible and necessary to continue the work of schools, colleges, universities, and other educational institutions?

How to organize the educational process?

What forms and methods of training can be implemented in such conditions?

What learning tools will be effective?

We describe the results of the analysis of our own experience of teaching mathematics for students at the Sumy National Agrarian University (Ukraine) in crisis conditions (martial law has been declared in the country) in the article.

The full-scale invasion of Ukraine began at the end of February 2022. The entire country is divided into different parts: occupied territories, territories in active hostilities, and territories that accept refugees. Our university is located in the Sumy region, which borders an aggressor country. Residential buildings and infrastructure objects are shelled, air strikes are often announced, during which it is necessary to interrupt classes and hide in shelters, and electricity and the Internet are cut off in many areas of the region. At the same time, the country is trying to live, and educational institutions continue to work.

As a result of the analysis of our own experience of work in such conditions, we made the following conclusions:

1. It is necessary to find all opportunities to continue the educational process, because this leads to the stabilization of the psychological state of mind of students and teachers

at the university, even in crisis conditions. Additional efforts by teachers are needed to support students' educational motivation and maintain a positive emotional mood.

2. The educational process is possible only in the form of distance learning (sometimes blended or hybrid learning).
3. In the process of distance learning of mathematics for university students, it is effective to use the elements of the «programmed learning» technology (in terms of content) and the elements of the «flipped classroom» technology (in terms of form).
4. The effectiveness of students' learning increases under the condition of mandatory generalization and systematization of educational material in mathematics with the use of visualization tools.

Research Results

General comments on the structure of the education system in Ukraine

For a better understanding of the article content, we will make a few remarks about the structure of the education system in Ukraine. The education system in Ukraine is multi-level, comprising primary, secondary, and higher education. Secondary school has two levels: basic and senior. High school students choose the profile according to which they continue their studies. Educational programs for classes within profiles differ in the number of hours for studying subjects. Mathematics is a compulsory subject. All (elementary, middle, and high school) students study mathematics.

University students have different mathematics curricula depending on the faculty in which they study. Most of the first-year students at the Sumy National Agrarian University study mathematics. All specialties of the university can be called «non-mathematical» because the mathematics program is small in scope, and it contains only those topics that are necessary for

professional activity or for mastering professional disciplines during further education.

The problem of the mathematical training of pupils and students

Modern society needs specialists with a high level of training. Ukraine, like other industrialized countries, has a technical infrastructure that requires constant maintenance, development, and updates. Insufficient personnel training can lead to a decline in production, the destruction of infrastructure, and a halt in civilizational development, resulting in numerous negative consequences for the Ukrainian people. Mathematics learning has a special place in the training of future specialists who ensure the economic viability. Recently, there has been a decline in the quality of mathematical training of specialists in various areas. The problem is important and relevant. Understanding the relevance of this problem at the state level led to the declaration of the academic year 2020-2021 as the Year of Mathematics Education in Ukraine (Presidential Decree, No. 31/2020). The issue of mathematical training for pupils and students is relevant for many countries worldwide. Scientists have observed a general trend of declining mathematical knowledge among pupils and students, as well as significant difficulties in studying mathematics courses (Petrillo, 2016; Lo, Hew, & Chen, 2017), which also impacts their personal educational motivation.

The problem of educational motivation of students and ways to increase it during the study of mathematics

Ukraine has been living in war conditions for more than a year, but schools and universities continue to work. Students' educational motivation, in particular the motivation to study mathematics, decreases in crisis conditions.

We have investigated the level of educational motivation of students at the Sumy National Agrarian University when studying mathematics under martial law.

We conducted a survey of students of various specialties studying mathematics for this purpose. Ninety full-time students, including 19 from the Faculty of Agricultural Technologies and Nature Management, 18 from the Faculty of Engineering and Technology, and 53 from the Faculty of Economics and Management, participated in the event.

Students answered the following questions:

1. Is mathematical knowledge mandatory for your future professional activity?

Options for answers:

a) Yes, knowledge of mathematics is important and mandatory

b) Yes, knowledge of mathematics is important, but not mandatory

c) No, knowledge of mathematics is not needed

d) Cannot choose

2. Do you have any difficulties while studying the mathematics course?

Options for answers:

a) Yes, mathematics is very complicated and not understandable

b) Yes, mathematics is complicated, but understandable

c) No, mathematics is easy and understandable

d) Cannot choose

3. What is the main reason for these difficulties?

Options for answers:

a) No difficulties, everything is fine

b) Lack of school mathematical preparation

c) Lack of time planned for the mathematical course

d) other reasons

Let us underline that we did not aim for statistical substantiation of the survey results.

The results of the survey are shown in diagrams 1, 2, and 3.

The first diagram illustrates the distribution of students based on their understanding of the need to study mathematics for future professional activities. As we can see, 87% of respondents consider mathematical knowledge to be important. However, most of them (52%) do not consider mathematics to be mandatory. In our opinion, this result suggests that future specialists anticipate that gaps in their mathematical training will not hinder their success in their profession.

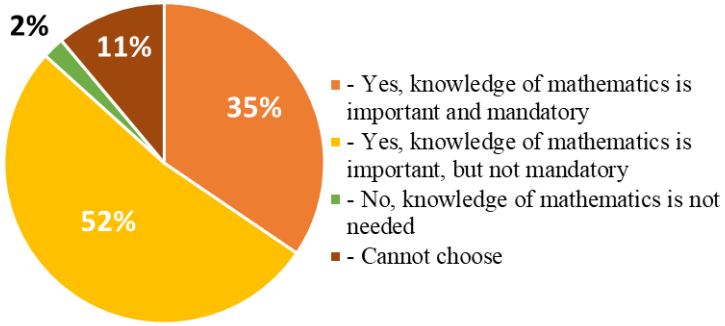


Diagram 1. **The need for mathematical knowledge for future occupations**

The second diagram illustrates students' self-assessment of the difficulties they encounter in studying the mathematics course. Most respondents (80%) believe that the higher mathematics course is difficult, but a bigger part of them (53%) understand the educational material. We were pleased with the results of the survey, which showed the presence of students (unfortunately, only 14%) for whom mathematics is easy and understandable. At the same time, it is surprising that some students are unable to choose a reply to this question. We attribute this to a lack of educational motivation, not only in relation to learning mathematics, but also in relation to learning in general (although it can be explained by other psychological reasons under martial law conditions).

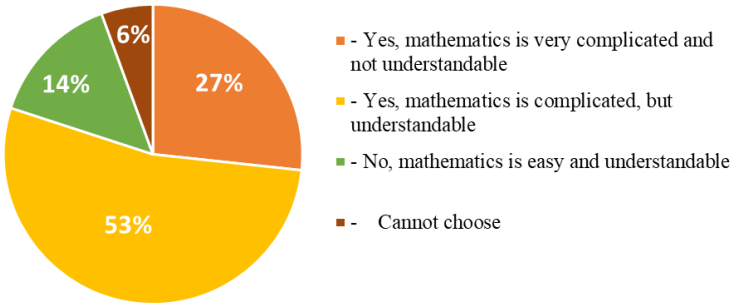


Diagram 2. **The presence of difficulties in studying a mathematics course at the university**

It is evident that studying the higher mathematics course is complicated by students' insufficient knowledge of fundamental concepts in elementary mathematics and their inability to solve typical tasks on various topics in school mathematics. This fact is confirmed by the results of our experimental research. As we can see on the third diagram, almost half of the respondents name gaps in school preparation as the reason for difficulties in studying a higher mathematics course. At the same time, a third of the respondents claim that «everything is fine», although only 14% of students consider mathematics easy and understandable. In our opinion, to explain such results, it is necessary to conduct additional conversations with students to clarify «other reasons», which prevent almost a fifth (21%) of respondents from qualitatively mastering the educational material in mathematics. Perhaps they do not consider low academic results to be a problem for themselves.

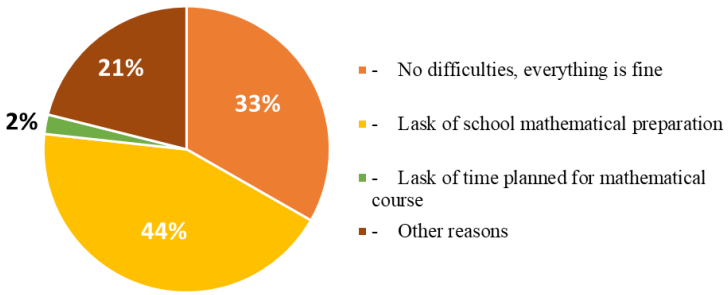


Diagram 3. **Reasons for difficulties in studying a mathematics course at the university**

Summarizing the above, we concluded that:

1. Most students of non-mathematical specialties understand the importance of mathematical training for future professional activities.
2. Mathematics is a rather difficult subject for many students.
3. One of the reasons for difficulties in studying mathematics at the university is the insufficient level of school preparation.
4. Many students have a low level of educational motivation.

In our opinion, the special efforts of university teachers in enhancing student motivation are necessary. A mathematics teacher can reveal the meaning of mathematics in various aspects. When teaching mathematics at Sumy National Agrarian University, we discussed the following aspects with students:

1. The need for mathematical knowledge in everyday life and housekeeping (the ability to calculate, estimate interest on loans, fuel calculations, etc.) for every person.

2. The great importance of mathematics for the development of a person's critical and logical thinking (Zacharopoulos, Sella, Kadosh, 2021).

3. Necessity of mathematical training for specialists of various professions. Industrialized countries rely on technical infrastructure (energy, transport, utilities). This requires engineers and technical personnel who can maintain and improve the vital activity of this infrastructure. Note that an effective technique for improving the motivation to study mathematics is to provide examples of the use of mathematical knowledge in future professional activities.

4. The great importance of mathematics for the defense capability of the state. The modern army requires appropriate technical equipment, a developed military-industrial complex, as well as specialists who can master new technical means. The development of digital technologies necessitates the training of high-level programmers. Therefore, the training of engineers, military personnel, and specialists in the information and digital

sphere is impossible without a solid mathematical foundation.

5. The importance of mathematics for further education and career growth. Mathematics operates with abstract concepts, structures that most people do not use directly in their professional activities. However, today the world is changing at an extremely fast pace. It is becoming increasingly difficult to learn a future profession (and it is even difficult to predict which professions will be in demand in the near future), and professional information is updated very quickly. It becomes impossible to have all the information. Therefore, a person who knows how to distinguish structural abstract elements, establish connections between them, and assess risks will be able to fill these elements with updated content and will be successful and capable in any profession for a long time! Such a person will be able to easily change their field of professional activity if necessary.

In the conditions of the war, we focus students' attention on the importance of mathematical knowledge for the defense capability of the country now and the restoration of the economy (especially the agricultural sector) after it. Our observations suggest that such conversations have a positive impact on students' emotional states, instilling confidence in their future and promoting a sufficient level of educational motivation.

