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Educational innovation and resilience in crisis: a critical review of ICHTML 2025

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Abstract. The International Conference on History, Theory and Methodology of Learning (ICHTML 2025), convened on May 13, 2025, under extraordinary circumstances of ongoing military conflict and post-pandemic recovery, provided unprecedented insights into educational resilience and innovation during compound crises. This comprehensive review analyses five conference papers spanning diverse contexts – from AI integration under martial law in Ukraine's Kherson region to historical analysis of 19th-century Polish military education, from distance athletic training innovations to in-service teacher development in India's Odisha state. Through systematic thematic analysis incorporating conference transcripts and supporting literature, this review identifies convergent themes including crisis as a catalyst for innovation, technology ambivalence, multi-level resilience mechanisms, and the centrality of teacher professional development. The analysis reveals how educational communities navigate extreme disruption through creative adaptation rather than predetermined protocols, with successful innovations emerging from the intersection of necessity, human agency, and institutional flexibility. Critical examination exposes significant gaps, including limited longitudinal data, theoretical fragmentation, and insufficient attention to equity impacts. The review advances theoretical understanding of educational resilience as a multi-level, emergent phenomenon distinct from individual psychological resilience, while proposing practical frameworks for institutional adaptation, policy development, and pedagogical innovation. The conference's documentation of real-time educational transformation under extreme conditions contributes valuable empirical evidence while highlighting urgent research priorities, including longitudinal studies of innovation sustainability, comparative analysis across crisis types, and development of crisis-specific pedagogical theory. These findings have profound implications for educational systems worldwide facing intensifying disruptions from climate change, technological transformation, and geopolitical instability.

Keywords: educational resilience, crisis education, distance learning, teacher professional development, artificial intelligence in education, educational innovation, martial law education, COVID-19 pandemic, educational technology, institutional adaptation, pedagogical transformation, Ukrainian education, historical education analysis, athletic training, in-service teacher education

1. Introduction

The convergence of global crises in the early 2020s has fundamentally transformed the education landscape, compelling institutions worldwide to reimagine pedagogical approaches, technological integration, and the very nature of teaching and learning.

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The COVID-19 pandemic, which emerged as the largest disruption to education systems in recorded history, affected over 1.6 billion learners across more than 190 countries [20, 36]. Before educational institutions could fully recover from this unprecedented challenge, new crises emerged, notably the full-scale Russian invasion of Ukraine in February 2022, which created additional layers of complexity for educational systems already struggling with pandemic-induced transformations [21, 34]. These overlapping disruptions have not merely tested the resilience of educational institutions but have catalysed profound innovations and adaptations that may permanently reshape the educational landscape.

The International Conference on History, Theory and Methodology of Learning (ICHTML 2025, https://ichtml.org/2025/), held on May 13, 2025, under the leadership of Chairs Vita Hamaniuk and Iryna Mintii, emerged as a critical forum for examining these transformative changes in education. As part of the broader Ukrainian Science Week and conducted in conjunction with the International Conference on Mathematics, Science and Technology Education (ICon-MaSTEd 2025, https://icon-masted.easyscience.education/2025/), this gathering represented a unique convergence of educational researchers, practitioners, and policymakers grappling with the dual challenges of maintaining educational quality while navigating extraordinary circumstances. The conference proceedings, enriched by real-time discussions captured in session transcripts, provide insights into how educational communities respond to what Sedochenko and Shyyan [32] characterises as a "crisis within a crisis" phenomenon in higher education.

The Ukrainian educational context offers a compelling case study for understanding educational resilience under extreme conditions. While the global education community was still processing lessons from the pandemic's emergency remote teaching phase [3], Ukrainian institutions faced the additional burden of maintaining educational continuity under martial law [40], with challenges including infrastructure damage from military attacks, massive population displacement affecting millions of students, and the psychological toll of ongoing conflict on both educators and learners [14, 16] (figure 1). Despite these extraordinary circumstances, the Ukrainian education system has demonstrated remarkable adaptability, implementing innovative solutions ranging from sophisticated digital transformation initiatives to creative approaches for maintaining practical training in fields traditionally resistant to remote instruction [31].

The papers presented at ICHTML 2025 reflect this complex landscape of challenges and innovations. The conference brought together diverse perspectives spanning historical analysis of civic education traditions, contemporary investigations of distance learning in specialised fields such as athletic training, explorations of artificial intelligence integration in teacher professional development, and case studies of educational resilience in varied geographical and socioeconomic contexts. This diversity of topics, united by the common thread of educational adaptation and innovation, provides a rich tapestry for understanding how educational systems respond to extraordinary pressures while maintaining their fundamental mission of knowledge transmission and skill development.

The significance of this conference extends beyond its immediate context. As Trubacheva, Mushka and Zamaskina [39] notes, the lessons learned from educational responses to simultaneous crises offer valuable insights for building more resilient educational systems globally. The Ukrainian experience, in particular, demonstrates that educational continuity depends not merely on technological solutions but on a complex interplay of institutional adaptation, policy flexibility, community support, and individual resilience. The rapid implementation of blended learning models, the development of new assessment strategies, and the creation of psychological

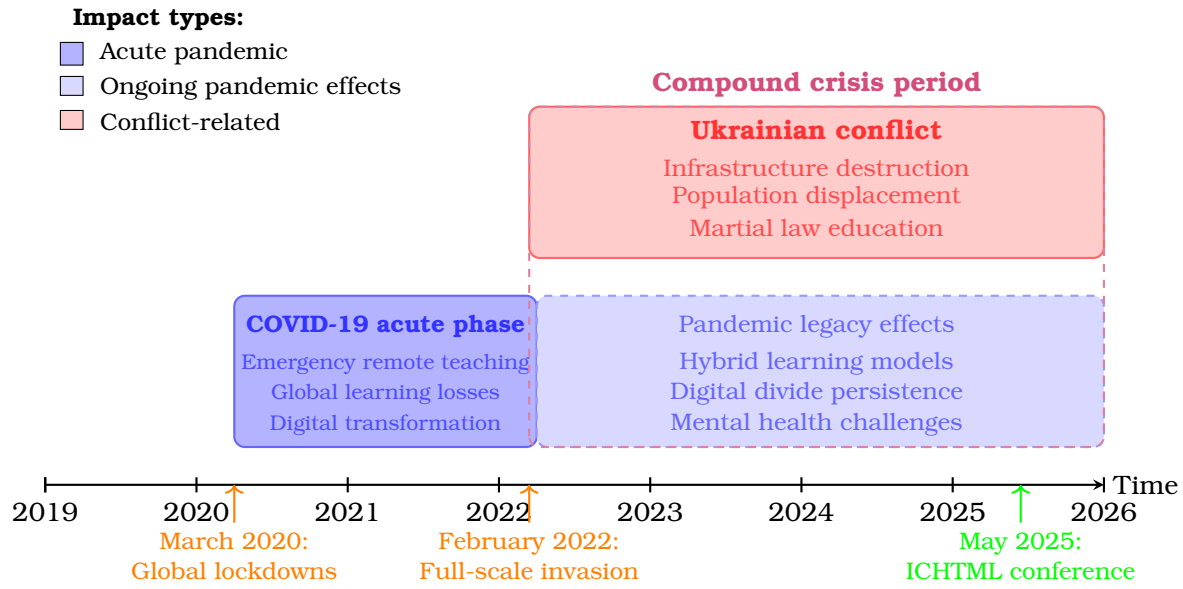

Figure 1: Timeline of major educational disruptions (2019-2025) showing the COVID-19 pandemic's acute phase (2020-2022) and its ongoing legacy effects continuing through 2025, overlapping with the Ukrainian conflict to create a period of compound crisis affecting global education systems.

support systems all contribute to what Fidanian [6] describes as a new paradigm of crisis-responsive education design.

The methodological diversity represented in the conference papers also merits attention. The conference showcased multiple approaches to understanding educational phenomena, from historical archival research examining nineteenth-century military education to contemporary survey-based investigations of teacher readiness for AI integration. This methodological pluralism reflects the complexity of educational challenges in the contemporary era, where traditional disciplinary boundaries become increasingly permeable and solutions often require interdisciplinary collaboration and innovative research designs.

Furthermore, the conference proceedings illuminate critical tensions in contemporary education that transcend immediate crisis response. The challenge of maintaining practical, hands-on training in fields such as physical education and athletics through distance learning platforms raises fundamental questions about the nature of embodied knowledge and skill acquisition. Similarly, integrating artificial intelligence in teacher training programs, particularly in regions under martial law, highlights the potential of technology to democratise access to professional development and the ethical complexities of deploying advanced technologies in crisis contexts where basic infrastructure may be compromised.

This review paper aims to comprehensively analyse the contributions presented at ICHTML 2025, situating them within the broader context of global educational transformation and crisis response. Through systematic examination of the five major papers presented, analysis of conference discussions captured in session transcripts, and integration with relevant supporting literature, this review seeks to identify key themes, assess methodological approaches, evaluate practical implications, and propose directions for future research. The analysis is structured to move from individual paper reviews to synthetic analysis, offering insights that may inform both immediate crisis response strategies and longer-term educational system design.

