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Cultivating Psychological Safety during Disaster Response: Enhancing Resilience and Psychological Recovery

Vadym Pienov
Candidate of Pedagogical Sciences, Associate Professor, Associate Professor of the Department of Physiology, Human Health and Safety and of Natural Science Education, Odesa I.I. Mechnikov National University, Odesa, Ukraine.
vadim_v.p@ukr.net
https://orcid.org/0000-0002-0900-525X

Yuliia Chystovska
Doctor of Science of Psychology, Professor, Head of the Psychology Department, Bohdan Khmelnytsky National University of Cherkasy, Cherkasy, Ukraine.
j.chystovska@ukr.net
https://orcid.org/0000-0001-7817-1967

Natalia Shavrovska
Candidate of Psychological Sciences, Docent, Associate Professor at the Department of the Psychology, Bohdan Khmelnytsky National University of Cherkasy, Cherkasy, Ukraine.
shavrovska.natalia@gmail.com
https://orcid.org/0000-0002-6875-8534

Olena Grebeniuk
Candidate of Pedagogical Sciences, Senior Lecturer of the Psychology Department, Bohdan Khmelnytsky National University of Cherkasy, Cherkasy, Ukraine.
luginalena86@gmail.com
https://orcid.org/0000-0002-1468-0911

Svitlana Gvozdii
Doctor of Pedagogical Sciences, Full Professor, Professor of the Department of Physiology, Human Health and Safety and of Natural Science Education, Odesa I. I. Mechnikov National University, Odesa, Ukraine. spgvozdiy77@onu.edu.ua
https://orcid.org/0000-0002-8208-2972

Tetyana Ivanova
Docent, Candidate of Psychological Sciences, Associate Professor at the Department of the Psychology, Political Science and Sociocultural Technologies, Sumy State University, Sumy, Ukraine.
sociol8tanya@gmail.com
http://orcid.org/0000-0002-9394-8858

Abstract: *The article presents a theoretical and empirical justification for the author's neuropedagogical model aimed at fostering psychological safety. This model is adapted explicitly to environments marked by catastrophes, such as during wartime. The article aims to integrate neuroscientific insights into stress regulation with humanistic educational practices. This integration seeks to strengthen the emotional stability and resilience of students at the university level. The research methodology adopts an interdisciplinary approach. It incorporates resilience scales (CD-RISC), psychological flexibility (AAQ-II), empathy (TEQ), and anxiety assessments (STAI), alongside interviews and qualitative content analysis. A total of 328 students from frontline and central-western regions of Ukraine participated in the formative diagnostic experiment. The findings show a statistically significant increase in resilience, a decrease in anxiety, and an improvement in emotional self-regulation among the experimental groups ($p < 0.01$). These outcomes confirm the effectiveness of the proposed model. The originality of the investigation is based on the development of a holistic, modularly structured neuropedagogical framework. This structure incorporates physical stabilisation, neurosensory integration, cognitive reconfiguration, and social reasoning. It not only addresses the shortcomings of traditional education during crises but also creates conditions for restoring subjectivity. The latter is viewed as an ontological resource for dignity, resistance, and personal growth. Finally, the article explores key neuroscientific approaches to understanding resilience. It introduces the authors' model of neuropedagogical intervention and presents the outcomes of a pedagogical experiment conducted among Ukrainian students living in regions with differing levels of security threat. This article is intended for researchers, educators, psychologists, and professionals in political and humanitarian fields interested in shaping a new humanistic epistemology of education under conditions of existential instability.*

Keywords: *neuropedagogy; emotional self-regulation; physical stabilisation; cognitive flexibility; meaning-making; mental hygiene; neurosensory integration.*

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1. Introduction

In the 21st century, the global educational, humanitarian, and security sectors are confronted with increasingly complex and multidimensional crises, ranging from natural and social disruptions to technological and armed conflicts. These challenges have become especially acute in the context of contemporary Ukraine, where the full-scale war transcends a purely political or military dimension. It has developed into a profound anthropological crisis, one that is transforming the very ways in which people experience existence, engage in learning, and interpret reality.

In such circumstances, psychological safety can no longer be regarded as a simple pedagogical concept or a secondary concern. Rather, it has emerged as a neuropsychological imperative and a central priority within the sphere of educational practice and influence.