Educational technologies that are effective in the crisis conditions of teaching mathematics

Our experience of teaching mathematical disciplines at the Sumy National Agrarian University under martial law convinces us that only distance (sometimes blended) learning can be implemented in crisis conditions. Let us explain this conclusion.

Some students from our university were evacuated to other cities in Ukraine, while others left for other countries. It is obvious that these students can only study remotely. The rest of the students stay in Sumy city or live in the suburbs, so they have the possibility to visit the university from time to time. We conducted classes remotely or in a blended format (some students were

present in the classroom, while others connected to the class online via Zoom at this time).

In the process of teaching mathematics to SNAU students, we were convinced of the possibility of implementation and the effectiveness of using the elements of «programmed learning» technology (in terms of content), «flipped classroom» technology (in terms of form), and visualization technology.

Use of elements of programmed learning technology

The concept of programmed learning originated a considerable time ago. Modern researchers associate it with the works of the famous American psychologist S. Pressey, who patented special machines for testing students' knowledge in the 20s of the 20th century. The author of the developments believed that the assimilation of knowledge occurs step by step; the transition to learning new material is possible only if correct answers are given to previous questions or the teacher corrects incorrect answers (Pressey, 1926, 1927). The idea of programmed learning received further development in the works of the American psychologist B. Skinner. The scientist claimed that it is important to constantly «reinforce» the student with positive evaluations, stimulation in the learning process, which means encouraging the student with the help of achieving certain success every day in the so-called «short term» (Skinner, 1954, 1957). Therefore, B.F. Skinner suggested dividing educational material into small portions, which should be learned gradually. The idea of programmed learning was developed into a coherent theory in the works of the scientist. This theory was further developed by various scientists, as well as by psychologists and teachers within the Soviet educational system (Kostiuk, 1964; Elkin, 1965; Rozenberh, 1965; Landa, 1967; Mashbyts, 1968; Krutko, 2010). The analysis of scientific studies on the substantiation of the theoretical foundations of programmed learning and its implementation in the schools' practice of this period allows us to draw a conclusion about the effectiveness of this form of education (Ianchenko, 2016).

At the current stage of the pedagogical science, development programmed learning is understood as a system of

theoretical provisions, organizational forms of means of educational work, which foresees mainly indirect program management of the cognitive activity of pupils (students) and specifies their independent assimilation of knowledge, abilities, skills, and mental development of the individual. The term «programming» in relation to the educational process means the creation of programs that manage the educational activities of pupils (students) while solving cognitive tasks. Such programs are called machine learning (learning algorithms).

Methodologists define the following features of training programs that are the basis of programmed training:

1) selection of educational material, its arrangement in a clear, logical sequence;

2) elimination of non-essential information, dividing the material into certain parts;

3) precise and specific instructions for dealing with the tasks that are necessary for learning each portion of the material;

4) tasks for self-assessment (internal feedback), as well as for teachers' control (external feedback) during the process of students' assimilation of knowledge, skills, and abilities;

5) controlled move from one portion of educational material to another, the next one.

In practice, we relied on the conclusion of scientists that the main, essential characteristics of programmed learning are the presentation of educational material in separate portions and constant two-way communication between the learner and the teacher.

The implementation of programmed training can take place according to the following scheme:

1) the teacher presents the first portion of the educational material, explains it, asks control questions; if the answers are correct, reports a new portion of the educational material;

2) students perceive the first portion of the material accordingly, learn the content, answer the questions, and move on to learning the next one;

3) after students have mastered the entire amount of material on this topic, the teacher asks questions that allow them to summarize and systematize the educational material.

Students can receive educational information directly from the teacher or use programmed manuals.

The material in such a manual can be presented in linear or branched systems.

According to the linear system of material presentation, it is assumed that educational information is divided into small, manageable portions that are easy to learn and comprehend. Each portion is designed to elicit the student's active response and contains hints or instructions that facilitate the search for the correct answer. Every answer should be checked by the student for its correctness. If the answer is incorrect, he continues to look for the correct one and then proceeds to another section of educational information. A linear program eliminates mistakes and brings satisfaction from success. All students learn the same educational material, but at varying paces.

In textbooks built based on a branched system of material presentation, information is also divided into portions. The difference between a branched system and a linear system is that it has several answers to each question, and after learning a portion of information, you need to choose the right answer. If the answer is correct, the student proceeds to learn the next portion of material; if it is incorrect, they also review the previously learned information. Such a textbook does not allow the students to progress further until they complete the task correctly. The focus is not on avoiding errors, but on clarifying and analyzing them (Fitsula, 2009).

The technology of programmed learning emerged a long time ago and is no longer within the scope of interest for modern textbook authors. We did not find special «programmed» mathematics textbooks. Therefore, we utilized our own developments in our work, which were built upon considering the principles of programmed learning. For example, students were offered structured lectures in which separate portions of the educational material were clearly identified.

The specific features of the educational process organization during military operations are the unplanned interruption of classes, dividing them into parts (the need to respond to an alarm signal, turning off the lights, etc.). The learning process becomes «discrete», often occurring in small intervals.

That is why features of programmed training like systematic selection of educational material, placing it in a clear logical sequence; elimination of non-essential information, division of material into certain parts; precise and specific instructions for performing the tasks necessary to learn each portion of the material; tasks for self- assessment, as well as for teacher's control; a controlled transition from one portion of educational material to another, the next one, allows to implement it in the distance form of education in the conditions of martial law.

We claim that the use of elements of programmed learning enhances the effectiveness of distance learning for mathematics students under martial law conditions.

Lectures and practical classes are traditional components of the mathematics learning process. We singled out the following methodological features of conducting a lecture session, taking into consideration the elements of programmed learning:

1. The topic and the main questions of the topic are clearly formulated.
2. Educational material is provided in small portions.
3. Tasks for learning each portion of the theoretical material are formulated (make an outline, write definitions, write down the formulation of theorems, make a corresponding drawing, make a general diagram, or fill in a table, etc.).
4. Students should send reports with the completed task to the teacher for verification (the deadline for submitting the reports is clearly determined by the teacher). No assessment is given after the task check.

We would like to note that the lecture content can be presented sequentially or with a certain branching structure. Learning the theoretical material should be supported by examples of tasks with complete solutions and comments.

During the practical lesson, tasks of various types related to the corresponding topic are planned to be solved. Students are offered tasks of different levels of difficulty (the student themselves chooses the level of task's difficulty) for self-completion. Students have the opportunity to solve problems using samples and comments. Solutions to tasks must be commented.

Use of technology elements in the «flipped classroom»

Today, scientists continue the discussion about the advantages and disadvantages of distance and blended learning, and the search for effective methods of distance learning of mathematics continues (Weurlander, Cohort, Filipsson, 2017; Hartikainen, Rintala, Pylväs, Nokelainen, 2019; Kotsopoulos, Weatherby, Woolford, 2022; Pereira, Gomes, 2022; Stanberry, Payne, 2023).

The technology of the «flipped classroom» is the most popular one. It can be interpreted as a «pedagogical model in which the typical elements of a lecture and homework are swapped. The flipped classroom approach relies on concepts such as active learning. The value of the flipped classroom is in changing the time of a lecture into time for a workshop where students can question lecture content, test their application skills, and interact during hands-on sessions». A large number of articles are devoted to the comparative analysis of the effectiveness of traditional and flipped learning in distance and blended learning in universities (Lo, Hew & Chen, 2017; Lo & Hew, 2020; Fernández-Martín et al., 2020; Fung, Besser & Poon, 2021; Fornons, Palau & Santiago, 2021; Al Mamun, Azad & Boyle, 2022; Sen, 2022). Most authors confirm the conclusion that the technology of the «flipped classroom» is more effective compared to the traditional one in terms of students' success, their social interaction, and educational motivation.

During the last academic year, when organizing mathematics education for students at the Sumy National Agrarian University, we utilized elements of the «flipped classroom» technology. We would like to note that this technology was

implemented not in a comprehensive scheme, but rather partially. Let us comment on this fact.

We believe that the number of hours allocated to the mathematics course at our university is insufficient. However, the course content is very informative. At the Sumy National Agrarian University, in accordance with the mathematics curriculum, students are traditionally introduced to the elements of linear algebra, vector algebra, analytical geometry, differential and integral calculus, probability theory, and mathematical statistics. The named topics contain a large amount of educational material.

According to the curriculum, based on the number of classroom hours, we plan one lecture and two practical classes for studying each topic in the mathematics course at the university. We use the following scheme to organize students' educational activities: a practical lesson, followed by a lecture, and then another practical lesson.

The mathematics course studied by students at our university is based on the school mathematics course and serves as its continuation. We conducted a comparative analysis of the content of the main topics in the mathematics course studied by university students and the content of the school mathematics course. As a result of the analysis, we found that the educational material of the university mathematics course contains approximately 30% to 50% of the basic concepts of school mathematics. We took this fact into account when organizing the educational activities of students, which consist of three main stages. Let us reveal the content of each stage.

First stage – practical lesson No. 1. At the first stage, the «flipped classroom» technology is implemented. The teacher acquaints the students with the topic and the main questions to be considered in advance of the first practical session. These questions correspond to the content of the school mathematics educational material. The teacher formulates tasks for students who independently process educational material based on school textbooks (tasks are sent to students via email) or other available sources of information.

The experience of teaching mathematics under martial law suggests that it is advisable to clearly formulate questions and

indicate the source from which answers should be found when students independently process the educational material of the school mathematics course.

In our work, we use the author's study guide (Rozumenko, 2014), in which the school mathematics course is systematized according to the main content line (appropriate educational material is sent to the student's e-mail together with the tasks, which are sufficient for completing the tasks).

In the first practical lesson, the educational material that the students have learned independently is discussed.

The second stage – a lecture. The teacher reviews the main concepts of the topic, which are already known to the students, and introduces new concepts, using the techniques of analogy and comparison during the lecture. He focuses attention on the interrelationships of the studied concepts, using methods of generalization and systematization of educational material.

The third stage – Practical Lesson No. 2. Students complete exercises of the main types and solve tasks to generalize and systematize the educational material on this topic, as proposed by the teacher in the second practical session.

Under normal conditions, before military operations on our country's territory, we offered students creative tasks that required a certain level of research skills. Students worked on group projects, the results of which were presented at the end of the topic study. The control papers had individual versions of the tasks.

In crisis conditions, according to our observations, most students lack (or have insufficient) motivation to perform such tasks. Therefore, to improve the quality of assimilating mathematical knowledge in crisis conditions, it is advisable to clearly formulate tasks, consider the main types of tasks, and provide examples of solving such tasks. We even offered one version of the test tasks, and after announcing the grades for performance to the students, we conducted a general analysis of errors, providing correct answers (it is impossible to perform such a general analysis by conducting individual tests).