The organisation of this paper follows a systematic progression from specific to

general insights. Following this introduction, section 2 presents the thematic analysis framework used to examine the conference contributions, including a comparative matrix of papers and identification of cross-cutting themes. Section 3 provides detailed critical reviews of each conference paper, examining their theoretical foundations, methodological approaches, and key findings. Section 4 offers a synthetic analysis that identifies convergent and divergent themes across the papers, drawing on conference discussions to enrich the analysis. Section 5 explores the theoretical implications of the conference contributions for educational theory and practice, while section 6 presents practical recommendations for various stakeholder groups. Section 7 critically discusses the conference's strengths and limitations, identifying gaps and proposing future research priorities. The paper concludes with reflections on the significance of the ICHTML 2025 conference for understanding education in times of crisis and the potential for these insights to inform more resilient and adaptive educational systems globally – the Ukrainian experience, while shaped by unique circumstances, offers lessons that resonate globally, demonstrating that educational resilience emerges not from rigid adherence to traditional models but from creative adaptation, technological innovation, and unwavering commitment to the educational mission even in the most challenging circumstances.

2. Thematic analysis framework

The analytical framework employed in this review draws upon established methodologies for systematic analysis of conference proceedings while adapting these approaches to address the unique characteristics of the ICHTML 2025 contributions. Given the interdisciplinary nature of the conference papers, ranging from historical analysis to contemporary technology integration, the framework needed sufficient flexibility to accommodate diverse methodological traditions while maintaining analytical rigour. The approach combines elements of content analysis, thematic synthesis, and comparative case study methodology, following the principles outlined by Gerbic and Stacey [7] for purposive content analysis in educational research and adapting them to crisis-driven educational innovation.

The initial analysis phase involved mapping the conference contributions across multiple dimensions. Each paper was examined as an isolated contribution and as part of a broader discourse on educational resilience and adaptation. This mapping process considered both explicit content and implicit assumptions, recognising that papers emerging from crisis contexts often carry embedded narratives about educational priorities, technological determinism, and institutional adaptation that may not be immediately apparent in surface-level analysis. The conference transcripts provided an additional layer of insight, revealing real-time interpretations and cross-paper connections that emerged during presentations and discussions.

The comparative matrix presented in table 1 reveals the remarkable diversity of approaches and contexts represented at ICHTML 2025, while simultaneously highlighting convergent concerns around educational continuity, quality maintenance, and innovation under pressure. This diversity necessitated a multi-layered analytical approach that could accommodate both the specificity of individual contributions and the identification of broader patterns. The framework, therefore, employed iterative coding processes, moving between deductive categories derived from the literature on crisis education and inductive themes emerging from the papers themselves.

The thematic network visualised in figure 2 emerged through a systematic process of identifying recurring concepts, examining their relationships, and mapping their hierarchical organisation within the conference discourse. The central positioning of crisis-driven educational transformation reflects its role as the organising principle

Table 1
Comparative analysis matrix of ICHTML 2025 conference papers.

Dimension	**Zazymko, Klikh and Nazarenko [42]**	**Cwer [1]**	**Yefremenko and Shutieiev [41]**	**Osypova, Kokhanovska and Zhorova [24]**	**Palai and Nanda [30]**
Primary focus	Educational recovery	Historical civic education	Distance athletic training	AI in teacher training	In-service teacher development
Temporal context	2020-2025	1794-1864	Contemporary	2023-2025	Contemporary
Geographic scope	Kyiv, Ukraine	Poland	Kharkiv region, Ukraine	Kherson region, Ukraine	Odisha, India
Methodology	Mixed methods	Historical archival	Survey and modeling	Survey analysis	Case study
Sample/Data	5-year institutional data	Historical documents	20 experts	84 teachers	Policy documents
Crisis response	Direct (war and pandemic)	Historical parallel	Indirect adaptation	Direct (martial law)	Systemic challenges
Technology role	Central (digital transformation)	Not applicable	Enabling factor	Primary focus (AI)	Supporting element
Innovation type	Institutional	Pedagogical tradition	Curriculum design	Tool integration	Program development
Key contribution	Recovery framework	Historical insights	3-block structure	Regional AI model	ISTE effectiveness
Scalability	Institution-specific	Conceptual transfer	Discipline-specific	Regional model	Context-dependent

connecting all conference contributions, though each paper approaches this theme from distinct angles. Identifying four primary thematic clusters – technology integration, institutional resilience, pedagogical innovation, and professional development – was validated through multiple analytical passes, including independent coding by research team members and triangulation with conference discussion transcripts.

The analytical process revealed that themes rarely appeared in isolation but formed complex interconnections reflecting the multifaceted nature of educational crisis response. For instance, technology integration appeared not merely as a tool for maintaining educational continuity but as a catalyst for pedagogical innovation and a requirement for professional development. This interconnectedness suggested that effective crisis response in education requires simultaneous attention to multiple dimensions rather than sequential or isolated interventions. The strength of connections between themes, represented visually through line weights in the network diagram, was determined through co-occurrence analysis, the explicit linking of concepts within individual papers, and cross-paper discussions during the conference.

Beyond identifying themes, the framework incorporated analysis of what Fang and Wang [5] describes as the diffusion patterns of educational innovations. This analytical lens proved particularly relevant given the conference's focus on crisis-driven adaptations often requiring rapid dissemination and implementation. The papers revealed

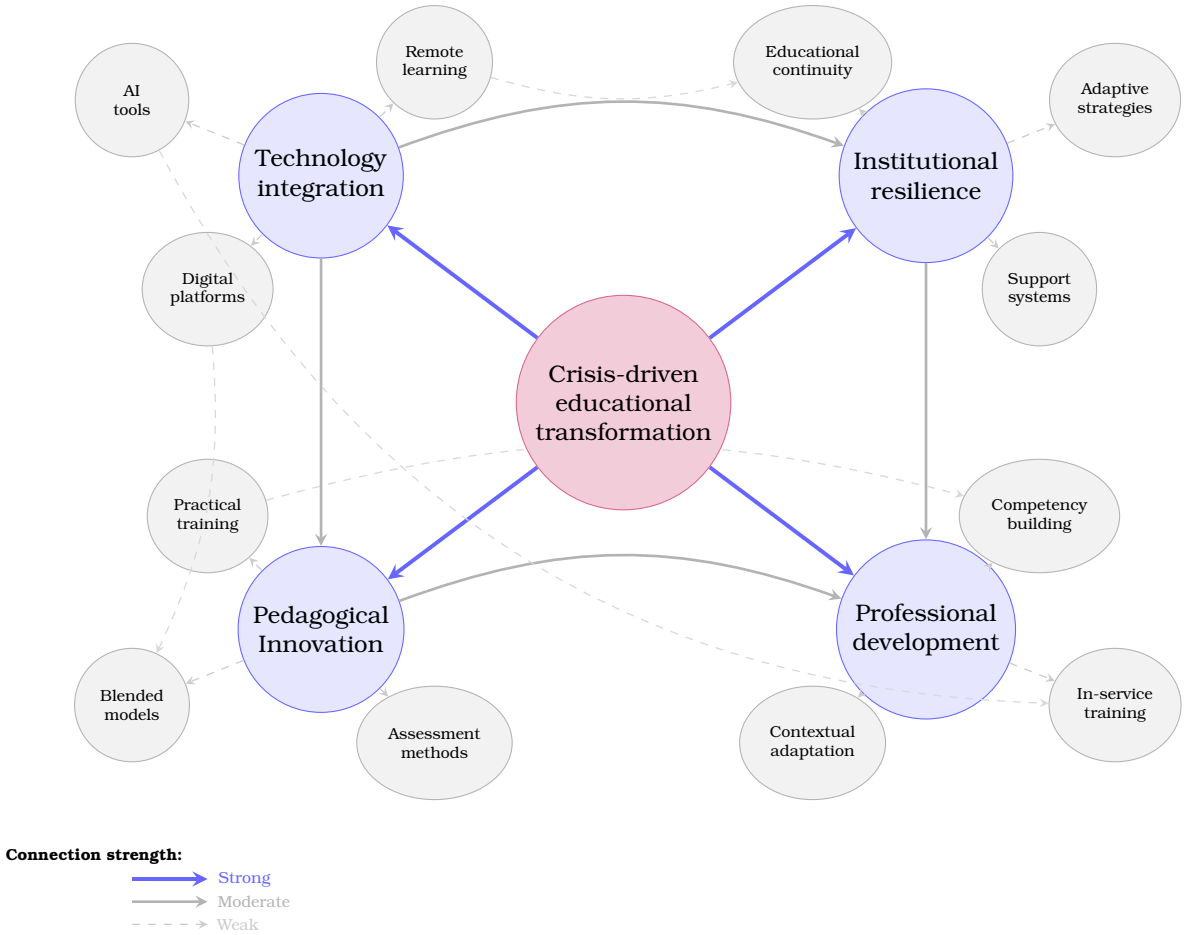

Figure 2: Thematic network diagram illustrating the relationships between primary and secondary themes identified across ICHTML 2025 conference papers. The strength of connections reflects the frequency and intensity of thematic co-occurrence in the analysed papers.

different diffusion mechanisms operating at various scales, from institutional-level digital transformation initiatives to regional teacher training programs to discipline-specific curriculum adaptations. Understanding these diffusion patterns provided insights into how educational innovations spread during crises and which factors facilitate or impede their adoption.

The temporal dimension of the analysis deserves particular attention, as the conference papers spanned dramatically different time periods while addressing fundamentally similar questions about educational adaptation and resilience. The historical analysis of Polish military education from 1794 to 1864 provided a unique comparative perspective, demonstrating that many contemporary challenges in civic education and character formation have historical precedents. This temporal breadth enriched the analysis by revealing both continuities and discontinuities in educational responses to societal crises, suggesting that while technologies and contexts change, fundamental pedagogical challenges persist across centuries.