2. Research Relevance

The question of psychological safety in education underscores the limitations of traditional pedagogical models, which frequently fail to account for the neurobiological foundations of stress, trauma, and emotional regulation. These mechanisms play a pivotal role in enabling individuals to adapt, communicate, and learn under conditions of threat. Findings from neuroscience reveal that, in the midst of catastrophic events, the brain exhibits heightened reactivity. In such states, fear and anxiety dominate neural activity, suppressing prefrontal cognitive functions and thereby impairing critical thinking, self-concept, and ethical judgment (Piccardi et al., 2016). This highlights the imperative of adopting neuropedagogy as an interdisciplinary approach that integrates cognitive neuroscience, emotional psychology, mental health practices, and principles of humanistic education.

The issue is most clearly illustrated in Ukraine's educational realities, where educators are forced to endure prolonged periods of waiting for or witnessing catastrophe. A study conducted by the Ministry of Education and Science of Ukraine found that fewer than 40% of education workers in border and frontline regions feel emotionally stable, while 82% report increased anxiety (Ministerstvo osvity i nauky Ukrainy, 2023). The situation is even worse for youth. This underscores the urgent need for psychological support programmes for educators in crises.

Ukrainian researchers frequently approach this issue from a holistic and global perspective. Romanchuk (2022) explores the concept of resilience in the wartime context. He defines resilience as the ability to preserve mental health and personal integrity during life's challenges. The researcher also highlights its significance for educational and social participants. It is crucial not only for overcoming war-related stress but also for securing success in such circumstances.

On the other hand, there is a limited number of practically and educationally oriented studies focused on neuropedagogical approaches to psychological safety during disaster response. However, broader insights can be drawn from related topics explored in leading journals. Sgambelluri & Placanica (2024) propose a theoretical approach to designing inclusive education through the Life Design paradigm, integrated with AI technologies. Their contribution to the issue of psychological safety lies in creating an educational environment that meets the needs of learners with special needs and promotes emotional self-realisation, self-determination, and life project planning. The scholars emphasise the role of personalised AI mentoring, based on narrative counselling (McIlveen, 2008), as a tool for psychological support through life-meaning reconstruction. Their approach aligns with post-normative inclusion models, where educational technologies enhance, rather than replace, human empathy, providing a safe space for development.

These approaches align with the article's central concern: fostering psychological safety in educational contexts vulnerable to catastrophe through neuropedagogical practices. They provide instruments for rebuilding identity and promoting resilient meaning-making, achieved through the integration of technological resources and humanistic support.

Regrettably, the neuropedagogical potential of educational institutions during periods of crisis remains largely overlooked in broader academic and practical discussions. Nonetheless, existing reviews provide important perspectives; for instance, Nikjoo, Partovi, and Biparva (2022)

present a synthesis of experiences related to the implementation of crisis management strategies. Regrettably, the neuropedagogical potential of educational institutions during periods of crisis remains largely overlooked in broader academic and practical discussions. Nonetheless, existing reviews provide important perspectives; for instance, Nikjoo, Partovi, and Biparva (2022) present a synthesis of experiences related to the implementation of crisis management strategies.

Recently, research on neuropedagogical design has gained attention as an innovative framework for responding to global educational challenges. In this context, Díaz-Cabriales (2025) explores the relationship between technological acceptance and the neuropedagogical design of e-learning tools in Mexico. This study contributes to a deeper understanding of how neuroeducational strategies can enhance psychological safety and strengthen pedagogical practices in addressing worldwide issues. In the framework of design-based research, it shows that the interaction between variables such as perceived usefulness, ease of use, neuroeducational experience, and content is crucial for forming an effective educational environment that supports educators during crises. In this context, neuropedagogy is not just a methodology for developing learning materials but also a strategy for creating an emotionally safe space where digital tools align with learners' cognitive and emotional needs.

Many publications also explore the use of neuropedagogical approaches to support mental health during the pandemic, which, before the new outbreaks of the Israeli-Palestinian conflict and Russia's war against Ukraine, was the main global challenge. While these works were particularly relevant in the early 2020s, their findings can be creatively applied to developing psychological safety, coping skills, and resilience culture (Huang & Zane, 2016).

A detailed analysis of these studies highlights the growing, still insufficient, attention given to neuropedagogical approaches in the context of psychological safety during catastrophes. Meanwhile, student youth in Ukraine, numbering in the hundreds of thousands, are forced to seek shelter during air raid sirens and have yet to be the focus of neuropedagogical or other psychological (coping, psychotherapeutic) interventions.