The use of elements of visualization technology in the process of generalization and systematization of knowledge

A specific feature of mathematical concepts is a high level of abstraction. This fact is a cause of difficulties in learning mathematics for many students from various academic backgrounds. One effective means of teaching mathematics, which enables you to improve your understanding of mathematical concepts, is the visualization of educational material.

There are different approaches to the interpretation of the concept of «visualization». Researchers are examining various aspects of this process. For example, visualization as a means of exploring the world (Evagorou, Erduran, & Mäntylä, 2015); visualization as a learning tool (Macnab, Phillips, & Norris, 2012).

The importance of visualizing educational material in the mathematics learning process has been substantiated for a long time. The analysis of the use of visualization tools in learning and teaching mathematics (Bishop, 1989; Presmeg, 2006) showed that the relevance of this problem is increasing in recent years.

Research into the role of visualization in mathematics learning and teaching continues to be conducted. Scientists investigate the influence of visual representations of pupils and students on the ability to solve problems (van Garderen, 2006; Vale & Barbosa, 2023); the use of visualization techniques to increase the level of creativity of students (Cioca & Nerișanu, 2020); the role of visual images in the process of solving problems from the theory of probabilities (Zorzos & Avgerinos, 2023); the use of various visualization tools in the earning process (Buzan & Buzan B., 2019; Lavrenova, 2019). The new stage of visualization research in education is closely tied to the development of information, communication, and digital technologies (Souto, 2014; Ivanova, 2020; Koval & Besklinska, 2020; Semenikhina, 2020; Schoenherr & Schukajlow, 2023).

In our opinion, the use of specialized methods for visualizing educational material is effective at the stage of generalizing and systematizing knowledge. In the process of teaching mathematics in crisis conditions, we consider the stage of generalization and systematization of educational material to be mandatory.

The generalization of knowledge is considered a method of mental and educational activity in didactics. The didactic content of generalization refers to the selection of essential features, characteristics, formation, and formulation of concepts, laws, and ideas within the educational material.

The result of generalizing a certain level of knowledge is its systematization. That is why, usually in didactics, these two processes are connected and considered together. Generalization and systematization of knowledge are effective means of deepening, universalizing, organizing, understanding, and memorizing knowledge. Generalization of knowledge enables the development of problem-solving abilities by transferring the method of action to a whole class of similar problems, which is a primary objective of teaching mathematics.

Our own experience in teaching mathematics has shown that at the stage of generalization and systematization, two means of visualizing the educational material are the most effective:

1) tables, which are used to systematize the learning material of the topic (concepts, their properties, basic facts, formulas, and equations), the section, as well as the entire mathematics course;

2) schemes that help to make connections between concepts, demonstrate the sequence of studying different questions of each topic, and different topics of the entire mathematics course.

Table 1 below shows the system of basic concepts from the topic «Vectors».

Tasks of three levels can be proposed to the students:

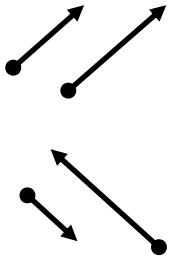
1) make a diagram and/or table on their own (with further discussion in a group or individually);
2) fill in the gaps in the diagram and/or table, if the basis is given (with further comment in the group);
3) comment on the scheme and/or table, which is given in the finished form.

Throughout the entire school year, we have been working under crisis conditions and ensured that the best results are

achieved when the basis of the tables and diagrams is provided by the teacher (in lectures or as a task for independent work).

Table 1.

«Vectors»

Basic concepts *Themes "Vectors"*	*Definition*	*Symbolic designation*	*Drawing*
Vector	Directed segment	$\vec{a}$; $\overrightarrow{AB}$	
Vector module	The length of the segment representing the vector	$\lvert\vec{a}\rvert$; $\lvert\overrightarrow{AB}\rvert$	
The null vector	A vector whose modulus is zero	$\vec{0}$; $\lvert\vec{0}\rvert$	
Collinear vectors	Vectors that lie on the same line or on parallel lines	Same direction $\vec{a} \uparrow\uparrow \vec{b}$ Opposite directions $\vec{a} \uparrow\downarrow \vec{b}$	
Equal vectors	Vectors that have the same direction and equal moduli	$\vec{a} \uparrow\uparrow \vec{b}$ $\lvert\vec{a}\rvert = \lvert\vec{b}\rvert$	

Figures 1 and 2 below show diagrams from the topic «Operations on vectors».

We believe that the basis of such visualization tools should be the same for all students, and the content and structure should be clearly defined and consistent. This contributes to students' awareness of the logical relationships between the main facts of the educational material, allowing them to avoid potential mistakes in the process of assimilation and systematization.

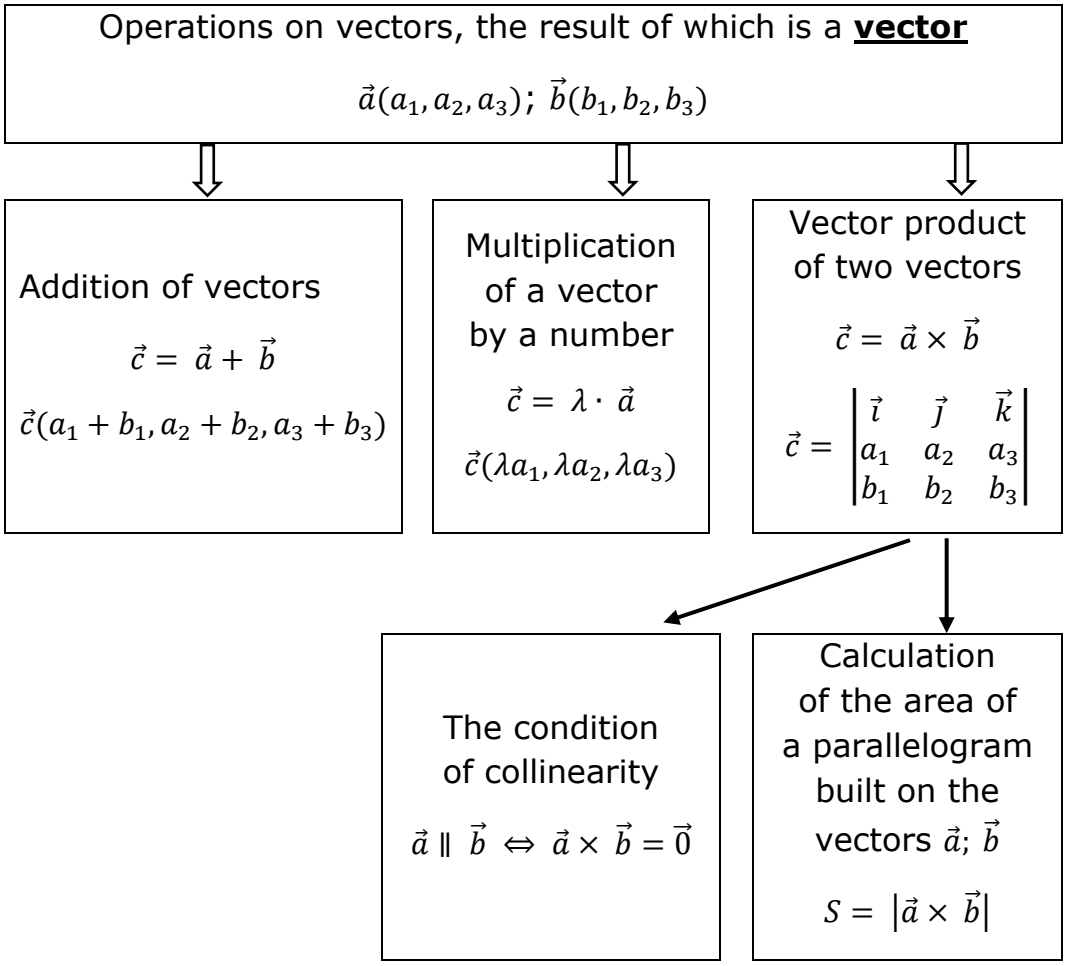


Figure 1. **Scheme 1 «Actions on vectors»**

Students are given the task to independently fill in the gaps, separate logical blocks, establish connections between concepts, and show them with arrows. During the practical lesson, a discussion takes place, and students comment on the completed tables and diagrams. The teacher then demonstrates his version of the tables and diagrams.

Students' independent processing of the means of sign-symbol visualization, along with their further discussion, contributes to their awareness of the main concepts of each topic, the logical connections between concepts, and the main content parts of the educational material.

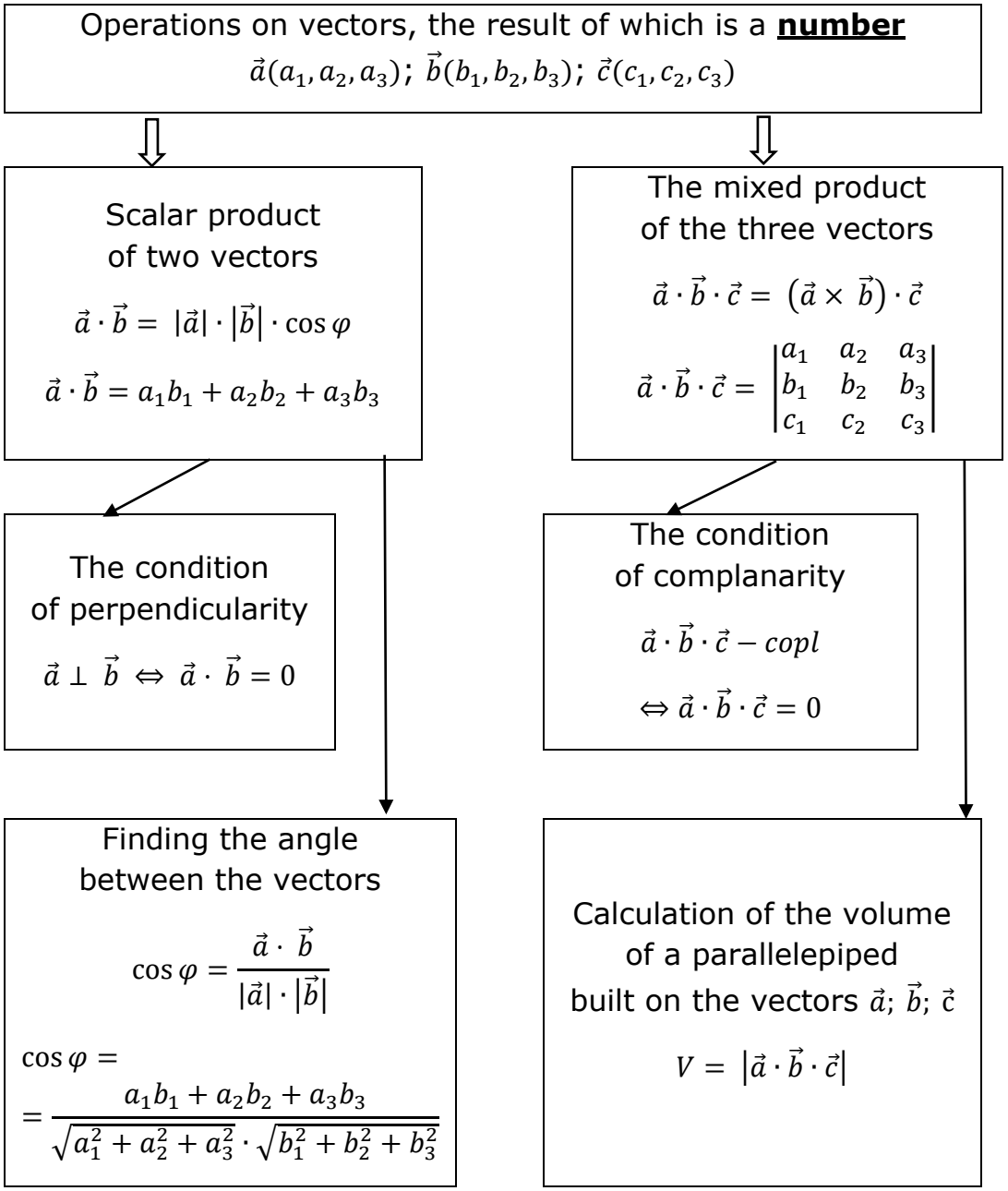


Figure 2. **Scheme 2 «Actions on vectors»**

In our opinion, students should not be required to clearly formulate definitions and properties, nor should they be expected to know formulas. We emphasize that the student should demonstrate the ability to apply a known fact to the solution of a certain type of problem (at the same time, students can use diagrams, tables, lecture notes, as well as notebooks for practical classes), doing control tasks.