Methodological triangulation strengthened the analytical framework by integrating multiple data sources and analytical techniques. The primary analysis of paper content was supplemented with examination of conference transcripts, which revealed nuances in how authors positioned their work and responded to questions from the audience. These transcripts proved valuable for understanding the practical implications of research findings and the challenges researchers faced in conducting studies under crisis conditions. Discussing technical difficulties, resource constraints,

and ethical considerations that emerged during conference presentations added depth to understanding research contexts that might not have been fully articulated in the formal papers.

The framework also focused on what remained unsaid or underexplored in the conference contributions. This analytical dimension, informed by critical discourse analysis principles, examined gaps and silences that might reveal assumptions about educational priorities, technological capabilities, or institutional resources. For instance, the limited discussion of educational equity in some technology-focused papers suggested implicit assumptions about universal access to digital resources that may not reflect the reality of crisis-affected educational contexts. Similarly, several papers' emphasis on institutional responses obscured individual educators' and learners' experiences and agency in navigating crisis conditions.

Our analytical framework recognised the positioned nature of knowledge production in crisis contexts. Researchers working under martial law [38], during pandemic lockdowns [18], or in post-conflict recovery [4] face unique constraints that shape both what can be studied and how it can be investigated. The framework, therefore, incorporated reflexive elements that considered how the conditions of knowledge production influenced the conference contributions. This reflexive dimension proved essential for understanding why certain methodological choices were made, why particular populations were studied, and how findings should be interpreted within their specific production contexts. The result was an analytical approach that balanced systematic comparison with contextual sensitivity, enabling both the identification of broad patterns and the preservation of important contextual specificity.

3. Critical review of individual papers

The five papers presented at ICHTML 2025 represent diverse yet interconnected responses to the fundamental challenge of maintaining educational quality and continuity under extraordinary circumstances. Each contribution offers unique insights into specific aspects of educational resilience, from institutional-level digital transformation to individual teacher development, from historical precedents to contemporary technological innovations. This section provides a detailed critical analysis of each paper, examining their theoretical foundations, methodological approaches, empirical findings, and practical implications within the broader context of crisis-driven educational transformation.

3.1. Educational recovery in higher technological education

The opening presentation by Volodymyr Nazarenko, representing the collaborative work of Zazymko, Klikh and Nazarenko [42] from the National University of Life and Environmental Sciences of Ukraine (NULES), established a compelling framework for understanding and addressing educational losses in technological higher education. Their comprehensive analysis, grounded in five years of institutional data spanning the COVID-19 pandemic and the ongoing military conflict, perhaps provides the most empirically robust contribution to the conference. The paper's strength lies in documenting the scale and nature of educational losses and proposing a sophisticated, multi-dimensional intervention framework that recognises the complex interplay between external disruptions and internal institutional factors.

The authors' conceptualisation of educational losses extends beyond simple academic performance metrics to encompass what they term a "systemic decline" in educational quality. This decline manifests across multiple dimensions that technological education particularly depends upon: the erosion of practical skills training when laboratories become inaccessible, the deterioration of collaborative learning experiences essential for engineering projects, and the disruption of industry partnerships

that provide crucial real-world context for technological disciplines. Their analysis reveals that technological universities face unique vulnerabilities during crises, as technological education's embodied and material nature resists simple translation to digital formats. The paper documents how NULES attempted to maintain laboratory work through video demonstrations and virtual simulations, yet acknowledges that these substitutions cannot fully replicate the tactile experience of working with actual equipment or the problem-solving skills developed through hands-on experimentation.

The paper's empirical foundation deserves particular attention for its methodological rigour and comprehensive scope. Drawing on institutional data from 2019 to 2024, the authors track multiple indicators of educational quality across technological disciplines, revealing patterns that challenge simplistic narratives about crisis-induced learning losses (table 2). Their analysis shows that while overall grade point averages initially declined during the pandemic transition to remote learning, the subsequent period of military conflict produced more complex patterns. Some disciplines adapted relatively successfully to blended formats, particularly those with strong theoretical components, while others requiring extensive laboratory work or field practice experienced persistent challenges. The data reveal differential impacts across student cohorts, with first-year students showing the greatest vulnerability to disrupted educational continuity, while senior students demonstrated greater resilience, possibly due to their established knowledge base and stronger self-directed learning capabilities.

Table 2
Key performance indicators at NULES during crisis periods (2019-2024).

Indicator	2019 (Baseline)	2020 (Pandemic)	2021 (Pandemic)	2022 (War onset)	2023 (Adaptation)
Average GPA (4.0 scale)	3.21	2.98	3.05	2.89	3.12
Expulsion rate (%)	4.2	6.8	5.9	8.3	5.7
Academic debt (%)*	12.3	21.7	18.4	24.6	16.2
Lab completion rate (%)	94.5	67.3	72.1	61.4	78.9
Industry placement (%)	89.2	34.6	45.7	28.3	52.1
Digital engagement**	3.2	4.1	4.3	4.5	4.6
Psychological support usage	125	342	487	891	756

*Percentage of students with incomplete coursework

**Average hours/day on digital platforms (self-reported)

Note: 2024 data partially available, showing continued improvement trends

The intervention framework proposed by Zazymko, Klikh and Nazarenko [42] (figure 3) represents a sophisticated response to the multifaceted nature of educational losses, moving beyond reactive measures to embrace what they term "anticipatory resilience building". Their approach integrates multiple intervention streams that operate synergistically rather than in isolation. The adaptive curriculum planning component, for instance, involves adjusting content delivery methods and fundamentally reconceptualising learning objectives to acknowledge the constraints of crisis conditions while maintaining educational standards. This includes developing modular course structures that can flexibly transition between in-person, hybrid, and fully remote formats depending on security conditions, creating redundant assessment pathways that account for potential disruptions, and establishing clear minimum competency thresholds that preserve program integrity even when optimal learning conditions cannot be maintained.

The paper's treatment of psychological support as an integral rather than supplementary component of educational recovery marks a significant contribution to the field. The authors document how NULES expanded its psychological services from a

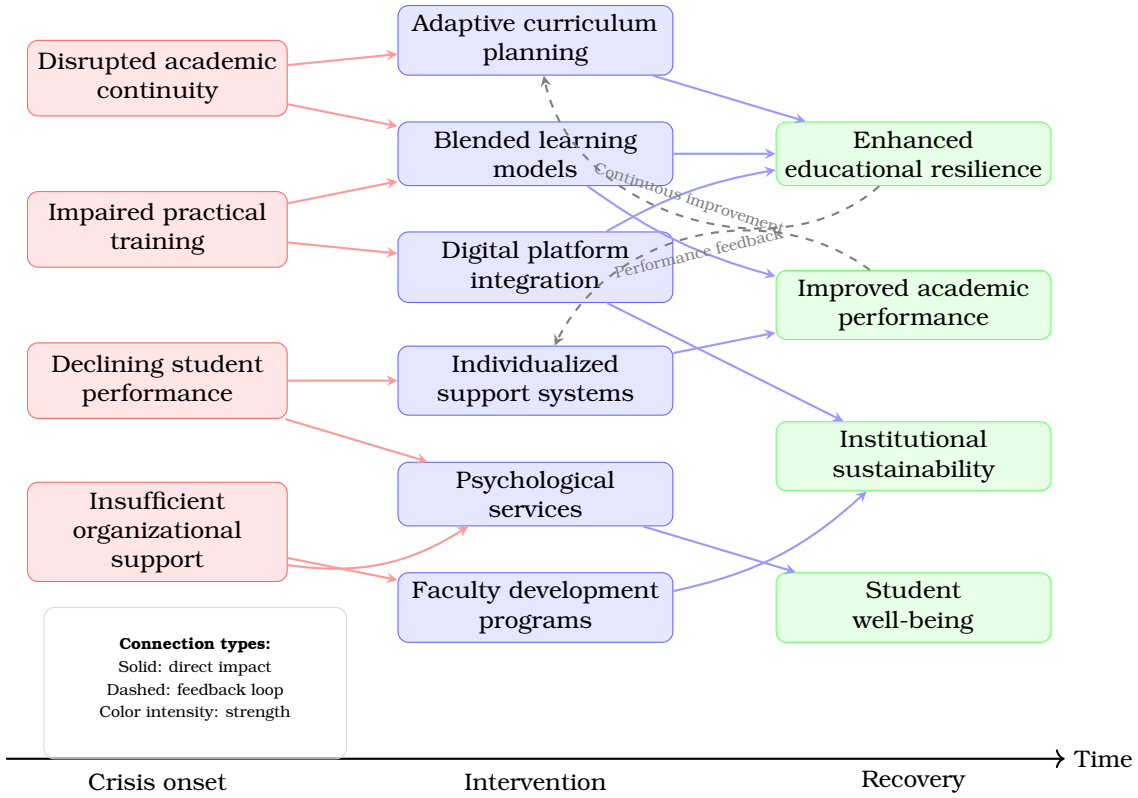

Figure 3: The NULES framework for addressing educational losses through multi-dimensional interventions, showing the progression from identified losses through targeted interventions to desired outcomes, with feedback loops enabling continuous improvement.

pre-pandemic staff of three counsellors serving primarily crisis cases to a comprehensive support system involving fifteen professionals providing preventive, developmental, and therapeutic interventions. Their data shows strong correlations between psychological support utilisation and academic recovery, with students accessing regular counselling services showing 23% better academic performance improvement than those who did not. This finding challenges the traditional separation of academic and psychological support in higher education, suggesting that effective educational recovery requires addressing the holistic needs of learners experiencing compound stressors [13, 15, 25].