These scientific and practical considerations have shaped the focus and aim of this article. The objective is to both theoretically and methodologically justify, as well as empirically investigate, a neuropedagogical model for fostering psychological safety in the context of catastrophic events, with particular emphasis on the war in Ukraine. The authors argue that psychological safety should be understood not as the absence of threats, but as a dynamic process of neuropsychic coordination, social reasoning, and meaning-making that supports the development of resilience, emotional flexibility, and long-term psychological recovery.

3. Research Methodology

The research was conducted within an interdisciplinary framework integrating neuropsychological, emotional, pedagogical, and qualitative-cognitive approaches to examining the dynamics of psychological safety. A combination of quantitative and qualitative tools was used: the Connor-Davidson Resilience Scale (CD-RISC), the State-Trait Anxiety Inventory (STAI), the Acceptance and Action Questionnaire (AAQ-II) to assess psychological flexibility, the safe space map, and the Toronto Empathy Questionnaire (TEQ). These tools were selected to measure latent neuropsychic responses, which mediate one's ability for emotional self-regulation, social reasoning, and meaning-making integration. These are critical components in forming neuropedagogical safety. Additionally, semi-structured interviews were analysed through content analysis to verify changes in subjective experience and reflective perceptions of resilience.

4. Design and Data Saturation

The research design follows an experimental-quasi-experimental structure, with a phased approach to implementing the neuropedagogical model in real educational practices. Experimental (EG) and control (CG) groups of students were formed from different regions of Ukraine, namely, the frontline and central-western regions. This allowed the model's impact to be examined under

varying levels of catastrophic stress. The experiment lasted 8 weeks and included stages of initial diagnosis, formative intervention (implementation of neuro-interventions), and post-diagnosis with both quantitative and qualitative assessments of changes. The educational influence was applied through formal courses (e.g., "Mental Hygiene in Times of War"), informal activities (workshops, art practices), and the integration of micro-interventions into regular classes. The design reflects a gradual process of neuropsychological renewal, involving physical stabilisation, emotional self-regulation, and cognitive reconfiguration of experience.

Empirical data saturation was achieved through both the quantitative representativeness of the sample (n = 328) and the qualitative depth of changes observed in EGs. Combining metrics for resilience, anxiety, flexibility, empathy, and subjective safety into one research field enables not only the observation of phenomenological manifestations but also an understanding of the neuropsychic adaptation logic behind the development of psychological safety. Positive dynamics, confirmed by statistically significant results ($p < 0.01$) and qualitative classifiers (e.g., *"I know what to do when I'm scared," "Our group is my support"*), indicate that the model effectively serves as a psycho-pedagogical renewal tool. It stabilises students while fostering their ability to act, empathise, and reflect in wartime conditions.

5. Research Ethics

The article's authors confirm that all students voluntarily participated in the experiment. Additionally, the ethics committees of the respective universities were notified about their students' involvement.

6. Neuropedagogical Model for Fostering Resilience, Psychological Stability, and Recovery during Wartime: A Focus on Ukrainian Students

The issue of cultivating psychological safety in response to disasters involves two key components: first, integrating neuroscientific insights into stress-related brain reactions; and second, through pedagogical approaches that foster environments in which meanings, emotions, and behaviours can be restructured and redefined. During periods of catastrophic disruption, whether physical, social, or symbolic, the brain's core regions, particularly the amygdala and hippocampus, activate the "fight–flight–freeze" response. This reaction suppresses the functioning of the prefrontal cortex, which governs higher-order cognition, empathy, and moral reasoning (Arnsten, 2009). As Sapolsky (2004) notes, the amygdala not only initiates this response by releasing cortisol, adrenaline, and noradrenaline but also links these physiological processes to ongoing mental states through its evolutionary mechanisms.

Consequently, psychological safety should not be viewed merely as a social construct but as a fundamental prerequisite for restoring neuropsychological functioning in individuals during times of crisis.