Conclusions

The primary tasks of higher education are to develop students' scientific worldview, enhance their competencies, and foster a system of knowledge and skills that enable future specialists to perform their professional activities effectively and continue learning throughout their lives. That is why questions about what to teach and how to teach are always relevant.

Ukraine is a young and independent state. The education system in our country is aligned with European standards. Traditional methodical systems are being improved in universities, and the search for new ones, oriented towards the achievements of modern science, continues.

On February 24, 2022, the war began, and life changed dramatically. This terrible reality has changed the conditions of study, the educational motivation of pupils and students, and the working conditions of schoolteachers and university professors. We call such conditions a crisis. Countries suffering from natural or ecological disasters may also find themselves in crisis conditions. Our article highlights the problems that arise in universities operating under crisis conditions.

The experience of teaching mathematics at the Sumy National Agrarian University during martial law helped us to reach the following conclusions.

Educational motivation of students

The cognitive motivation of students sharply decreases in crisis conditions, and a feeling of anxiety appears, although the understanding of the need to continue studying remains. The teacher can increase learning motivation by discussing the importance of mathematical training for future professional activities and for further education.

Teachers of mathematical disciplines at universities in different countries note the low level of mathematical training of students, especially in non-mathematical specialties, who study in "normal" conditions. One of the reasons for this problem is a lack of motivation for learning mathematics. Therefore, the teacher's

special work is necessary, aimed at familiarizing students with the stages of development of various mathematical theories and the current state of mathematization in science and production.

Educational technologies

Studying mathematics can cause difficulties for many students, and this effect is exacerbated in crisis conditions. We discovered that programmed learning technology is effective in crisis situations. In accordance with the technology of programmed learning, the amount of educational material is clearly defined and, if possible, minimized. Basic concepts and facts are highlighted in each topic. The educational material is divided into distinct parts, which are arranged in a clear and logical sequence. Precise and specific instructions for completing tasks necessary for learning each portion of the material are formulated. The assimilation of each part of the educational material is monitored with the help of self-assessment questions and teacher checks.

Elements of programmed learning technology are effective not only in martial law or other crisis conditions. This technology enables the organization of independent learning for higher mathematics students in general or for individual course topics.

Learning takes place in a distance (partially blended) form in crisis conditions.

It is effective to use elements of the «flipped classroom» technology. For studying each topic in the mathematics course, we employed the following scheme: a practical lesson, a lecture, and a subsequent practical lesson. The educational material, which students review in accordance with school textbooks (questions for study are provided in advance), is reviewed during the first practical session. New concepts of the given topic are introduced after reviewing the known facts from the lecture, which are then worked out and systematized in the second practical session.

Elements of the “flipped classroom” technology, the effectiveness of which we tested in the process of teaching a higher mathematics course under martial law, can be used by teachers of various disciplines when teaching “cross-cutting”

topics or when implementing interdisciplinary connections in educational material.

To improve the quality of assimilation of mathematical knowledge in crisis conditions, it is advisable to clearly formulate tasks, consider tasks of the main types, and provide examples of solving such tasks.

In the process of teaching mathematics in crisis conditions, we consider the stage of generalization and systematization of educational material to be mandatory.

We believe it is possible to significantly enhance the effectiveness of training by utilizing specialized means of visualizing educational material during the stages of generalization and systematization of knowledge. Two means of visualizing educational material are the most effective for learning mathematics: tables, which help systematize learning material, and schemes, which help establish connections between concepts.

The value of the article for teachers and students studying mathematics in higher education

At the current stage of societal development, the issue of inadequate mathematical training for future education specialists is a pressing concern for many countries worldwide. We hope that our experience in teaching mathematics at Sumy National Agrarian University (Ukraine) will be of interest to all teachers and students studying mathematics in higher education. In the article, we highlighted the problems that may arise in any educational institution in crisis conditions. We have described methodical ways of solving them. These ways improve the quality of mathematical training of future specialists in various areas and can be implemented in crisis conditions (also in the usual, normal educational process).

We have become convinced that in any crisis conditions (even during the war), it is necessary to find opportunities for schools and universities to work! This has a positive impact on the emotional stability of students, university teachers, and society as a whole.

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4.3. COGNITIVE AND RESEARCH ACTIVITY IN PHYSICAL EDUCATION AND SPORT

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***Abstract**. The section examines cognitive and research activity in physical education and sport as an integral component of the professional development of higher education students. Cognitive and research engagement is interpreted as a holistic formation that combines motivational, cognitive, activity-based, and reflective dimensions, ensuring the transition from the reproductive performance of motor tasks to conscious, research-oriented analysis of one's own physical activity. The aim of the study is to substantiate pedagogical conditions and empirically test a model that fosters such engagement in compulsory physical education classes. Theoretical methods (analysis, synthesis, comparison, modelling) were used to clarify the conceptual framework and to construct a model that integrates research tasks into the structure of physical education. Empirical data were collected through questionnaires, testing, pedagogical observations, expert evaluations, and a pedagogical experiment involving control and experimental groups (comprising 100 students from a faculty of physical education and sport). The model involved the systematic inclusion of mini-research projects, problem-based tasks, and digital tools for monitoring motor activity during classwork. The dynamics of students' engagement were evaluated according to four criteria: motivational (interest in research and internal motivation), cognitive (knowledge of research methods and ability to apply them), activity-based (skills in planning and conducting experiments), and reflective (capacity for self-analysis and self-assessment). Statistical analysis of the results revealed a significant increase in the proportion of students with sufficient and high levels of cognitive and research engagement in the experimental group compared to the control group, as well as a decrease in the proportion of students with low levels. The introduction of research tasks and digital monitoring tools enhanced students' awareness of the value of physical activity, improved their research skills, and fostered a more developed reflective culture. The findings confirm the effectiveness of the proposed pedagogical model and suggest the potential for its broader implementation in physical education courses, sports and wellness programs, and the training of future specialists in physical culture and sport.*

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Keywords: *cognitive and research activity; physical education; sport; pedagogical conditions; motivation; cognitive engagement; reflection; research skills.*

Introduction

The current educational paradigm is grounded in a competence-based approach that presupposes not only the acquisition of knowledge but also the individual's ability to actively obtain knowledge, apply it in practice, conduct self-analysis, and pursue self-improvement. From this perspective, the development of cognitive and research activities among higher education students becomes particularly significant, especially in the field of physical education and sport, which encompasses intellectual, emotional, and motor forms of activity.

In the twenty-first century, physical culture is viewed not only as a means of maintaining health but also as a domain of scientific inquiry where research methods are used to optimize teaching and training. The development in students of the ability to analyze their own activity, observe, experiment, and draw conclusions supports the growth of critical thinking and a scientific worldview.

The problem of developing cognitive and research activity in physical education is highly relevant in the context of educational reform in Ukraine, particularly the transition to profile schooling and the integration of digital technologies into teaching. Research engagement of higher education students in physical education and sport fosters a more conscious attitude towards their own health, increases motivation to exercise, and supports professional self-development.

The aim of the study is to substantiate the theoretical and methodological foundations and to experimentally verify the effectiveness of pedagogical conditions for the development of cognitive and research engagement of higher education students in physical education.

Research Methods

To ensure a comprehensive examination of the problem of forming cognitive and research activity in physical education and sport, a system of interrelated methods was used that complement each other and ensure the validity of the findings.

1. Theoretical methods

Theoretical methods included analysis, synthesis, generalization, comparison, and modelling.

Analysis and synthesis of scholarly sources made it possible to clarify the essence of the concepts "cognitive activity", "research competence", and "cognitive and research engagement", and to identify the structure and components of research skills in higher education students.

The method of generalization was used to identify leading trends in the development of research activity in contemporary education.

At the stage of theoretical analysis, generalization facilitated the transition from disparate facts and statements presented in the literature to a comprehensive understanding of the structure and mechanisms underlying students' research activity. As a result, a conceptual model was constructed that integrates cognitive, operational-activity, and value–motivational components.

At the empirical stage, generalization enabled the combination of questionnaire results, pedagogical observations, testing, and expert assessments into a unified system of indicators. This allowed us to identify typical levels of formation of cognitive and research skills (low, medium, sufficient, and high) and to describe their qualitative characteristics.

At the final stage, generalization was employed to interpret the quantitative data and draw conclusions regarding the effectiveness of the proposed model. Comparing the results of different groups and types of activity led to the conclusion that there was a gradual increase in cognitive motivation, a higher level of analytical thinking, and the ability to conduct independent mini-studies.

The method of comparison was used at the theoretical level to juxtapose different approaches to defining the essence of "cognitive engagement", "research competence," and "students' research activity" in the works of Ukrainian and international authors. This made it possible to identify common conceptual features and differences in the way the mechanisms of research skills development are understood.

At the empirical level, comparison was used to assess the dynamics of change in the control and experimental groups during the pedagogical experiment. Comparing pre- and post-test results in the context of research-based teaching technologies allowed us to identify which pedagogical conditions exerted the strongest influence on the formation of an active researcher position in students.

The method of comparison thus served not only as an analytical tool, but also as a means of revealing effective pedagogical practices that foster analytical thinking, independence, reflection, and critical evaluation of one's own activity.