The digital transformation strategy outlined in the paper extends beyond simple platform adoption to encompass what the authors describe as a "comprehensive reimagining of the technological university in digital space". This involved deploying learning management systems and video conferencing tools, creating virtual laboratory environments, developing augmented reality applications for equipment training, establishing digital twin simulations of industrial processes, and building online communities of practice that maintain the collaborative culture essential to technological education. The authors provide detailed cost-benefit analyses showing that while initial digital infrastructure investments were substantial, the long-term benefits of educational continuity, expanded access, and enhanced flexibility justify the expenditure. Their frank discussion of failed initiatives, such as an attempt to create fully virtual internships that proved inadequate for developing professional competencies, adds credibility to their analysis and provides valuable lessons for other institutions.

Perhaps most importantly, the paper addresses the sustainability of crisis-response measures beyond the immediate emergency period. The authors argue that many innovations developed under crisis conditions should be retained and refined rather

than abandoned when normal conditions return. They propose a model of "permanent adaptability" where institutions maintain the capacity to shift between different operational modes while preserving educational quality rapidly. This includes maintaining parallel curriculum tracks that can be activated as needed, preserving expanded digital infrastructure even when in-person instruction resumes, continuing enhanced psychological support services as a standard rather than emergency provision, and institutionalising crisis response protocols that can be quickly deployed for future disruptions. Their framework suggests that the goal should not be returning to pre-crisis conditions but instead evolving toward a more resilient and flexible educational model that can maintain quality under varying circumstances.

3.2. Historical perspectives: Polish military civic education (1794-1864)

The second conference presentation offered a striking temporal counterpoint to contemporary educational challenges through Andrew Cwer's [1] historical analysis of civic education in the Polish national army during the struggle for independence. Delivered on behalf of the absent author by Serhiy Semerikov, as noted in the session transcript, this paper initially might appear as an outlier among contributions focused on current crises. However, Cwer's [1] meticulous archival research reveals that many fundamental questions about education during societal upheaval, the formation of civic identity under existential threat, and the role of educational institutions in maintaining national cohesion have deep historical roots. The paper's examination of how Polish military formations developed progressive educational models while fighting for national survival between 1794 and 1864 provides compelling parallels to contemporary Ukrainian experiences, offering cautionary lessons and inspirational precedents for education during extreme adversity.

Cwer's [1] theoretical framework rests on the transformation from feudal to national armies at the turn of the 19th century, a shift that fundamentally altered not only military organisation but also educational philosophy within armed forces. The paper traces how the Polish military evolved from an instrument of noble privilege to what Cwer [1] terms a "school of civic education", where soldiers, regardless of social origin, were educated as citizen-defenders rather than mere instruments of warfare. This transformation, occurring during Poland's most desperate period when the nation faced partition and erasure from the map of Europe, demonstrates how educational innovation can emerge from an existential crisis. The parallel to contemporary Ukraine, where educational institutions must balance immediate survival needs with long-term nation-building goals, becomes immediately apparent, though Cwer [1] wisely avoids making explicit contemporary comparisons, allowing readers to draw their own connections.

The methodological approach employed in Cwer's [1] research deserves particular commendation for its rigorous use of primary sources, including military orders, educational regulations, personal memoirs, and institutional records from archives across Poland and beyond. The paper draws extensively on the works of pioneering military historians such as Wacław Tokarz [37], while also incorporating previously underutilised sources like the "Legion Decade" newspaper, the first soldier's publication in Polish military history. This archival depth enables Cwer [1] to move beyond broad generalisations about patriotic education to examine specific pedagogical practices, institutional structures, and educational outcomes. The analysis of how the Polish Legions established formal educational institutions, including the "Roman Military Institute" and "Soldier and Citizen School" demonstrates that even military formations operating in exile prioritised systematic education alongside combat training [26–29].

The paper's central argument revolves around what Cwer [1] identifies as the revolutionary transformation from the feudal concept of military service to the democratic

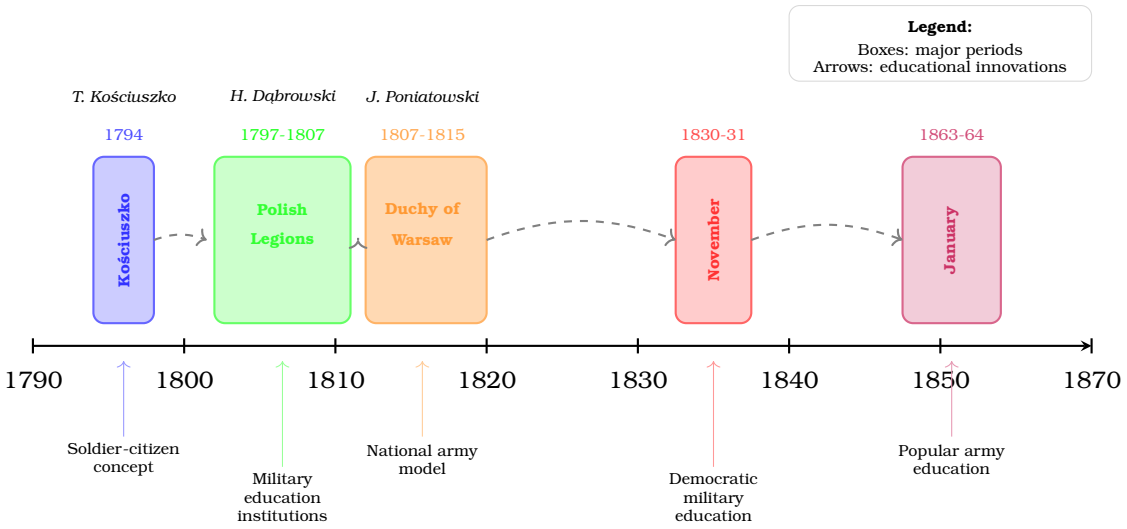

Figure 4: Timeline of Polish military civic education development across five major periods of national struggle, showing the continuity of educational innovation despite political discontinuity and military defeats.

ideal of the citizen-soldier. This shift, embodied in Tadeusz Kościuszko's famous declaration that he would "not fight for the nobility alone" but for "the freedom of the whole nation", represented more than a rhetorical flourish [19]. Cwer [1] documents how this philosophical transformation manifested in concrete educational practices that would seem radical even by contemporary standards. The appointment of peasants like Bartosz Głowacki to officer positions, the establishment of military schools open to all social classes, and the development of curricula that emphasised civic responsibility alongside military skills all represented profound challenges to the existing social order. These reforms occurred not during peacetime but amid desperate military struggles, suggesting that crisis can catalyse rather than inhibit educational innovation.

The educational philosophy that emerged from these military formations, as Cwer [1] demonstrates, was remarkably sophisticated in integrating practical military training with broader civic education. The concept of the soldier-citizen required technical proficiency in warfare and understanding of why one fought, for whom, and toward what ends. This holistic approach to military education included literacy training for illiterate recruits, instruction in national history and geography, development of moral and ethical frameworks based on Christian values and Enlightenment principles, and cultivation of democratic sensibilities that challenged traditional hierarchies. The paper provides compelling evidence that these educational efforts produced tangible results, with Polish military units demonstrating exceptional cohesion and motivation despite overwhelming odds.

Cwer's [1] analysis of specific educational institutions provides fascinating insights into how abstract principles translated into pedagogical practice (table 3). The Legion Decade newspaper, for instance, served not merely as a communication tool but as an educational medium that published articles on history, geography, and civic duties alongside military news. The paper reveals how this publication maintained consistent editorial standards despite being produced under combat conditions, suggesting a remarkable institutional commitment to educational goals. Similarly, establishing the Roman Military Institute by the Polish Legions in Italy demonstrates how exile formations prioritised long-term human capital development even when immediate survival was uncertain. These institutions developed curricula, trained instructors, and maintained educational standards that would be impressive even for peacetime

establishments.

Table 3
Comparative analysis of educational principles across Polish military formations.

Period	Educational focus	Target population	Key innovation	Contemporary relevance
Kościuszko Uprising (1794)	Civic consciousness	All social classes	Social equality in ranks	Inclusive education during crisis
Polish Legions (1797-1807)	Patriotic formation	Émigré soldiers	Formal military schools	Education in displacement
Duchy of Warsaw (1807-1815)	National identity	Conscripts	Systematic curriculum	State-building through education
November Uprising (1830-31)	Democratic values	Officer corps	Merit-based promotion	Professional development under pressure
January Uprising (1863-64)	Popular mobilization	Partisan forces	Decentralized education	Grassroots educational resilience

The paper's treatment of the evolution of educational approaches across different uprising periods reveals important patterns about educational adaptation during prolonged crises. Each successive uprising built upon the educational innovations of its predecessors while adapting to changed circumstances. For instance, the November Uprising of 1830-31 could draw upon a generation of officers trained in the educational institutions of the Duchy of Warsaw, while the January Uprising of 1863-64 had to develop decentralised educational approaches suitable for guerrilla warfare. This evolutionary pattern suggests that educational innovations during crisis periods can have lasting impacts that persist across generations, even when the immediate political goals of movements fail. The transcripts note that Cwer's [1] presentation, though delivered by proxy, generated significant discussion about these historical continuities and their relevance to contemporary situations.