From a methodological perspective, psychological safety may be understood as a shared space of meaning-making in which processes of restoration can take place. Importantly, such restoration does not imply a return to a previous "normal," but rather the establishment of a new norm within a post-catastrophic reality. This becomes particularly evident in a cultural context, where the contemporary pursuit of safety intersects with fear and uncertainty, giving rise to distinct narratives and forms of meaning (Eisch-Angus, 2018).At the same time, neuropedagogy offers a hybrid framework for addressing this issue. On one level, it draws on empirical evidence regarding brain plasticity, the recovery of emotional regulation, and the reinforcement of new neural networks. On the other hand, it integrates humanistic practices, such as dialogue, empathy, and existential support. In this context, psychological safety is not the absence of fear. It is rather the creation of a space where individuals can risk thinking, feeling, and acting in new ways.

Thus, from a neuropedagogical perspective, a catastrophe is both a methodological and ontological crisis and an attractor for development. It challenges classic approaches to learning, and discovering oneself, and how the world works. This is why a safe environment must not only

protect but also stimulate new cognitive and emotional configurations. Psychological safety is not an end goal; it is a dynamic condition necessary for "deep learning," in which one not only adapts but also transforms one's experience (Arif et al., 2024). In this sense, neuropedagogy in times of disaster serves not only as a tool for adaptation but also as a process of restoring subjectivity. The latter implies the ability to be present, think critically, and act responsibly in an unpredictable world.

As mentioned in the introduction, research on this issue within neuropedagogical discourse is insufficient. In the context of encountering war-related dangers, scholars primarily explore issues related to the protection and mitigation (avoidance) of reactions to catastrophes among rescuers, combatants, medical staff, and journalists. However, discussions on cultivating psychological safety in youth are relatively scarce.

Farokhzadian et al. (2024) analyse the deep barriers nurses face during disaster response. These findings have significant epistemological and methodological implications for developing comprehensive models of neuropedagogical resilience. The researchers used a qualitative content analysis approach based on the findings by Graneheim & Lundman (2004). They assert that the main issue, namely, nurses' inability to effectively respond to disasters, manifests in such categories as communication difficulties, lack of teamwork, ethical tension, and a lack of systematic training. These components can be extrapolated to a broader range of subjects. The data suggest that cognitive-emotional disorganisation caused by extreme conditions directly affects decision-making quality, empathy levels, and personnel resilience. These are key areas of intervention for neuropedagogy.

Methodologically, it is crucial to recognise that effective crisis response cannot be achieved through technical or administrative training alone. An ontological shift in education is necessary, one that incorporates pedagogy focused on embodied-affective dimensions, moral agency, and reflective abilities to act under uncertainty. Farokhzadian et al. (2024) also raise the issue of dissatisfaction with training systems. They claim that these systems fail to consider context and do not provide tools for moral self-preservation. This directly aligns with this article's thesis that neuropedagogical transformation is needed in educational and medical environments to foster psychological safety.

Nava (2022) uses a powerful ontological differentiation of three organisational responses. The researcher reveals that resilience is not full learning but rather improvisational manoeuvring based on existing resources. The focus is on the present moment, and the mechanism involves reorganising existing capabilities with minimal self-reflection. This approach challenges the traditional view of resilience as an inherently positive phenomenon, exposing its "dark side", which is the ability to suppress deeper learning due to excessive confidence.

Thus, the existing neuropedagogical and neuro-oriented pedagogical discourse lays the foundation for the multifaceted development of psychological safety during disaster responses. It emphasises increasing resilience. However, to apply this experience to enhance the well-being and psychological resilience of Ukrainian youth, one should be able to develop and implement an original methodological model.

In the context of the ongoing full-scale war in Ukraine, students have become one of the most vulnerable groups of young people. Their cognitive, emotional, and social resources are constantly being strained and depleted. Traditional educational paradigms do not fully address the deep neuropsychological effects of war. To respond to these challenges, the authors of this article propose their own neuropedagogical model rooted in the latest research in emotional neuroscience, resilience-based learning, and mental hygiene.

This choice relies on the understanding that conventional approaches, mainly cognitive-behavioural interventions, tend to focus on the rational reappraisal of thought patterns and behavioural training in response to stress. In contrast, the neuropedagogical model of psychological safety presented in this article is grounded in the integration of affective-sensory, neuroplastic, and socio-cognitive factors of adaptation.

Although cognitive-behavioural approaches have demonstrated evidence-based effectiveness in the short-term treatment of post-traumatic conditions (Beck & Beck, 2020; Foa et al., 2009), they often neglect key elements. These include autonomic regulation, non-verbal cues, and bodily-emotional communication. These factors are critically important in contexts involving collective trauma or large-scale catastrophes (van der Kolk, 2015).