Modelling**.** In pedagogical research, modelling is viewed as a method of scientific inquiry that involves constructing a model – a simplified but structurally adequate system that reflects the essential relationships and connections of a real object. In this study, the object of modelling was the process of developing students' cognitive and research engagement, and the model was a pedagogical system integrating the aims, content, means, forms, methods, and outcomes of this process.

2. Empirical methods

The empirical methods included pedagogical observation, questionnaires, testing, interviews, a pedagogical experiment, and expert evaluation.

Pedagogical observations were conducted during an academic semester to record specific features of students' behavior, interest, and engagement during classes and research-related work.

Questionnaires and interviews were used to explore the motivational, cognitive, and reflective aspects of students'

attitudes toward research activities, their experiences of participation in scholarly events, project work, and writing course and qualification papers.

Testing was applied to diagnose the level of development of research skills (the ability to formulate a hypothesis, select research methods, analyze results, and draw conclusions).

The pedagogical experiment followed a quasi-experimental design with control and experimental groups. The experimental group was taught using a specially designed methodology that integrated research tasks into course content to develop cognitive and research skills.

Expert evaluation involved university teachers who assessed changes in students' independence, analytical thinking, and ability to work with scholarly information.

To ensure the validity and reliability of the results, repeated measurements and data triangulation were used. The robustness of the conclusions was supported by an adequate sample size (100 students of the Faculty of Sport and Physical Education) and the use of appropriate statistical procedures.

Research Results

Cognitive and research activity in physical education is an integrative phenomenon that combines elements of cognition, research, self-observation, and self-development. It is grounded in the logic of scientific inquiry, which involves the sequence: problem formulation, hypothesis generation, experiment, analysis of results, and conclusions. Applying this sequence in physical education promotes not only a deeper understanding of the regularities of motor activity but also the formation of research competencies that are essential for students' future professional development.

An analysis of recent studies and publications reveals that in pedagogical and sports science, cognitive and research activities are examined from psychological, methodological, and technological perspectives. In physical education, these ideas have been elaborated by Ukrainian scholars such as Proskurin and

Stadnichenko (2023), Holenkov (2024), and Medvedovska (2024), who emphasize the integration of cognitive and motor components of the educational process.

The problem of cognitive and research activity in physical culture is closely linked to the formation of competence. In particular, competence-based approaches treat research activity as a means of shaping key competences – cognitive, communicative, and health-preserving (Boiko, 2025; Momot et al., 2025).

Recent Ukrainian works view students' cognitive and research engagement as the core of the professional competence of a specialist in physical culture and sport, focusing on the ability to pose research questions, design measurements, and interpret data in the training process. Khomenko (2022) presents a systematic approach to "research competence" and its development in higher education, emphasizing the interconnection of motivational–value, cognitive, and activity-based elements.

A separate body of work addresses the digitalization of physical education, where the integration of mobile applications, fitness trackers, electronic observation logs, and data visualization enhances self-observation, feedback, and reflection, directly fueling students' research engagement. Review and teaching materials published in 2023–2024 summarize these approaches, presenting digital tools as methodological conditions for the transition from "passive exercise performance" to inquiry-based and analytical learning (Yudenko, 2024).

Other publications focus on motivational and reflective dimensions, as the formation of interest in physical education and the development of a reflective culture in the educational process are seen as prerequisites for stable, research-oriented behavior (Lazarenko & Balashov, 2021).

In the Ukrainian educational context, there has been a gradual expansion of research tasks in physical education classes, including keeping self-monitoring diaries, using fitness applications, participating in student research conferences, and developing individual learning projects focused on health monitoring. These methods bring together pedagogical, motivational, and research aspects of teaching.

Recent international studies by Tendinha and Alves (2023) and Kitching (2024) indicate that involving students in self-monitoring their physical activity using digital devices enhances analytical thinking, self-reflection, and motivation to exercise. According to the World Health Organization's Global Status Report on Physical Activity (2022), over 25% of adults do not meet the recommended levels of physical activity, which underscores the need for educational strategies that promote a more conscious approach to movement.

At the policy level, the reform of senior profile school (Reforma starshoi profilnoi shkoly, 2024) targets competence-based learning outcomes and individual educational trajectories, opening a "window of opportunity" for more extensive implementation of research practices in physical education at the school–university interface (continuity of content, integration of STEM/HEALTH components).

Taken together, the sources reviewed suggest the methodological expediency of combining theory with micro-research tasks during classes, the key role of digital technologies in collecting and analyzing learning data, the need for targeted development of motivational and reflective dimensions, and alignment with the competence logic of current educational reforms. This provides a sound scholarly basis for implementing pedagogical models to develop cognitive and research activity in physical education and sport.

Methodological Foundations

From a methodological standpoint, cognitive and research activity in physical education is based on the following approaches.

Activity approach. Learning is understood as active engagement aimed at independent discovery of knowledge. In physical education, this approach is realized through the observation of exercise performance, independent analysis of movement effectiveness, and the design of individualized training plans. Research tasks become a means of self-exploration, and the teacher serves as a facilitator of cognitive activity.

Competence-based approach. The goal of education is defined as the development of the ability to apply knowledge in practice. In physical education, this approach involves developing skills to analyze one's health status, assess physical indicators, and identify ways to improve them. Research activity becomes an instrument for developing self-assessment and self-control.

Learner-centered approach. Teaching is oriented toward the individual needs, abilities, and interests of the learner. In cognitive and research activities, this approach involves learners in selecting research topics, formulating individual goals and plans, and applying their own experiences to address pedagogical problems.

Information and digital approach. Under conditions of educational digitalization, the use of mobile applications, fitness trackers, and interactive platforms creates new opportunities for collecting and analyzing data on physical activity. This enables the organization of full-scale mini-studies, thereby increasing the objectivity and motivational value of the learning process.

An important methodological guideline is the systems approach, which treats research activity as an interconnected system of components:

- motivational (desire to explore, interest in one's own results);
- cognitive (knowledge of regularities of motor activity and methods of observation and analysis);
- operational (skills in planning experiments and recording results);
- reflective (ability to evaluate achievements, draw conclusions, and adjust one's activity).

The theoretical and methodological basis of cognitive and research activity in physical education thus integrates pedagogical, psychological, and information-based approaches, forming the foundation of a new learning culture – a culture of inquiry.

Psychological Factors and the Role of the Teacher

The development of cognitive engagement is a central goal of education, as it ensures readiness for independent learning and self-organization. In physical education, cognitive engagement has its own distinct characteristics, combining motor, emotional, and intellectual components.

Key psychological factors in the development of cognitive engagement in physical education include:

- Achievement motivation, which drives the desire for improvement, higher results, and exploring new ways of acting;
- Cognitive curiosity, expressed in the desire to understand how the body functions under physical load and to find effective training methods;
- Reflection, which allows students to recognize their own progress, identify mistakes, and rethink experience;
- Self-efficacy, the sense of confidence in one's abilities that drives cognitive and research engagement.

The role of the teacher or coach in organizing cognitive and research activity is pivotal. Rather than acting as a source of ready-made knowledge, the teacher becomes a research supervisor and consultant who helps learners formulate questions, plan experiments, and analyze results. This aligns with the facilitative paradigm of teaching, in which the focus shifts from transmitting knowledge to stimulating its independent construction and development.

An important task for the teacher is to cultivate motivational persistence, since research processes often require time, patience, and the ability to work with errors. Through support, positive reinforcement, and opportunities for choice, the teacher fosters a sense of success and confidence in learners' capacity for inquiry.

Forms and Methods of Cognitive and Research Activity

The study showed that cognitive and research activity in physical education can be implemented in a variety of forms, such as:

- Mini-studies during lessons – short practical tasks (measuring pulse, respiratory rate, recovery speed).
- Individual projects – analysis of one's own physical fitness and the creation of a personal training program with recorded results.
- Group research projects – comparing the effects of different training methods or dietary regimes.
- Interactive movement laboratories – using digital devices (smart bracelets, mobile apps) to collect data.
- Research clubs – extracurricular activities aimed at conducting experiments and participating in conferences.

These forms not only expand students' knowledge but also develop skills in analysis, generalization, and drawing scientific conclusions.

The methods used to organize cognitive and research activity included:

- Problem-question method. Students are presented with situations that require a solution (for example, "How can we optimize a warm-up to improve speed performance?").
- Hypothesis method. Students formulate a hypothesis, which they then test during practical sessions.
- Self-analysis method. Students compare actual results with their forecasts.
- Reflection method. Students analyze their own activity, emotional state, and difficulties.
- Project method. Work culminates in a report, poster, presentation, or mini-article.

The effectiveness of these methods is confirmed in practice: students who regularly complete research tasks show not only

improved physical indicators but also growth in analytical thinking, initiative, and responsibility.

Pedagogical Conditions for Developing Cognitive and Research Engagement

Effective development of students' cognitive and research engagement requires specific pedagogical conditions that ensure the coherence and continuity of the process. In this study, the following conditions were implemented: creating a motivational and informational environment, utilizing problem-based research methods, individualizing research tasks, and conducting reflective assessments of cognitive and research outcomes. Their interaction ensures steady growth in cognitive engagement, the development of research skills, and the formation of scientific thinking in physical education and sport.

Below, we outline the content and stages of these pedagogical conditions.

1. Creating a motivational and informational environment

This condition entails establishing a supportive educational and research space that combines information resources, digital technologies, and a system of motivational stimuli. The aim is to foster students' internal interest in scholarly inquiry and to involve them actively in research activities. Implementation includes organizing access to electronic databases, integrating modern educational technologies (LMS platforms, scholarly forums, virtual laboratories), and digital tools for self-monitoring (fitness trackers, online platforms) that strengthen interest in personal results, as well as creating success experiences that support intrinsic motivation for research creativity.

Such an environment allows students to:

- access up-to-date scholarly databases and online courses;
- participate in research seminars and student conferences;
- carry out practical studies using ICT;
- understand the significance of their contribution to sport-related research.

The result is increased cognitive engagement, the development of research initiative, and the formation of information and communication competence.

2. Using problem-based research methods

Problem-based research methods aim to develop critical thinking, the ability to formulate hypotheses, analyze results, and make generalizations. They are implemented through the design of problem situations, experimental tasks, case solutions, project-based studies, and research practicums. These methods foster cognitive independence, planning and organizational skills, and the ability to apply scientific methods in practice. The teacher formulates situations that require analysis, hypothesis generation, and testing, such as: "Which type of warm-up increases the effectiveness of the main exercises?" or "How does heart rate change after different rest intervals?"

The implementation of this condition involves:

- formulating learning and research problems that demand critical thinking;
- using case studies, project methods, heuristic tasks, and experimental methods;
- engaging students in observation and analysis of training and competitive processes;
- working with real physiological and biomechanical data.

This supports the development of analytical thinking, the capacity to formulate and experimentally test scientific hypotheses, and to draw well-founded conclusions.