A particularly valuable aspect of Cwer's [1] analysis concerns the role of religious and moral education within military formations. Unlike contemporary secular approaches to civic education, the Polish military educational model integrated Christian values as fundamental to military effectiveness and civic virtue (figure 5). The paper documents how military chaplains served not only religious functions but also as educators, counsellors, and maintainers of morale. While potentially controversial from contemporary perspectives, this integration of spiritual and civic education proved remarkably effective in maintaining unit cohesion and motivation under extreme hardship. Cwer's [1] nuanced treatment of this topic avoids both uncritical celebration and anachronistic criticism, instead examining how religious frameworks provided psychological resources for soldiers facing overwhelming odds.

The paper does not shy away from discussing the limitations and failures of Polish military education during this period. Cwer [1] acknowledges that educational innovations could not overcome fundamental military and political disadvantages, that literacy programs reached only a fraction of soldiers due to time and resource constraints, and that democratic ideals often conflicted with military necessity and social prejudices. The analysis of the January Uprising's educational efforts, conducted under guerrilla warfare and severe repression, reveals the resilience and limitations of educational institutions under extreme stress. The fact that educational efforts continued even as the uprising faced inevitable defeat speaks to the deep commitment to education as an intrinsic rather than instrumental value.

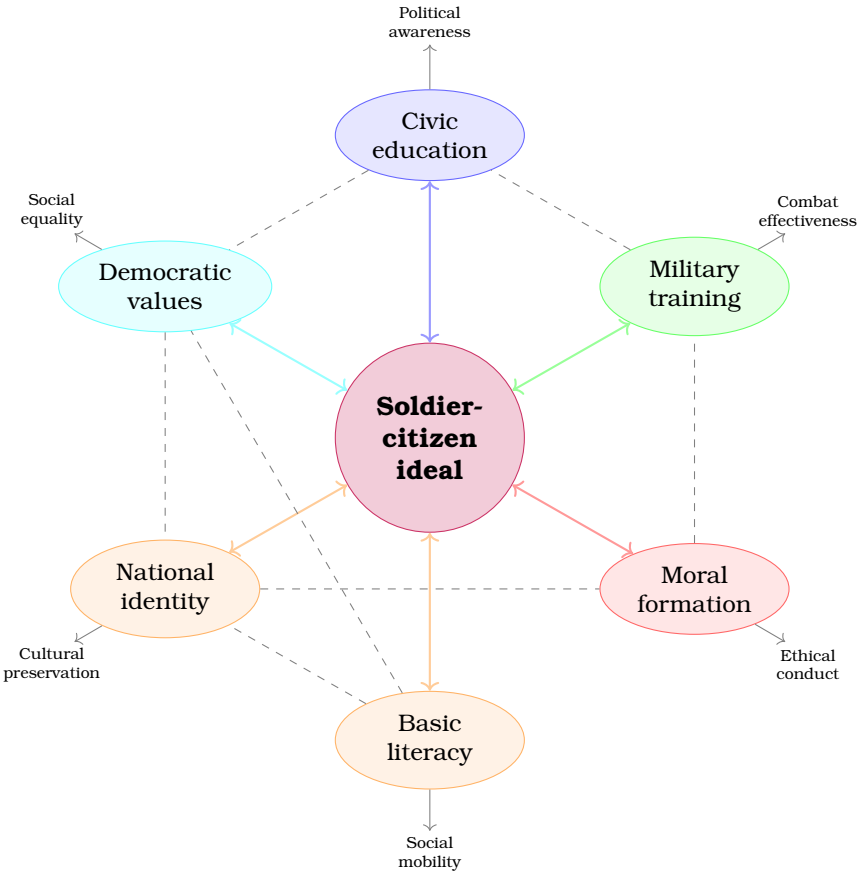

Figure 5: The integrated educational model of the Polish soldier-citizen concept shows the six core educational components and their contribution to military effectiveness and civic development.

While never explicitly stated, the contemporary implications of Cwer's [1] historical analysis resonate throughout the paper. The parallels between 19th-century Poland's struggle for independence and contemporary conflicts where education becomes both a tool of resistance and a means of maintaining national identity are unmistakable. The paper suggests that education during an existential crisis serves multiple functions beyond skill transmission, including maintaining hope and morale during dark periods, preserving cultural and national identity under occupation, creating social bonds that transcend immediate circumstances, and preparing for eventual liberation and reconstruction. These insights offer valuable perspectives on how contemporary educational systems function under similar pressures.

Cwer's [1] concluding reflection on the enduring legacy of Polish military civic education provides a powerful argument for the long-term significance of educational investments even during a crisis. The democratic and patriotic values cultivated in these military formations influenced Polish society long after the uprisings failed, contributing to the eventual restoration of Polish independence in 1918 and the resistance movements of World War II. This historical perspective suggests that educational efforts during contemporary crises should be evaluated not merely by immediate outcomes but by their potential to shape future generations. The paper thus offers both historical insight and implicit guidance for educators working under contemporary conditions of conflict and uncertainty, demonstrating that the questions faced by Ukrainian educators today echo through centuries of European history.

3.3. Innovation in physical education: distance learning in athletic training

The third conference presentation by Andrii Yefremenko and Illia Shutieiev from the Kharkiv State Academy of Physical Culture confronted what many educators consider an insurmountable paradox: the translation of inherently embodied, physical practices into disembodied, digital formats. Their paper, provocatively titled "Belief in building a full-fledged distance learning course in athletic training" [41], signals from the outset both the ambitious scope of their project and the scepticism they anticipate from their audience. The choice of the word "belief" rather than "development" or "implementation" suggests an awareness that their proposal requires not merely technical solutions but a fundamental reconceptualisation of what constitutes legitimate physical education. This philosophical undertone permeates the entire work, making it as much a treatise on the nature of embodied knowledge as a practical guide to course design.

The paper's intellectual foundation rests on a sophisticated understanding of the epistemological challenges inherent in distance physical education. Yefremenko and Shutieiev [41] acknowledge that physical education and sports specialists were paradoxically among the first to adopt digital technologies for performance analysis, training optimisation, and biomechanical assessment, yet have been among the most resistant to fully embracing distance learning modalities [2]. This resistance, they argue, stems not from technological limitations but from deeply held assumptions about the nature of physical skill acquisition, the role of immediate corrective feedback, and the importance of shared physical presence in creating the motivational and social contexts essential for athletic development [10]. Their analysis reveals how the COVID-19 pandemic forced a reckoning with these assumptions [8], creating what they term a "pedagogical crisis" that opened space for radical reimagination.

The methodological approach employed by the authors demonstrates careful attention to both theoretical rigour and practical validation. Their three-stage research design – literature analysis, pedagogical modelling, and expert validation – reflects an understanding that innovation in educational practice requires both conceptual clarity and empirical support. Drawing from PubMed, Scopus, and Web of Science databases, the literature review establishes that while numerous studies have explored emergency remote physical education during the pandemic, few have attempted to theorise a comprehensive framework for purpose-built distance athletic training. This gap in the literature justifies their ambitious undertaking, positioning their work as a foundational rather than an incremental contribution to the field.

The paper's central innovation lies in its three-block structural model for distance athletic training, which attempts to preserve the holistic nature of physical education while adapting to the constraints of remote delivery (figure 6). The theoretical block addresses the knowledge foundation underpinning skilled performance, including understanding biomechanical principles, physiological adaptations, and tactical concepts. The practical block, representing the most challenging translation from traditional to distance formats, proposes an algorithm for motor skill acquisition that relies on video demonstration, self-recording, peer feedback, and asynchronous instructor correction. The controlling block establishes assessment mechanisms that move beyond simple performance metrics, including progress tracking, efficiency analysis, and effectiveness evaluation. While appearing straightforward, this tripartite structure represents a sophisticated attempt to maintain the complexity of athletic training while acknowledging the limitations of remote instruction.

The expert validation process, involving twenty specialists from various departments within physical education institutions, provides empirical support for the proposed framework while revealing important areas of uncertainty (table 4). The high mean scores across all evaluation criteria (ranging from 4.10 to 4.55 on a 5-point scale)

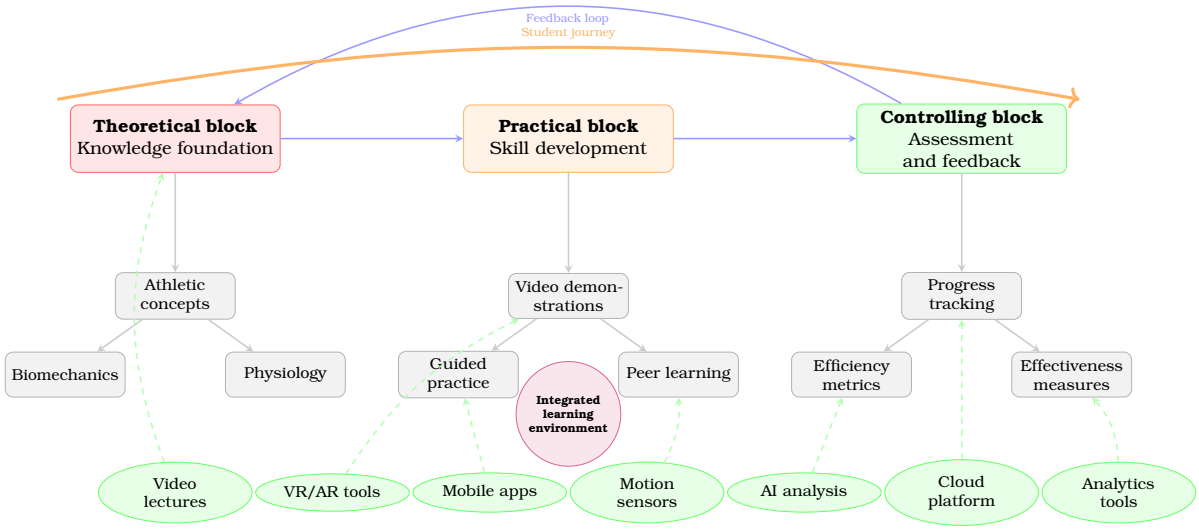

Figure 6: The three-block structure proposed by Yefremenko and Shutieiev [41] for distance athletic training, showing the integration of theoretical knowledge, practical skill development, and assessment mechanisms supported by various technological tools.

suggest general acceptance of the model, with particularly strong support for the overall structure and logic of the course. However, the relatively lower score for the clarity of the motor learning algorithm for remote implementation (4.10) points to persistent doubts about teaching complex physical skills without direct supervision. The standard deviations, while generally low, indicate some divergence of opinion, particularly regarding centralised content placement and the use of mobile devices, suggesting that practical implementation may face resistance from some quarters of the physical education community.