In contrast, the neuropedagogical approach addresses deeper mechanisms of emotional self-regulation. It fosters the development of empathy, supports response modulation via body-oriented practices, and engages the dynamics of a neuroeducational environment. This environment activates not only prefrontal cognitive processes but also limbic system-based reciprocity (Siegel, 2020; Perry & Szalavitz, 2007).

This type of integration supports individual recovery. At the same time, it strengthens the cultural resilience of communities by promoting socially rooted models of safe and supportive interaction.

The authors believe that the model should rely on several key ontological assumptions:

- A student's brain is a dynamic system, constantly influenced by chronic stress, anxiety, and informational instability.
- Resilience is not an inborn trait but a multifaceted neuro-psycho-social skill that can be developed and strengthened.
- Psychological recovery is not about returning to a previous "normal" but about constructing a new, adaptive self-concept in a world that has undergone profound existential change.

It is imperative to take into account key neuropedagogical principles and align them with the specific needs of students. Based on this foundation, this article offers a structured model that draws on concrete, evidence-based findings from neuroscience (see Table 1).

Table 1. The authors' model for cultivating resilience, psychological stability, and recovery in Ukrainian youth during wartime

Component	Goal	Neuroscientific basis	Methods/techniques
1. Neurosensory integration	Regulating the autonomic nervous system	The polyvagal theory (Porges, 2011); the HPA reaction axis (Sapolsky, 2004)	Breathing practices, tactile stimulation, audio meditations
2. Emotional self-regulation	Restoring emotional stability	The left PFC, and the role of dopamine (Davidson, 2012)	Emotion journaling, cognitive rewriting of traumatic narratives
3. Collective reflection	Creating an environment of psychological safety	Mirror neurons, social neurobiology (Cozolino, 2013)	Safety circles, collaborative meaning-making projects, dialogic pedagogy
4. Meaning-making of war experience	Transforming traumatic experience into a narrative of recovery	The sensemaking theory (Weick, 1995)	Reflective essays, storytelling, art practices, philosophical dialogues
5. Resilience skills	Integrating self-soothing, adaptation, and planning abilities	Neuroplasticity (Doidge, 2007), PFC training	Educational simulations, micro-experiments with new behavioural patterns
6. Mental hygiene in education	Acquiring knowledge about the psyche, embodiment, and stress	Emotional neuropedagogy (Immordino-Yang, 2015)	Infographics, micro-lectures, self-care pathways, mental health mobile applications

Source: The authors' own conception

The proposed model for cultivating resilience, psychological stability, and recovery in Ukrainian youth during wartime is theoretically well-founded. It brings together principles from emotional neuropedagogy, existential psychology, and crisis education. This results in a unified structure specifically adapted to the demands of an extreme learning environment.

This model is grounded in well-established neuroscientific theories, including the polyvagal theory (Porges, 2011), the HPA reaction axis (Sapolsky, 2004), and the concept of neuroplasticity (Doidge, 2007). These frameworks ensure the biological validity of the model's regulatory mechanisms.

A key theoretical contribution of the model is its shift from vague notions of "psychological support" to a structured neuropsychological intervention. It emphasises bodily and cognitive stabilisation, social reasoning, and the narrative reconstruction of traumatic experiences. In the context of an ongoing war, these processes are not optional. Instead, they are essential for maintaining the subjectivity and inner coherence of young individuals.

The following section outlines the model's modular structure and provides a detailed explanation of each component (see Figure 1).