3. Individualizing research tasks

Individualization means giving students the opportunity to independently determine the topic, purpose, and direction of their research, aligning with their interests, aptitudes, and professional goals. The teacher acts as a facilitator, supporting individual educational trajectories, providing methodological guidance, and monitoring and evaluating progress. Individual research tasks encourage independence, responsibility, and creativity, and

deepen the mastery of theoretical knowledge through its practical application.

In practice, this is implemented through:

- allowing students to formulate their own research problems;
- designing individual research plans;
- consulting with a supervising teacher;
- using diverse formats for presenting results (essay, research report, multimedia presentation, article, etc.).

Individualization helps reveal students' creative potential, increases personal responsibility for outcomes, and supports the development of intrinsic motivation for scholarly self-development.

4. Reflective assessment of cognitive and research outcomes

Reflective assessment is the final stage of research activity that ensures students' awareness of their progress, analysis of results, and strategies for improvement. This process includes self-assessment, peer assessment, group discussions of research outcomes, and presentations of individual work. Reflection is a necessary component of cognitive and research activities, as it supports self-control, critical thinking, and a value-based attitude toward scholarly work, enhances professional maturity, and enables not only the assessment of achievements but also the planning of further self-development.

Implementation mechanisms include:

- organizing reflective discussions after research tasks;
- creating a "researcher's portfolio" with interim and final results;
- self- and peer assessment of research projects;
- using criterion-based assessment systems (novelty, coherence, practical relevance, scholarly rigor).

Reflective assessment supports the development of self-control, fosters critical thinking, and promotes the consolidation of motivation for further scholarly inquiry.

The pedagogical conditions, their aims, core mechanisms, forms, and expected outcomes of students' cognitive and research development in physical education and sport are summarized in Table 1.

Table 1.

Pedagogical conditions for developing students' cognitive and research engagement in physical education and sport

Pedagogical condition	*Aim of implementation*	*Main mechanisms and forms of work*	*Expected outcomes*
Creating a motivational and informational environment	Fostering intrinsic motivation for research, developing an information culture	Creating a digital learning space; using educational platforms, e-libraries, research seminars, promoting student research	Higher cognitive engagement, development of research initiative
Using problem-based research methods	Developing research skills and scientific thinking	Problem-based learning, project method, experiment, case method, analysis of training data	Ability to formulate hypotheses, analyze results, and draw scientific conclusions
Individualizing research tasks	Developing students' independence and creative potential	Individual research topics, consultations, project trajectories, and personal reports	Higher personal responsibility, development of independence, and creativity
Reflective assessment of outcomes	Supporting students' awareness of achievements and prospects for growth	Self- and peer assessment, defense of research work, portfolios, and group discussion	Development of reflection and critical thinking, readiness for self-development

Criteria and Levels of Cognitive and Research Engagement

In the experimental work, students' cognitive and research engagement was assessed using four main criteria – motivational, cognitive, activity-based, and reflective. Each criterion was operationalized through indicators that clarify its content and enable the determination of the level of research engagement in physical education and sport.

Motivational criterion

The motivational criterion characterizes students' level of interest, their internal need for cognitive and research activity, and their attitudes towards scholarly inquiry in physical education and sport. It is manifested in:

- interest in participating in research events (conferences, projects, seminars);
- positive attitudes toward scholarly activity and awareness of its importance;
- initiative in completing learning and research tasks;
- striving to independently acquire new knowledge;
- stable motivation throughout the educational process.

Methods used:

- Questionnaire on motivational orientation (adapted from T. Ilyina) to identify leading motives (cognitive, professional, social);
- "Learning motivation" diagnostic method (A. Rean, V. Yakunina) to determine dominant motives of cognitive engagement;
- observation of students' activity during scholarly events;
- self-assessment of motivation using an author scale of research initiative (low, medium, high).

Interpretation: A high level is characterized by a stable interest in scholarly activity, initiative, and a positive emotional attitude toward research.

Cognitive criterion

The cognitive criterion reflects the level of scholarly knowledge and understanding of the theoretical foundations of research activity, including pedagogy, psychology, methodology of physical education, biomechanics, and sport physiology. It is manifested in:

- knowledge of the basics of the scientific method, research logic, and conceptual apparatus;
- skills in identifying problems, formulating hypotheses, and choosing research methods;
- ability to analyze, compare, and generalize information;
- integration of knowledge from other disciplines into research projects.

Methods used:

- testing of theoretical preparedness (questions on research methodology, pedagogy, physiology, biomechanics);
- expert evaluation of knowledge (by department staff);
- analysis of completed learning and research assignments (reports, essays, presentations);
- content analysis of written work to assess depth of argumentation and coherence.

Interpretation: a high level presupposes systematic knowledge, the ability to analyze, generalize, draw conclusions, and apply them to research situations.

Activity-based criterion

The activity-based criterion reflects students' practical ability to conduct research, from planning an experiment to presenting results. It is manifested in:

- ability to plan research (aim, objectives, stages, methods);
- capacity to organize and conduct an experiment in physical education;
- adherence to requirements for data collection, systematization, and processing;

- ability to interpret findings, draw conclusions, and substantiate one's position.

Methods used:

- analysis of individual and group research projects (coherence, scholarly justification, practical value);
- observation of experimental task performance (adherence to protocol, accuracy, consistency);
- teacher observation sheets to record planning, organization, and data-processing skills;
- pedagogical modelling to assess the application of knowledge in simulated teaching or training situations.

Interpretation: A high level means that a student can independently plan, conduct research, and present findings in a well-argued manner.

Reflective criterion

The reflective criterion characterizes students' ability to engage in self-analysis, evaluate their own activities, identify strengths and weaknesses, and define pathways for professional and scholarly growth. It is manifested in:

- ability to analyze one's achievements and mistakes in the research process;
- capacity to relate outcomes to intended goals;
- readiness for self-correction and improvement of one's approaches;
- participation in collective discussions of results and openness to critique;
- having plans for further development in the research sphere.

Methods used:

- "Reflexivity level" diagnostic method (A. Karpov) to assess awareness and depth of self-analysis;
- questionnaire "Self-assessment of research competence" (author modification);

- analysis of student portfolios (diaries, reports, essays) to determine the level of independence in planning and analyzing results;
- reflective interviews after the completion of learning and research projects to assess the capacity to identify future development directions.

Interpretation: A high level is characterized by conscious self-assessment, readiness to analyze mistakes, and a commitment to continuous improvement.

As universal methods applied across all criteria and indicators of research competence in physical education and sport, the study used:

- the expert evaluation method, involving teachers and coaches in assessing competence levels;
- a rating-based self-assessment method, where students evaluated their own achievements on a five-point scale.

Table 2 summarizes the criteria and indicators of students' cognitive and research engagement in physical education and sport.

Table 2

Criteria and indicators of students' cognitive and research engagement in physical education and sport

Criterion	*Description*	*Indicators*
Motivational	Level of interest, initiative, and independence in research	Interest in research; initiative; positive attitude toward science; striving for self-development
Cognitive	Depth of knowledge and ability to apply theory in practice	Knowledge of methodology; understanding of regularities; ability to formulate hypotheses; systemic thinking
Activity-based	Practical implementation of research activity	Planning experiments; organizing observation; data analysis; preparing conclusions
Reflective	Self-analysis, evaluation of results, and improvement	Self-assessment; analysis of mistakes; readiness for correction; planning further development

To determine the level of cognitive and research engagement, four levels were distinguished: low, medium, sufficient, and high.

Level Characteristics

1. High level

General profile. Students with a high level demonstrate stable cognitive motivation, a pronounced orientation toward scholarly inquiry, and self-development. They recognize the importance of research for professional growth and show initiative, perseverance, and creativity in solving problem tasks.

By criteria:

- Motivational: well-formed intrinsic motivation for cognitive and research activity; a need for scholarly self-expression; positive emotional attitude to research; high initiative.
- Cognitive: deep, systematic knowledge of research methodology and theory; ability to independently select methods and analyze scholarly sources; creative approaches to solving cognitive problems.
- Activity-based: ability to independently plan and conduct research, correctly process results, and draw well-grounded conclusions; active participation in scholarly events.
- Reflective: well-developed capacity for self-assessment; in-depth analysis of one's activity; ability to identify avenues for improvement; presence of a personal research style.

Behavioral indicators: participation in student conferences, preparation of scholarly publications, initiation of research projects, and leadership in group studies.

2. Sufficient level

General profile. These students have a positive attitude toward research, possess basic scholarly knowledge and skills, and require methodological support from the teacher. They are capable of carrying out research tasks with partial assistance.

By criteria:

- Motivational: cognitive interest and a desire for self-realization prevail, though motivation often has an external character (grades, recognition).
- Cognitive: knowledge is fairly complete but not always systematic; students can use research methods under the teacher's guidance; moderate independence in interpreting data.
- Activity-based: they carry out research tasks following a model or instructions; they comply with protocols but do not always analyze results in depth; they possess skills in preparing reports and presentations.
- Reflective: they are able to evaluate their own activity, although reflection is mainly descriptive; they need prompts to identify directions for self-improvement.

Behavioral indicators: participation in research clubs, joint presentations, interest in experimental work.

3. Medium level

General profile. Students at the medium level possess some elements of research skills, but their engagement is situational. Motivation is mostly external, and cognitive activity is episodic.

By criteria:

- Motivational: interest in research is unstable; activity manifests itself only in the presence of external stimuli; there is a degree of indifference to scholarly innovation.
- Cognitive: knowledge is fragmented; limited understanding of research methods; difficulties in analyzing and systematizing information.
- Activity-based: research tasks are completed formally; students reproduce ready-made patterns; inaccuracies occur in planning and analyzing experiments.
- Reflective: self-assessment is insufficiently critical; limited ability to draw conclusions about personal progress; low level of self-correction.

Behavioral indicators: participation in research only at the teacher's insistence, avoidance of extra work, and lack of initiative.

4. Low level

General profile. This level is characterized by the absence of conscious motivation for research, low levels of knowledge and skills, and a passive approach to learning.

By criteria:

- Motivational: indifference to cognitive activity; lack of internal need for research; exclusively external motivation (grades, pressure).
- Cognitive: superficial and often unsystematic knowledge; no understanding of the research process; inability to use basic analytical methods.
- Activity-based: students are unable to independently complete research tasks; they do not follow methodological requirements; results are random.
- Reflective: absence of self-assessment; students do not recognize their mistakes and do not strive for self-improvement.

Behavioral indicators include a lack of interest in scholarly events, failure to complete additional tasks, and passive and formal attitudes toward learning.

Table 3 summarizes the levels of cognitive and research engagement according to the defined criteria.