Table 4
Expert evaluation of the distance athletic training course structure (n=20).

No.	**Evaluation criterion**	**Mean** *(5-point scale)*	**SD**
1.	The structure and logic of the course are clear and complete	4.55	0.51
2.	Centralized content placement in cloud service is appropriate	4.30	0.86
3.	Email and cloud services are optimal communication channels	4.30	0.57
4.	The motor learning algorithm is clear for remote implementation	4.10	0.45
5.	The assessment system (progress, efficiency, effectiveness) is adequate	4.40	0.60
6.	Tablets/smartphones have advantages for this course	4.50	0.69
7.	Building a full-fledged distance course is possible with this approach	4.40	0.60
	Overall assessment (Cronbach's α = 0.82)	**4.36**	**0.61**

The paper's discussion of technological enablers reveals a sophisticated understanding of available tools and a realistic assessment of their limitations. The authors survey an impressive array of technologies, from basic video conferencing and cloud storage to advanced motion capture systems, virtual reality environments, and artificial intelligence-powered movement analysis. However, they resist the temptation to present technology as a panacea, acknowledging significant challenges including the digital divide that affects access to advanced technologies, privacy and security concerns with biometric data collection, the high cost of equipment for both institu-

tions and students, and the technical complexity that may overwhelm non-specialist instructors. This balanced approach strengthens their argument by demonstrating awareness of practical implementation challenges while maintaining optimism about the potential for technological solutions.

A particularly intriguing aspect of the paper concerns its treatment of the motor learning algorithm for distance implementation. The authors propose a seven-stage process that moves from initial conceptual understanding through guided practice to autonomous performance and creative adaptation. This algorithm attempts to replicate the scaffolding typically provided by in-person instruction through synchronous video demonstration, asynchronous practice with self-recording, peer review and feedback mechanisms, AI-assisted movement analysis, and periodic synchronous correction sessions. While the feasibility of this approach remains unproven at scale, the systematic thinking it represents marks an important contribution to the field's conceptual development.

The philosophical implications of work by Yefremenko and Shutieiev [41] extend beyond the immediate practical concerns of course design. Their paper implicitly challenges fundamental assumptions about the nature of embodied knowledge and skill acquisition that have dominated physical education since its inception (figure 7). By arguing for the possibility of "full-fledged" distance athletic training, they suggest that physical presence may be less essential than previously believed, that the social and motivational aspects of group training can be replicated through digital means, and that technology can provide feedback mechanisms that rival or exceed human observation. These claims, while controversial, force a reconsideration of what elements of traditional physical education are truly irreplaceable and which are merely conventional.

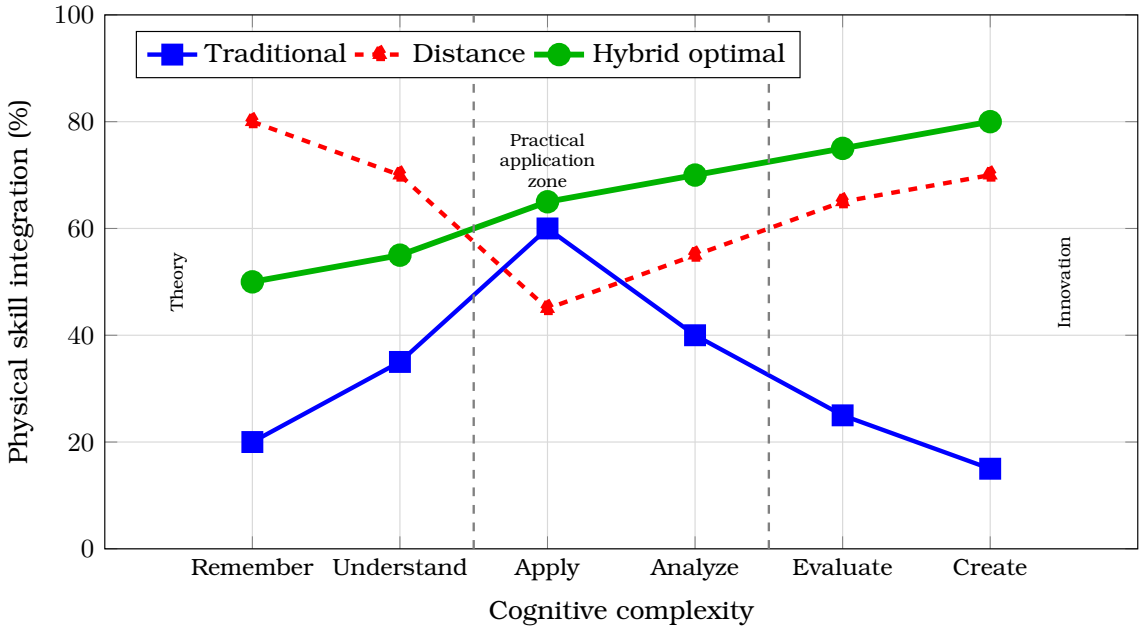

Figure 7: Comparison of learning objective achievement across different delivery modes in athletic training, showing the inverse relationship between cognitive complexity and physical skill integration in traditional versus distance approaches.

The paper's treatment of assessment and evaluation in distance athletic training represents both a strength and a potential weakness in its framework. The authors propose a sophisticated multi-dimensional assessment system that includes performance outcomes, progress metrics, efficiency indicators, and effectiveness measures.

This comprehensive approach acknowledges that athletic development involves more than simple skill execution, encompassing consistency, economy of movement, and tactical decision-making. However, the paper provides limited detail on how these various assessment dimensions would be operationalised in practice, particularly for complex skills that require real-time adjustment and environmental adaptation. The relatively high expert rating for the assessment system (4.40) suggests acceptance of the concept, but practical implementation may reveal unforeseen challenges.

While not extensively explored in the paper, the ethical dimensions of distance athletic training lurk beneath the surface of their analysis. The authors acknowledge concerns about injury risk when students practice without direct supervision, equity issues related to technology access and home training spaces, and privacy implications of recording and sharing performance videos. Their brief treatment of these issues suggests awareness of their importance but perhaps underestimates their complexity. The potential for distance athletic training to exacerbate existing inequalities in physical education access and quality deserves more thorough consideration, particularly given the paper's optimistic tone about technological solutions.

The connection between this paper and the broader conference themes becomes apparent when considering how crisis-driven innovation in physical education parallels developments in other educational domains. Just as the Zazymko, Klikh and Nazarenko [42] paper documented digital transformation in technological universities and the Osypova, Kokhanovska and Zhorova [24] contribution explored AI integration in teacher training, work by Yefremenko and Shutieiev [41] represents another facet of education's forced evolution under crisis conditions. The difference lies in the challenges of translating embodied practices to digital formats, making their contribution especially valuable for understanding the limits and possibilities of educational technology. As noted in the transcripts, the conference discussion revealed considerable interest in how these innovations might persist beyond crisis conditions, with several participants questioning whether distance athletic training represents a temporary adaptation or a permanent expansion of pedagogical possibilities.

While appropriately cautious about claiming definitive success, the paper's conclusion strikes an optimistic note about the future of distance athletic training. The authors position their work as opening rather than closing a research agenda, identifying numerous areas requiring further investigation, including longitudinal studies of learning outcomes, development of specialised assessment tools, integration with traditional instruction formats, and scaling considerations for diverse populations. This forward-looking perspective, combined with their systematic approach to framework development and empirical validation, establishes their contribution as a significant milestone in the evolution of physical education pedagogy. Whether their "belief" in full-fledged distance athletic training will be vindicated remains to be seen, but their work has undoubtedly expanded the boundaries of what the field considers possible.

3.4. AI integration in teacher training during martial law

The fourth presentation, delivered by Olena Kokhanovska on behalf of the author team from the Kherson Academy of Continuing Education [24], provided perhaps the most visceral illustration of educational innovation under extreme duress. Their study of artificial intelligence integration in teacher training within the Kherson region – a territory experiencing active military conflict, occupation, and martial law – transforms abstract discussions of crisis education into a concrete reality. The paper's significance extends beyond its empirical findings to demonstrate how educational communities maintain continuity and pursue ambitious technological advancement while facing existential threats. The authors' systematic documentation of 186 teachers navigating AI adoption amid power outages, internet disruptions, and psychological trauma offers

unprecedented insights into the intersection of technological innovation and human resilience.