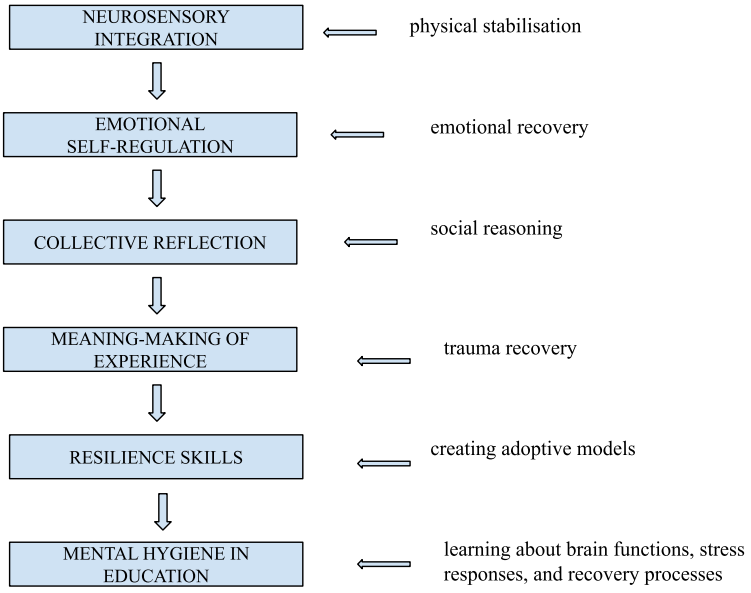

Figure 1. The model's modular framework
Source: The authors' own conception

The modular framework is presented as a vertically structured sequence, starting from neurosensory integration and ending with mental hygiene in education. It serves both a structural and functional-dynamic role, reflecting the process of neuro-psychic recovery during a crisis. Each module activates different levels of integration, namely, neurovegetative, emotional, social, existential, and cognitive, allowing one to move from reactive anxiety to a reflective ability to act. In this way, the framework functions as a neuropedagogical trajectory, where each stage builds logically upon the previous one. It also enables a deeper process of integration, from stabilising the body to reconstructing experience and strengthening resilience skills through education.

7. Formative-Diagnostic Experiment among Students: From Sample to Effect

The formative-diagnostic stage of the experiment aimed to test the effectiveness of the model for fostering resilience, psychological stability, and recovery during wartime instability among students. A key focus was comparing the results between experimental and control groups of students from regions with different levels of combat exposure (the frontline and central-western regions of Ukraine).

The study involved 328 students aged between 17 and 23. The participants were divided based on their regional characteristics: 1) 216 students from frontline areas (Donetsk, Kharkiv, Zaporizhzhia, etc.) who study remotely; 2) 112 students from central-western regions of Ukraine (Kyiv, Lviv, Ivano-Frankivsk, Vinnytsia), where regular combat does not occur, but sporadic shelling may take place.

The sample was evenly split into two groups: experimental groups (EG), where the neuropedagogical model was applied, and control groups (CG), which followed the traditional educational format (see Table 2).

Table 2. The distribution of EG and CG

Category	EG (Model)	CG (Regular education)	Total
Frontline regions	108	108	216
Central-western regions	56	56	112
Total	**164**	**164**	**328***

Note: *One case was deemed invalid, and the final analysis was conducted for n=327.
Source: The authors' own conception

It was decided to integrate the model into the educational space through its implementation in three formats:

●*Formal education*. Courses such as "Mental Hygiene in Times of War" and "The Neuropsychology of Resilience" were introduced.

●*Informal education*. This included workshops, support groups, body therapy classes, and storytelling sessions.

●*Integration into the learning process*. Short neurocognitive interventions (2-5 minutes) were conducted at the beginning or end of classes, particularly in STEM disciplines, where the cognitive load is high.

In EGs, neuropedagogical interventions were carried out over 8 weeks. These included:

a) breathing techniques and guided audio meditations,

b) group reflection and storytelling,

c) infographics and micro-lectures on mental hygiene, and

d) art practices and body awareness.

In CGs, participants continued their usual learning without any additional interventions.

The authors structured the formative diagnostic experiment in stages. These involved pre-diagnostics (to assess the baseline level), the formation phase, and post-diagnostics (both absolute and comparative with the CG), as shown in Table 3.

Table 3. Experiment design

Stages	Content
Diagnostics	Determining the baseline level of resilience, psychological flexibility, anxiety levels, and self-efficacy
Formative influence	Implementing the neuropedagogical model in EGs (8 weeks, 2 sessions per week, online/offline depending on the region)
Post-diagnostics	Reassessing all parameters to analyse dynamics
Control group	Remaining in the regular educational environment (without the model)

Source: The authors' own conception

The methodological tools for this experimental research were selected with a multidisciplinary approach to the neuropedagogy of safety in mind. This approach combines neuropsychological, emotional, and cognitive-meaning measurements.