Table 3

Levels of students' cognitive and research engagement

Level	*Motivational criterion*	*Cognitive criterion*	*Activity-based criterion*	*Reflective criterion*
High	Intrinsic motivation, strong interest	Deep knowledge, independence	Independent research	Developed reflection, adequate self-assessment

Level	*Motivational criterion*	*Cognitive criterion*	*Activity-based criterion*	*Reflective criterion*
Sufficient	Cognitive interest, partial independence	Fair but not fully systematic knowledge	Task performance by instruction	Descriptive self-assessment, awareness of errors
Medium	Unstable interest	Fragmented knowledge	Formal task performance	Superficial self-assessment
Low	External motivation only	Superficial knowledge	Lack of skills	Lack of self-assessment

Organisation and Course of the Pedagogical Study

To verify the effectiveness of the pedagogical conditions for developing cognitive and research engagement in physical education and sport, a pedagogical experiment was conducted.

The objectives were to:

1. Diagnose baseline levels of cognitive and research engagement using the motivational, cognitive, activity-based, and reflective criteria.
2. Implement in practice a pedagogical model that incorporates a specially designed set of forms, methods, tools, and pedagogical conditions for developing cognitive and research engagement in physical education and sport.
3. Carry out a comparative analysis of the dynamics of indicators in the control and experimental groups.

The hypothesis assumed that integrating elements of research activity (mini-projects, experimental observations, reflective analysis, digital self-monitoring tools, etc.) into the classroom structure would increase students' cognitive and research engagement.

The experiment employed a quasi-experimental design, comparing two groups of students: an experimental group (EG)

and a control group (CG). Participants were assigned to academic groups to ensure the equivalence of initial indicators.

The study lasted one academic semester (10–12 weeks) and included three stages:

- Diagnostic stage, determining baseline levels of cognitive and research engagement;
- Formative stage, introducing the model of research skill formation into physical education;
- Control stage, summative assessment of changes and their statistical analysis.

Participants were first- and second-year higher education students (aged 18–20) who attended compulsory physical education classes and extracurricular sport sessions. The total sample consisted of 100 participants, with 50 in each group. All students provided informed consent in line with ethical requirements for pedagogical experiments.

At the diagnostic stage, baseline levels of cognitive and research engagement were assessed using four criteria:

- motivational (interest, awareness of research significance, initiative);
- cognitive (knowledge of methods of inquiry in physical education and ability to apply them);
- activity-based (capacity to plan, organize, and conduct micro-studies);
- reflective (ability to analyze results, draw conclusions, and assess one's own activity).

Data collection involved questionnaires, test tasks, observation of learning activities, and students' self-assessment using specific scales. Initial diagnostics revealed no statistically significant differences between the groups.

Formative Intervention

At the formative stage, the experimental group's learning process incorporated a model of cognitive and research

development based on systems thinking, integration of theory and practice, an active student role, and reflective self-development.

Throughout the experiment, the following pedagogical modules were integrated into classes:

- *"Question–Hypothesis"* – familiarizing students with the logic of scientific inquiry, formulating research questions and hypotheses;
- *"Data Collection"* – developing skills in measuring and recording physical indicators and using digital monitoring tools;
- *"Analysis and Interpretation"* – processing collected data, constructing tables and graphs, and formulating conclusions;
- *"Communication and Reflection"* – presenting results as mini-reports or posters, conducting self-assessment, and identifying directions for improvement.

Each module combined elements of classroom experiments, independent analytical work, and group discussion. The control group had classes in a traditional format without explicit research components.

The final control stage consisted of repeated diagnostics based on the same criteria as at the beginning of the experiment, a questionnaire assessing students' attitudes toward the new learning model, and a qualitative analysis of reflective reports.

Statistical Processing

Quantitative data were analyzed using descriptive statistics, the Student t-test for independent samples, the paired t-test for within-group changes, and the effect size coefficient (Cohen's d). For data that did not meet the normality assumption, the Mann–Whitney test was applied. Statistical significance was set at $p < .05$.

To minimize the influence of external factors, identical conditions were maintained for all classes (schedule, venue, instructors). To reduce subjectivity, a "blind" assessment of results by external experts was used. Participant selection

followed uniform criteria, and adherence to procedures was monitored using checklists.

It was expected that implementing the model would increase:

- levels of intrinsic motivation for cognitive and research activity;
- the ability to independently plan and conduct learning-oriented research;
- the depth of reflective analysis of personal results;
- awareness of the connection between theoretical knowledge and practical aspects of physical improvement.

Baseline and Post-test Results

At the initial stage, both groups showed practically identical levels of cognitive engagement, confirming their comparability. Generalized results are presented in Table 4.

Table 4

Levels of cognitive and research engagement at the beginning of the experiment

Engagement level	*CG (start)*	*EG (start)*
Low	14%	20%
Medium	40%	40%
Sufficient	33%	30%
High	13%	10%

After implementing the experimental methodology, the results changed.

Changes in the Motivational Criterion

The motivational criterion characterizes the level of internal and external motivation for cognitive and research activity, students' initiative, interest in independent knowledge seeking, and aspiration for self-realization in physical education and sport.

Assessment indicators included:

- cognitive interest (interest in inquiry and experimental tasks);
- intrinsic motivation (awareness of research importance for personal development);
- independence and initiative in choosing topics and tasks;
- positive emotional attitude toward the research component of classes.

Each indicator was assessed on four levels: low (0–25 points), medium (26–50 points), sufficient (51–75 points), and high (76–100 points).

The comparative dynamics of motivational levels in the CG and EG are presented in Table 5.

Table 5

Distribution of students by motivational levels before and after the experiment (%)

Motivational level	*EG (before)*	*EG (after)*	*CG (before)*	*CG (after)*
High	10.0	43.0	13.0	16.0
Sufficient	30.0	44.0	33.0	36.0
Medium	40.0	10.0	40.0	36.0
Low	20.0	3.0	14.0	12.0

The data show pronounced positive changes in the experimental group. In particular:

- the proportion of students with a high level of motivation increased from 10.0% to 43.0% (a 33.0% increase);
- the number of students with a sufficient level rose by 14.0%;
- only 3% remained at a low motivational level.

In the control group, dynamics were less marked: a slight rise in the sufficient level (by 3.0%) and a marginal decrease in the low level (by 2.0%) were observed.

The Student t-test yielded a t-value of 3.36 ($p < .01$), confirming significant differences between the EG and CG after the formative phase. The results indicate that the pedagogical conditions embedded in the model effectively boosted students' motivation for inquiry and independent learning.

Changes in the Cognitive Criterion

The cognitive criterion reflects the level of knowledge required for cognitive and research activities in physical education and sport, as well as students' ability to apply this knowledge in practice. The main indicators were:

- volume and systemic nature of theoretical knowledge about methods of investigating physical phenomena and processes;
- understanding of the essence of experiments and the structure of the research process;
- analytical thinking and ability to generalize results;
- ability to transfer knowledge to new learning and practical situations.

Assessment used four levels: high (76–100 points), sufficient (51–75 points), medium (26–50 points), and low (0–25 points). The dynamics are presented in Table 6.

Table 6

Distribution of students by cognitive levels before and after the experiment (%)

Cognitive level	*EG (before)*	*EG (after)*	*CG (before)*	*CG (after)*
High	7.0	36.0	6.0	10.0
Sufficient	33.0	46.0	39.0	40.0
Medium	44.0	16.0	40.0	40.0
Low	16.0	2.0	15.0	10.0

There was a substantial increase in the cognitive component of engagement in the experimental group. The proportion of students with a high level rose from 7.0% to 36.0%, while the proportion of students with a low level decreased to 2%. The

number of students with a sufficient level increased by 13.0%, indicating a qualitative enrichment of students' cognitive potential.

In the control group, positive dynamics were minor, with an increase in the high level of only 4.0% and essentially stable medium values.

The Student t-test ($t = 3.0$, $p < .01$) indicated statistically significant differences between EG and CG after the formative intervention.

The growth in cognitive readiness in the experimental group can be explained by:

- systematic integration of theoretical knowledge with practical research;
- the use of problem-based and inquiry methods;
- organization of mini-experiments and micro-projects that deepened understanding of theoretical principles;
- active use of digital analysis tools (heart-rate monitors, mobile apps, electronic logs).

Thus, students developed a holistic understanding of the research logic, improved planning and systematization skills, and enhanced their overall cognitive performance.

Changes in the Activity-based Criterion

The activity-based criterion captures the level of practical skills for organizing, planning, implementing, and analyzing cognitive and research tasks in physical education and sport. Indicators included:

- ability to plan the course of an experiment (aim, objectives, hypothesis, variables);
- skills in measuring, observing, and recording results;
- ability to analyze data and summarize results as conclusions;
- adherence to scholarly rigor and safety requirements during research tasks.

The four-level scale (high, sufficient, medium, low) was used again. Dynamics are presented in Table 7.

Table 7

Distribution of students by activity-based levels before and after the experiment (%)

Activity level	*EG (before)*	*EG (after)*	*CG (before)*	*CG (after)*
High	6.0	33.0	10.0	13.0
Sufficient	30.0	45.0	37.0	37.0
Medium	44.0	20.0	40.0	40.0
Low	20.0	2.0	13.0	10.0

The comparative analysis reveals significant growth in the activity-based component within the experimental group. The share of students at a high level rose from 6.0% to 33.0%, and the low level dropped to 2%. The proportion with a sufficient level increased by 15.0%, indicating the formation of stable practical skills for organizing research, planning experiments, and interpreting results.

In the control group, changes were insignificant, with a minor increase in the high level (3.0%) and essentially unchanged medium and sufficient levels.

Statistical analysis confirmed significant differences between EG and CG after the formative phase ($t = 2.25$, $p < .05$).

Positive changes in the experimental group resulted from:

- practically oriented research tasks (measurement of heart rate, speed–strength indicators, evaluation of training regimes);
- mini-projects involving independent data collection and analysis;
- small-group work that required interaction, role distribution, and joint result interpretation;
- the use of digital technologies for recording and visualizing results (electronic logs, monitoring apps).

This contributed to the development of independence, responsibility, accuracy, analytical capacity, and creativity in solving movement and learning tasks.

Changes in the Reflective Criterion

The reflective criterion characterizes students' ability to evaluate their own cognitive and research activities, recognize achievements and difficulties, and identify pathways for further self-improvement. Its main indicators were:

- awareness of one's learning achievements and problems;
- ability to analyze results and relate them to set goals;
- ability to plan further self-improvement;
- level of critical thinking and self-analysis.

The same four-level scale was used. Dynamics are shown in Table 8.

Table 8

Distribution of students by reflective levels before and after the experiment (%)

Reflective level	*EG (before)*	*EG (after)*	*CG (before)*	*CG (after)*
High	5.0	33.0	10.0	13.0
Sufficient	26.0	50.0	30.0	31.0
Medium	46.0	16.0	43.0	40.0
Low	23.0	5.0	18.0	16.0

These results demonstrate pronounced positive dynamics in reflective skills in the experimental group. In particular:

- the proportion of students with a high level of reflection increased from 5.0% to 33.0% (a 28.0% rise);
- the share at the sufficient level nearly doubled (from 26.0% to 50.0%);
- only 5% remained at a low level (a decrease of 18%).