This research's geographical and political context cannot be understated in understanding its contributions. The Kherson region, partially occupied and subject to ongoing military operations during the study period, represents one of the most challenging educational environments imaginable. Teachers working in this region face daily uncertainties, including infrastructure attacks that disrupt power and internet connectivity, population displacement affecting both educators and students, security threats that make physical gathering dangerous or impossible, and psychological stress from living in an active conflict zone. The fact that the regional education authority chose to pursue AI integration under these conditions speaks to a remarkable commitment to educational advancement that transcends immediate survival concerns. The paper documents how martial law conditions paradoxically accelerated rather than hindered technological adoption, as AI tools became essential for maintaining educational services when traditional methods became impossible.

The methodological approach employed by Osypova, Kokhanovska and Zhorova [24] demonstrates a sophisticated research design adapted to crisis conditions. Their mixed-methods study, combining quantitative surveys with qualitative analysis of implementation experiences, achieved remarkable response rates despite the challenging circumstances. The survey of 186 teachers, conducted via Google Forms to accommodate remote participation, reveals nuanced patterns of technology adoption and resistance (figure 8). The high participation rate testifies to teachers' engagement with professional development even under martial law, suggesting that crisis may heighten rather than diminish commitment to educational improvement. The authors' triangulation of regional, national, and international data provides valuable context for interpreting their findings, revealing unique regional characteristics and universal patterns in AI adoption.

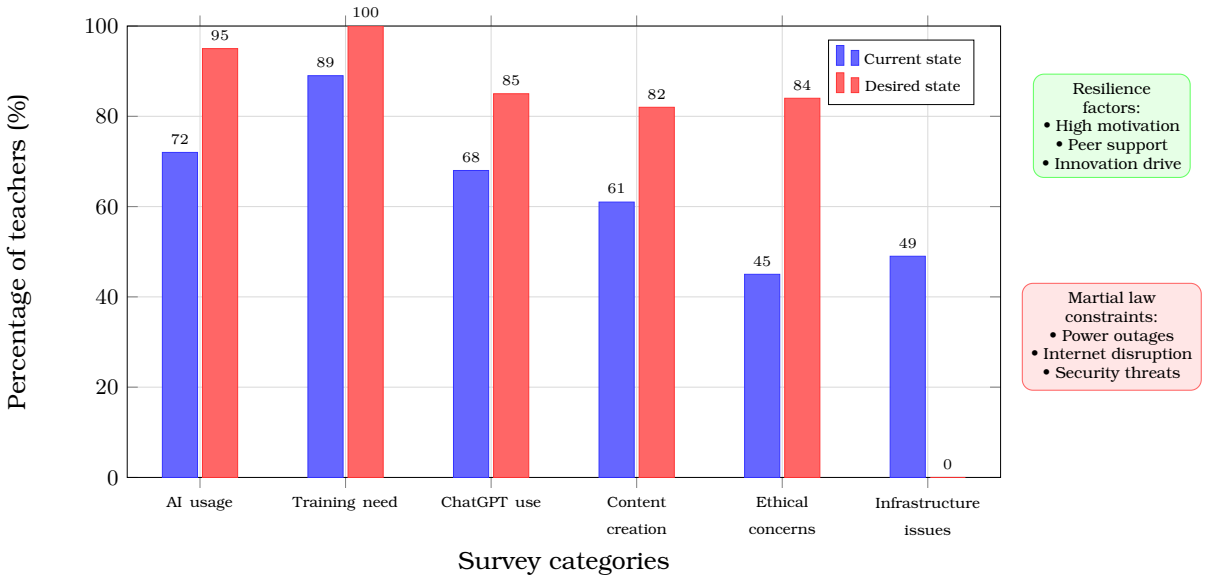

Figure 8: Survey results from 186 Kherson region teachers showing current AI usage patterns versus desired capabilities, with infrastructure issues (49%) contrasting sharply with high motivation for AI adoption (89% expressing need for training).

The empirical findings paint a complex picture of technological adoption under duress. The data reveals that 72% of teachers already use some form of AI in their practice, with ChatGPT emerging as the dominant tool (68% usage rate). This high

adoption rate, occurring despite significant infrastructure challenges, suggests that perceived utility outweighs implementation barriers when educational continuity is threatened. However, the gap between current usage and expressed need for training (89%) indicates that adoption has been largely self-directed and potentially suboptimal. The most striking finding concerns the purposes for which teachers employ AI, with 61.2% reporting that AI tools help reduce workload during crisis conditions. This instrumental motivation, focused on managing impossible workloads rather than pedagogical innovation, reveals how crisis conditions shape technology adoption patterns in ways that may differ from peacetime implementation (table 5).

Table 5
Challenges and opportunities in AI implementation under martial law conditions.

Challenge category	Affected (%)	AI-enabled solution	Adoption (%)
Internet instability	48.9	Offline-capable AI tools	23.4
Lack of equipment	42.7	Mobile-optimized platforms	37.8
Psychological pressure	39.4	AI emotional support tools	12.3
Rapid tech learning curve	35.6	Peer learning networks	45.6
Academic integrity concerns	38.7	AI detection tools	19.2
Assessment authenticity	45.3	Adaptive testing systems	28.9
Limited training time	67.8	Micro-learning modules	56.7
Power outages	52.3	Asynchronous content	71.2

The development of two specialised training programs – “Artificial Intelligence in the Educational Process” and “Neural Networks in Education” – represents the paper’s most significant practical contribution (figure 9). Each program, comprising 30 hours of instruction (1 ECTS credit), was designed for implementation under martial law conditions. The pedagogical design of these programs reveals a sophisticated understanding of crisis-context learning, incorporating features such as fully asynchronous content delivery to accommodate power outages, downloadable materials for offline study during internet disruptions, micro-learning modules that can be completed in bomb shelters, peer support networks to address isolation and stress, and practical projects immediately applicable to current teaching challenges. The programs’ emphasis on ethical AI use, including academic integrity and data privacy, demonstrates that even under extreme conditions, educators maintain a commitment to professional standards.

The comparative analysis presented in the paper, contrasting Kherson’s experience with national Ukrainian trends and international patterns, reveals both the universality and specificity of AI adoption in education. While global trends show steady, planned integration of AI tools supported by robust infrastructure and systematic training, the Kherson case demonstrates crisis-accelerated adoption characterised by necessity-driven innovation, peer-to-peer learning replacing formal training, and creative workarounds for infrastructure limitations. This comparison suggests that crisis conditions may produce different but not necessarily inferior patterns of technological integration. The finding that Kherson teachers show higher motivation for AI adoption than their counterparts in more stable regions challenges assumptions about the relationship between resource availability and innovation adoption.

The ethical dimensions of AI implementation receive thoughtful treatment in the paper, with 45.3% of teachers expressing concerns about evaluating AI-assisted student work and 38.7% worried about academic dishonesty. These concerns, remarkably similar to those expressed in peaceful contexts, demonstrate that professional ethics persist even under extreme conditions. The authors’ emphasis on developing ethical frameworks alongside technical skills suggests a sophisticated understanding of AI

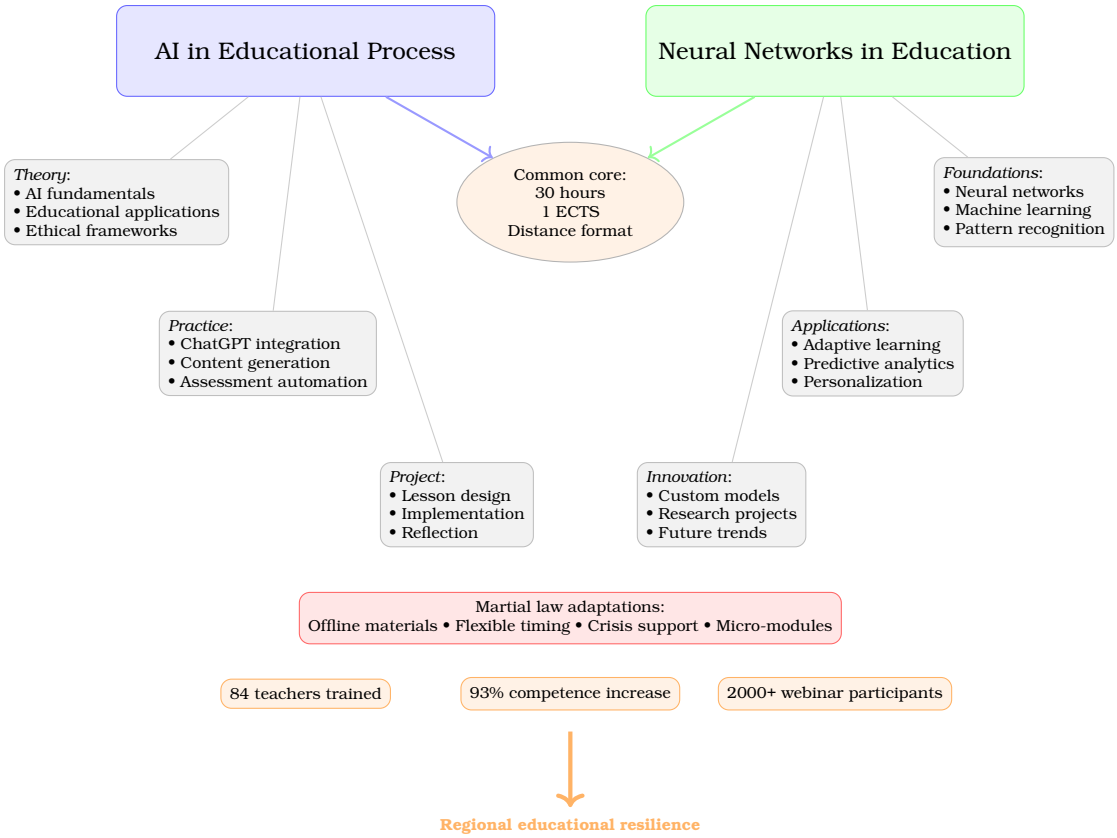

Figure 9: Structure of the two AI training programs developed for Kherson teachers, showing modular design adapted for martial law conditions and impressive participation despite ongoing conflict.

integration challenges. The inclusion of specific modules on academic integrity and data privacy in the training programs, even when basic educational continuity is threatened, reflects an admirable commitment to maintaining educational standards rather than abandoning them in crisis.