As outlined in the study, each tool, such as the Connor-Davidson Resilience Scale (CD-RISC), the safe space map, and the Toronto Empathy Questionnaire, serves not only as a diagnostic indicator but also as an analytical tool. These instruments allow one to capture the latent dynamics of neurocognitive adaptation in a war context, within the framework of the "ontology of recovery."

This offers an alternative to reductionist cognitive pedagogy (see Table 4).

Table 4. Methodological tools for diagnostics, statistical assumptions, and multiplicity correction

Indicator	Method/instrument	Assumptions for t-test / statistical analysis	Effect size (Cohen's d/r)	Correction for multiplicity
Resilience level	Connor-Davidson Resilience Scale (CD-RISC) (Davidson, 2012)	Normal distribution, homogeneity of variance	d = 0.78 (large)	Holm–Bonferroni
Anxiety level	State-Trait Anxiety Inventory (STAI)	Normal distribution	d = 0.63 (medium)	Holm–Bonferroni
Psychological flexibility	Acceptance and Action Questionnaire (AAQ-II)	Normality confirmed (Shapiro–Wilk), independent samples	d = 0.81 (large)	Holm–Bonferroni
Subjective sense of safety	The "safe space map" technique and semi-structured interview	Non-parametric assumptions (ordinal data); Mann–Whitney U test	r = 0.46 (moderate)	Holm–Bonferroni
Empathy / emotional involvement	Toronto Empathy Questionnaire (TEQ)	Normal distribution, homogeneity of variance	d = 0.69 (medium)	Holm–Bonferroni

Source: The authors' own conception

Table 4 illustrates that both the diagnostic tools and the statistical approach provide a sound basis for assessing changes in the participants' psychological state. These changes are observed in response to the neuropedagogical intervention.

In this study, two hypotheses were formulated to test the effectiveness of the proposed neuropedagogical model in the context of wartime instability.

The null hypothesis (H_0) stated that implementing the model would not lead to statistically significant changes in students' resilience or psychological stability. This aligns with traditional experimental control methods, where the model is treated as a potentially neutral variable. The alternative hypothesis (H_1) suggested that participants in EGs, who underwent the intervention cycle, would show significantly higher scores on key variables after the formative intervention compared to CGs. This hypothesis supports the theoretical assumption that the model is effective at the intersection of neurophysiological stabilisation, emotional self-regulation, and meaning-making reflection.

Thus, the structure of the hypotheses serves a dual purpose. First, it enables statistical verification of the results. Second, it provides a basis for conceptually validating the model as an effective mechanism for restoring subjective integrity in the context of a catastrophic environment. The use of mathematical-statistical methods, the obtained results, and their reliability are presented in Tables 5 and 6 below.

Table 5. Mathematical-statistical methods

Goal	Method
Comparing EG and CG (before/after)	Student's t-test for independent and dependent samples
Intra-group dynamics	Paired t-tests
Assessing regional effect	Analysis of variance (ANOVA)
Correlations between variables	Pearson correlation coefficients (r)
Qualitative analysis	Thematic coding of interviews (NVivo/Atlas.ti)

Source: The authors' own conception

Table 6. The obtained results

Indicator	EG (after)	CG (after)	Δ Difference	Statistical significance
Resilience (CD-RISC)	↑ by 17.2%	↑ by 2.1%	+15.1%	$p < 0.01$ (high)
Anxiety (STAI)	↓ by 22.4%	↓ by 2.8%	-19.6%	$p < 0.01$ (high)
Psychological flexibility	↑ by 14.9%	↑ by 3.2%	+11.7%	$p < 0.01$ (high)
Sense of safety	Qualitative increase (verbalisations: "control," "community," "support")	No change	–	Content analysis of interviews
Empathy	↑ by 9.5%	Minor changes	+9.5%	$p < 0.05$ (moderate)

Source: The authors' own conception

To make the qualitative research clearer (based on interviews), the authors highlight the key thematic clusters of positive changes observed in the EG: 1) *"I know what to do when I'm scared"* – somatic self-soothing strategy; 2) *"Our group is my support"* – increased social attachment; and 3) *"War is not the end, it's a challenge"* – meaning transformation through storytelling.

The control group, on the other hand, expressed statements such as: 1) *"What's going to change?"*; and 2) *"I'm constantly stressed anyway."* These responses indicate a lack of systematic affect regulation.