In the control group, changes were minor and statistically insignificant.

The Student t-test ($t = 3.36$, $p < .01$) revealed significant differences between the experimental group and the control group.

The increased reflective level in the experimental group can be attributed to:

- the use of reflective essays, research diaries, and self-assessment questionnaires;
- group discussions of micro-project results, which stimulated peer assessment;
- the introduction of evaluation rubrics that included self-analysis criteria;
- final reflective sessions after each module (oral or written).

These strategies helped students develop critical awareness of their own activity, identify reasons for success and failure, and outline personal development paths.

The reflective criterion is integrative, combining motivational, cognitive, and activity-based aspects and enabling conscious self-regulation of learning and self-development.

Overall Dynamics of Cognitive and Research Engagement

To determine the overall effectiveness of the model, results for all four criteria were summarized. The combined dynamics in the experimental and control groups after the formative phase are presented in Table 9.

Table 9

Levels of cognitive and research engagement at the end of the experiment

Engagement level	*CG (end)*	*EG (end)*
Low	12%	3%
Medium	39%	15%
Sufficient	36%	46%
High	13%	36%

The experiment demonstrated a significant increase in cognitive and research engagement among students in the experimental group. The proportion of highly engaged students rose from 10% to 36%, while those at a low level decreased from 20% to 3%. This confirms the effectiveness of integrating cognitive and research methods into the teaching and training process. In the control group, changes in engagement were statistically insignificant.

The results are also illustrated in a diagram showing the distribution of engagement levels in both groups after the experiment (Figure 1).

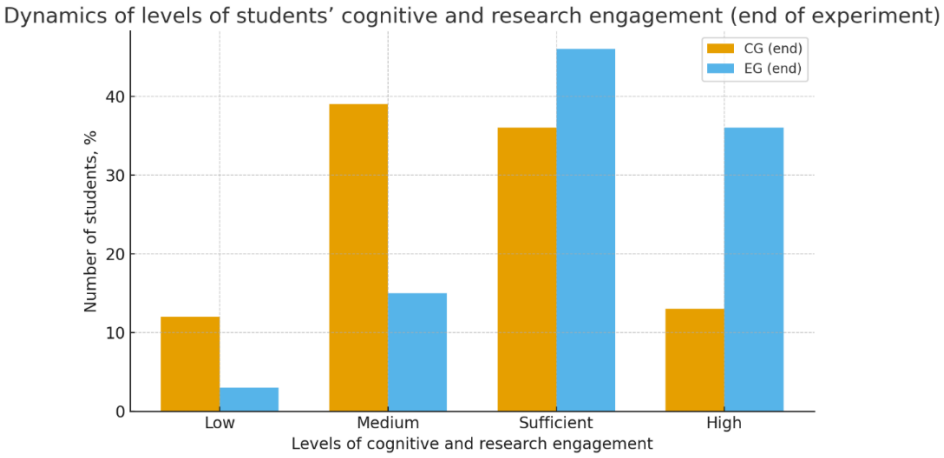

Figure 1. **Dynamics of cognitive engagement in control and experimental groups after the experiment**

The data are consistent with previous research (Jansson, 2022; Tacla & Ofrin, 2023; Sorensen, 2024), which indicates that students' active participation in research enhances motivation for physical education, supports self-control, and develops analytical skills. The use of digital technologies in teaching also had a positive effect on students' cognitive and research engagement. Incorporating research elements into physical education thus improves not only knowledge and skills but also strengthens students' active role as researchers of their own development.

Conclusions

The study enables the drawing of several theoretical and practical conclusions regarding the essence, significance, and effectiveness of cognitive and research activities in physical education and sport.

Cognitive and research activities in physical education are an important pedagogical tool aimed at developing intellectual engagement, independence, and reflection. It integrates the motor, emotional, and cognitive dimensions of personality, thereby supporting harmonious development.

The theoretical and methodological foundations of cognitive and research activities rest on activity-based, competence-based, learner-centered, and information–digital approaches. These approaches ensure the integrity of the process in which the student becomes an active subject of learning and research.

The pedagogical conditions for activating cognitive engagement include creating a motivational environment, supporting independence, using problem-based research methods, and developing reflective skills. The teacher plays a key role as a facilitator of inquiry.

The pedagogical model of research activity is realized through interactive technologies, digital monitoring tools, group and individual projects, and an assessment system that takes into account not only outcomes but also processes of inquiry.

Empirical results from the experiment confirmed the effectiveness of the methodology, as the level of cognitive and research engagement in the experimental group increased by approximately 20%, demonstrating the positive impact of research methods on motivation, analytical thinking, and self-organization in physical education.

The practical significance of the study lies in the possibility of applying the proposed approaches in physical education courses, sport and wellness activities, research clubs, and in the training of future physical education teachers. The findings underscore the need for a systematic shift from a reproductive model of teaching to one oriented toward students' research

engagement and lead to several practical recommendations, in particular:

- educational programs should include a coherent research track that covers the basics of sport research and pedagogical experiments, methods for assessing physical condition and functional capacities, individual or group mini-studies, and public defense of research (mini-report, presentation, poster);
- curricula for specialists in physical education should incorporate components such as "Fundamentals of Sport Research", "Methods for Measuring and Monitoring Physical Condition", and "Digital Monitoring of Motor Activity";
- professional development for teachers should adopt a research-oriented paradigm, including training in sport pedagogy methods, the use of digital sensors and analysis software, the basics of statistics for pedagogical experiments, and methods for fostering cognitive engagement.

Overall, cognitive and research activity in physical education is an effective lever for modernizing the educational process. Its implementation contributes to the development of a holistic personality capable of self-awareness, critical thinking, and responsible attitudes toward personal health.

Future research should focus on developing models for the deeper integration of digital technologies into research activities and on designing systems of criteria for assessing research competencies in students from different specializations.

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EPILOGUE.
Education as a Space of Recovery and Hope

Olena Semenikhina

The war has brought to the surface aspects of education that previously remained in the background: the fragility of established institutional forms, the dependence of learning on security, infrastructure, and resources, and, at the same time, the deep capacity of schools and universities to support people in moments of extreme strain. Throughout this monograph, education appears not only as a system, but as a living web of relationships, practices, and decisions in which fear and courage, fatigue and responsibility, loss and the desire for a future are constantly intertwined. Examining local cases, international experience, and potential trajectories of post-war development, it becomes clear that, despite all, education remains one of the few spaces through which society learns to rebuild itself.

The experience of Ukrainian schools and universities during the war is highly heterogeneous. There are displaced universities that have moved across cities and regions in an effort to keep their staff and programs together; border communities in which every decision about the format of classes carries an element of risk; and rural schools that simultaneously support children whose parents are at the front and receive internally displaced learners. Universities in host cities navigate the coexistence of different educational trajectories and wartime experiences; schools in de-

occupied territories work with children returning after occupation, disrupted schooling, and periods of informational isolation. Across this diversity runs a common thread: education is not limited to transmitting knowledge. It becomes a setting in which a sense of ordinary life is gradually restored and where routines emerge that extend beyond mere survival.

Comparisons with countries that have lived through long conflicts and large-scale destruction – including Syria, Afghanistan, and a number of African and Balkan states – confirm the ambivalent role of education in wartime and post-war societies. On the one hand, schools and universities can serve as channels for reproducing propaganda narratives, perpetuating inequality, and perpetuating discrimination. On the other hand, education can serve as a means of rebuilding trust, establishing fundamental norms of coexistence, and creating opportunities for children and young people to engage in public life. Research on post-conflict education emphasizes the importance of three key elements: physically and psychologically safe learning environments; curricula that foster reflection on traumatic experiences rather than simply repressing them; and the meaningful involvement of local communities in decision-making processes. The Ukrainian experience already resonates with these findings, while also following its own trajectory shaped by a high level of digitalization, a dense landscape of civic initiatives, and extensive volunteer support for educational projects.

The question of what education should look like after victory goes far beyond technical choices about lesson length or program structure. It concerns which elements of wartime experience should be preserved and embedded institutionally, and which practices must be deliberately left behind. It is evident that flexible learning formats, robust digital platforms, and remote support for learners will not disappear. They can form the basis of a system that better accommodates diverse life circumstances, such as illness, disability, geographical remoteness, or the need to balance study with work and care obligations. At the same time, there is a risk of allowing digital flexibility to become a pretext for under-investing in physical learning spaces, in-person interaction, and the cultivation of school and university communities.

Equally important are the forms of mutual support that emerged spontaneously during the war, including horizontal professional networks of teachers, student and pupil self-help initiatives, and partnerships between educational institutions and civil society organizations. Their strength lies in trust, responsiveness, and relative freedom from rigid hierarchies. In the post-war period, such practices can underpin renewed systems of professional development, the cultivation of soft skills, and project-based learning. It will be crucial to ensure that they are not absorbed and diluted by bureaucratic procedures, but instead receive support that respects their autonomy.

At the same time, the war has revealed practices that should not be carried over into peacetime without critical reflection. This includes chronic overwork among educators, the normalization of "working to exhaustion", and the implicit expectation that learners and teachers will always be ready to go beyond reasonable limits for the sake of a "higher goal". What might have seemed unavoidable under conditions of existential threat would become a destructive factor in the post-war period. Rebuilding education must therefore involve revisiting workload norms, criteria of effectiveness, and systems of motivation, with the aim of preserving a readiness for commitment and solidarity without making permanent self-sacrifice the main foundation of the system.

The war has also changed how learners are perceived. Children, adolescents, and adults engaged in study are no longer seen only as recipients of instruction but as individuals whose lives have been shaped by loss, displacement, ruptured social ties, and new responsibilities within their families. This experience will not simply vanish with the end of active hostilities. It will require long-term engagement across civic education, history, language, and social-emotional learning. Post-war education will have the opportunity to become a space where traumatic histories give rise not to a culture of revenge, but to a culture of memory and responsibility that helps prevent cycles of violence from repeating.

In this sense, the practices described in the monograph are not only responses to crisis; they also function as a kind of laboratory for future solutions. Forms of organizing teaching and learning, as well as mechanisms for supporting educators and

learners that have proven viable in the most challenging years, can form the basis for far-reaching change. An important task for the editorial team and all those involved in this volume is to ensure that this experience is preserved not only as text, but as a set of practices that continue to evolve after the war.

To speak of education as a space of recovery and hope is not to rely on metaphor, but to acknowledge the daily work of many people who, despite fatigue, fear, and loss, continue to prepare lessons, assess assignments, talk with children and adults, and build bridges between a devastated past and a possible future. If this monograph helps to make those efforts more visible and comprehensible, supports those engaged in post-war planning, and contributes to more balanced decision-making about the future of education, it will have fulfilled its purpose. The path from wartime resilience to sustainable peace will be a long and complex one. Yet education has all the prerequisites to remain the arena in which this path acquires meaning, structure, and, ultimately, a distinctly human dimension.

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