8. Conclusion

Analytical and methodological research concludes that psychological safety in disaster situations is not only a functional educational indicator but also an ontological precondition for restoring subjectivity. This involves key neuropsychological mechanisms, such as emotional regulation, physical stabilisation, and cognitive-semantic integration. According to the HPA reaction axis (Sapolsky, 2004) and the polyvagal theory (Porges, 2011), catastrophic events block prefrontal cognitive functions and activate primitive defence mechanisms. This underscores the need for pedagogical intervention that addresses the neurophysiology of fear, rather than simply its social-behavioural manifestations. Traditional cognitive-rational paradigms cannot adequately address these challenges, as they overlook the bodily-emotional component of the educational process in extreme environments.

Instead, neuropedagogy presents an interdisciplinary methodology that combines the empirical foundation of neuroscience with the humanistic potential of education. Specifically, the authors' model is based on the understanding that psychological safety can only be formed through the systematic engagement of modules such as physical regulation, sensory recovery, social resonance, emotional integration, and narrative meaning-making. An important insight is that a catastrophe not only disrupts educational norms but also creates the need for a new methodology. In this methodology, learning is not about mere assimilation but about reconstructing the inner world through experiences of vulnerability, anxiety, and solidarity.

In this context, the neuropedagogical model developed in this study works not only as a reaction to exogenous threats but also as a framework for fostering resilience, both individual and

collective. The theoretical foundation of this model also draws from critical analyses of international approaches, which increasingly emphasise tools for emotional self-recovery (Farokhzadian et al., 2024; Ein et al., 2024). However, these approaches often lack systematic interventions specifically targeting youth as a vulnerable group. Therefore, in the Ukrainian context, where students carry identities, ideas, and traumatic experiences, psychological safety cannot be optional. It is a pedagogical necessity for survival, understanding, and transformation in the face of disaster.

Practical results from the model's implementation provide valuable insights into its effectiveness during the formative phase of the experiment. These include:

- The neuropedagogical model has been statistically shown to improve resilience and reduce anxiety in students in the context of war.
- Psychoeducation, combined with body-sensory practices, contributes to emotional stabilisation and fosters a sense of subjective safety.
- The results confirm the model's social validity – students not only acquire knowledge but also engage emotionally in the process.

In the discussion, the authors note that this model seeks to overcome the limitations of the cognitive-behavioural paradigm in education, where students are viewed solely as "carriers of knowledge" rather than emotionally vulnerable individuals. It aligns with and confirms the validity of established theories in neuropedagogical modelling and intervention. Specifically, the following pedagogical concepts were applied and shown to be effective: 1) neuroplasticity (Doidge, 2007), 2) psychosocial integration (Herman, 2015), 3) meaning-making learning (Mezirow, 1991), and 4) the pedagogy of caring (Noddings, 2013).

As a result, neuropedagogical cultivation of psychological safety in response to disasters, focused on resilience and psychological recovery, goes beyond pedagogy. It represents an ontology of restoration, namely, an approach to thinking about education as a homeostatic space, where new subjectivity can emerge, even in the most extreme circumstances, such as war.

Following the principles of neuropedagogy outlined in the article, the psychological safety model can be effectively adapted to digital educational platforms. This includes platforms that integrate artificial intelligence (AI).

The model's affective-relational structure supports the preservation of empathic interaction in virtual environments. However, this requires careful attention to bodily-sensory feedback, thoughtfully designed visual content, and interfaces that enhance "digital safety" – such as a sense of control, privacy, and predictability.

This approach aligns with recent research demonstrating that AI-adaptive platforms can analyse emotional states through speech and facial expressions. These platforms automatically adjust learning scenarios according to the learner's level of psycho-emotional resilience, thereby increasing the effectiveness of learning (Holstein et al., 2019).

Therefore, the neuropedagogical model offers potential as a foundational framework for digital platforms. It can enhance individual engagement, ethical reflection, and cognitive involvement within AI-supported learning environments.

9. Research Prospects

The potential areas for future research involve expanding the empirical verification of the neuropedagogical model across intercultural and intergenerational contexts. Additionally, there is a need to develop digital adaptations of psychological safety modules for distance learning platforms. Another key area is the in-depth study of neuropsychological markers of effectiveness, particularly through biometric indicators and neuroimaging methods. This should not only strengthen the evidence base of the approach but also contribute to the development of an innovative crisis education paradigm, one that focuses on supporting subjectivity in the face of global challenges.

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