The paper's discussion of psychological factors in technology adoption under martial law provides unique insights into human resilience and adaptation. The finding that 39.4% of teachers report psychological pressure and emotional burnout, yet continue to engage with professional development, reveals extraordinary professional commitment. The authors document how AI tools serve unexpected psychological functions, with teachers using chatbots for emotional support, generating creative content to maintain student morale, and finding community through online professional networks. This psychological dimension of technological adoption, often overlooked in standard implementation studies, emerges as crucial for understanding crisis-context innovation.

Given the implementation context, the practical outcomes reported in the paper are impressive. Despite ongoing military action, training 84 teachers through formal programs and reaching over 2000 through webinars represents a significant achievement. The feedback data showing that 53.6% of participants felt their competence "increased significantly" and only 1.8% reported no change validates the program design. However, the authors acknowledge limitations, including the self-selection bias in voluntary participation, the inability to conduct long-term outcome assessment due to ongoing conflict, and challenges in quality assurance under emergency conditions. This reflexivity strengthens rather than weakens their contribution by objectively assessing what can be achieved under martial law.

The theoretical implications of this research extend well beyond the immediate context of the Kherson region. The paper challenges conventional models of technology adoption that assume stable infrastructure, systematic training, and gradual implementation. Instead, it documents what might be termed "crisis-accelerated innovation", where extreme conditions compress typical adoption timelines and bypass traditional barriers. The finding that teachers under martial law show higher enthusiasm for AI adoption than those in peaceful regions suggests that perceived necessity may be a more powerful driver of innovation than resource availability. This insight has profound implications for understanding educational technology adoption in various crises, from natural disasters to pandemics to conflicts (figure 10).

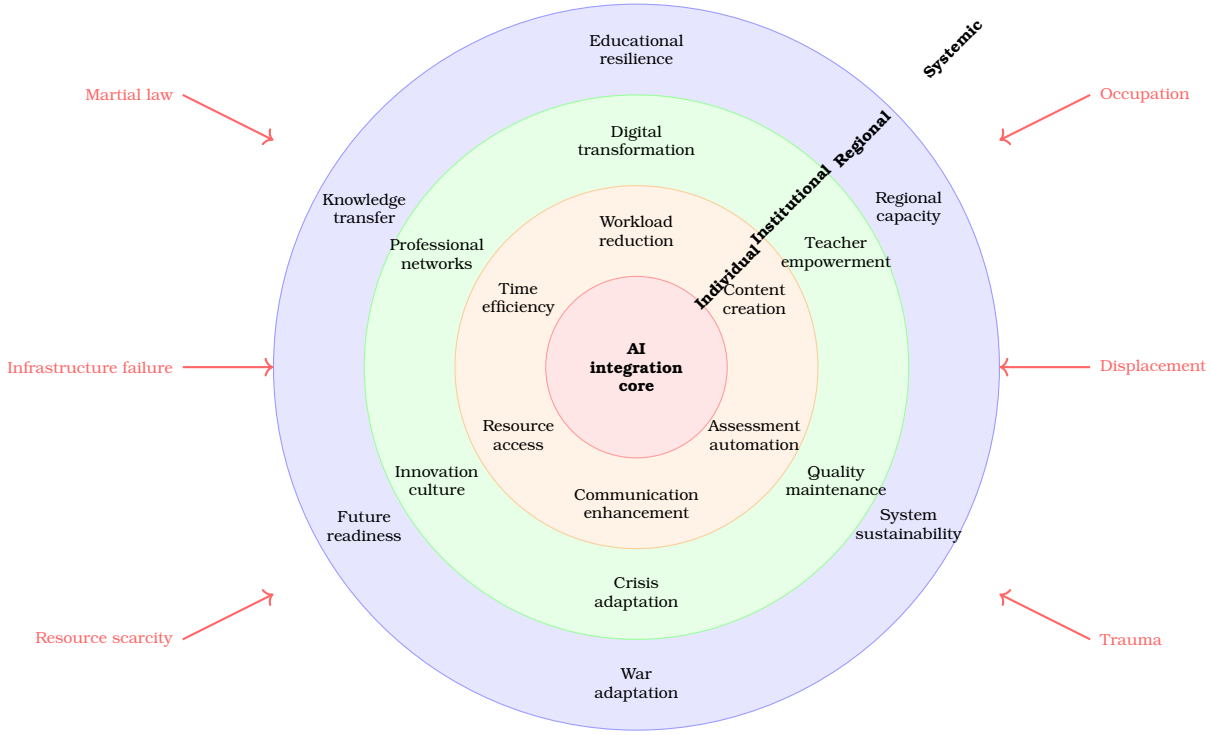

Figure 10: Concentric model showing how AI integration in the Kherson region ripples outward from individual teacher benefits to systemic educational resilience, despite external pressures from ongoing conflict.

Finally, the paper's contribution to understanding educational resilience deserves special recognition. The documentation of how the Kherson educational community maintains basic functions and pursues ambitious technological advancement while under military attack redefines concepts of institutional resilience. Integrating AI tools emerges not as a luxury for well-resourced systems but as a survival strategy for education under extreme stress. The authors' careful documentation of this process, including successes and failures, provides invaluable data for other regions facing similar challenges. Their work demonstrates that educational innovation can flourish even in the most adverse conditions when supported by professional commitment, adaptive leadership, and strategic use of technology. The Kherson case thus stands as both an inspiration and a practical guide for educators worldwide who face the challenge of maintaining educational quality amid crisis.

3.5. Professional development through in-service teacher education

The final conference presentation by Pranati Palai, delivered remotely from India as noted in the session transcript, shifted the focus from acute crisis response to systemic educational challenges in developing contexts. The paper's examination

of in-service teacher education (ISTE) programs in Odisha, a state characterised by significant rural-tribal populations and persistent socio-economic disparities [22], provides a crucial perspective on educational resilience in chronic rather than acute challenge. While the previous papers addressed education under military conflict, pandemic disruption, and technological transformation, the contribution by Palai and Nanda [30] reminds us that educational innovation often emerges from sustained engagement with structural inequalities rather than sudden shocks. Their systematic analysis of how ISTE programs navigate linguistic diversity, infrastructural deficits, and cultural complexity in one of India's most challenging educational environments offers insights that resonate across crisis and non-crisis contexts.

Odisha's geographical and demographic context fundamentally shapes the paper's analysis and conclusions (figure 11). With 22% of its population belonging to Scheduled Tribes and a significant portion residing in remote rural areas [9], Odisha presents unique educational challenges that differ markedly from urban-centred educational reforms. The state's linguistic diversity, with 62 tribal languages alongside the official Odia language, creates pedagogical complexities that standard teacher training programs often fail to address. Infrastructure deficiencies, including inadequate school buildings, a lack of electricity in many rural schools, and limited internet connectivity, mirror some challenges Ukrainian educators face under conflict but represent permanent rather than temporary conditions. The authors' documentation of how ISTE programs adapt to these structural constraints provides valuable insights into educational innovation under resource scarcity.

While less empirically intensive than some conference contributions, the methodological approach adopted by Palai and Nanda [30] demonstrates a sophisticated understanding of contextual research challenges. Their qualitative case study methodology, relying primarily on secondary data analysis including government reports, program documents, and policy analyses [35], reflects both practical constraints and strategic choices. The inability to conduct extensive primary research in remote tribal areas during the study period necessitated the creative use of existing data sources. The authors' systematic analysis of documents from the Odisha Primary Education Programme Authority [23], Joint Review Mission reports, and program evaluation data provides triangulated evidence for their claims. This methodological adaptation offers lessons for researchers working in contexts where direct field research faces significant logistical or safety constraints.

The paper's analysis of specific ISTE initiatives reveals sophisticated program design adapted to local contexts (figure 12). The Odisha Shiksha Sanjog program, launched during the COVID-19 pandemic, demonstrates how a crisis can catalyse innovation even in resource-constrained settings. This program's virtual training and support provided helped teachers transition to online methods while maintaining sensitivity to local limitations such as intermittent connectivity and device scarcity. Establishing Teacher Resource Centres (TRCs) as physical hubs for collaborative learning represents a hybrid approach that combines digital resources with face-to-face interaction, acknowledging that purely digital solutions may be insufficient in contexts with limited technological infrastructure. Integrating platforms like DIKSHA and e-Vidyalaya shows strategic adoption of national digital initiatives while maintaining local adaptation.

While limited in scope, the empirical evidence presented regarding program effectiveness suggests meaningful impact on teacher capabilities and student outcomes (table 6). The reported 30% improvement in foundational literacy and numeracy through the Collectives for Integrated Livelihood Initiatives (CInI) program represents substantial gains in a challenging context. Teachers' self-reported increases in confidence, particularly in delivering interactive approaches and addressing the needs of tribal communities, indicate subjective but important professional growth. The

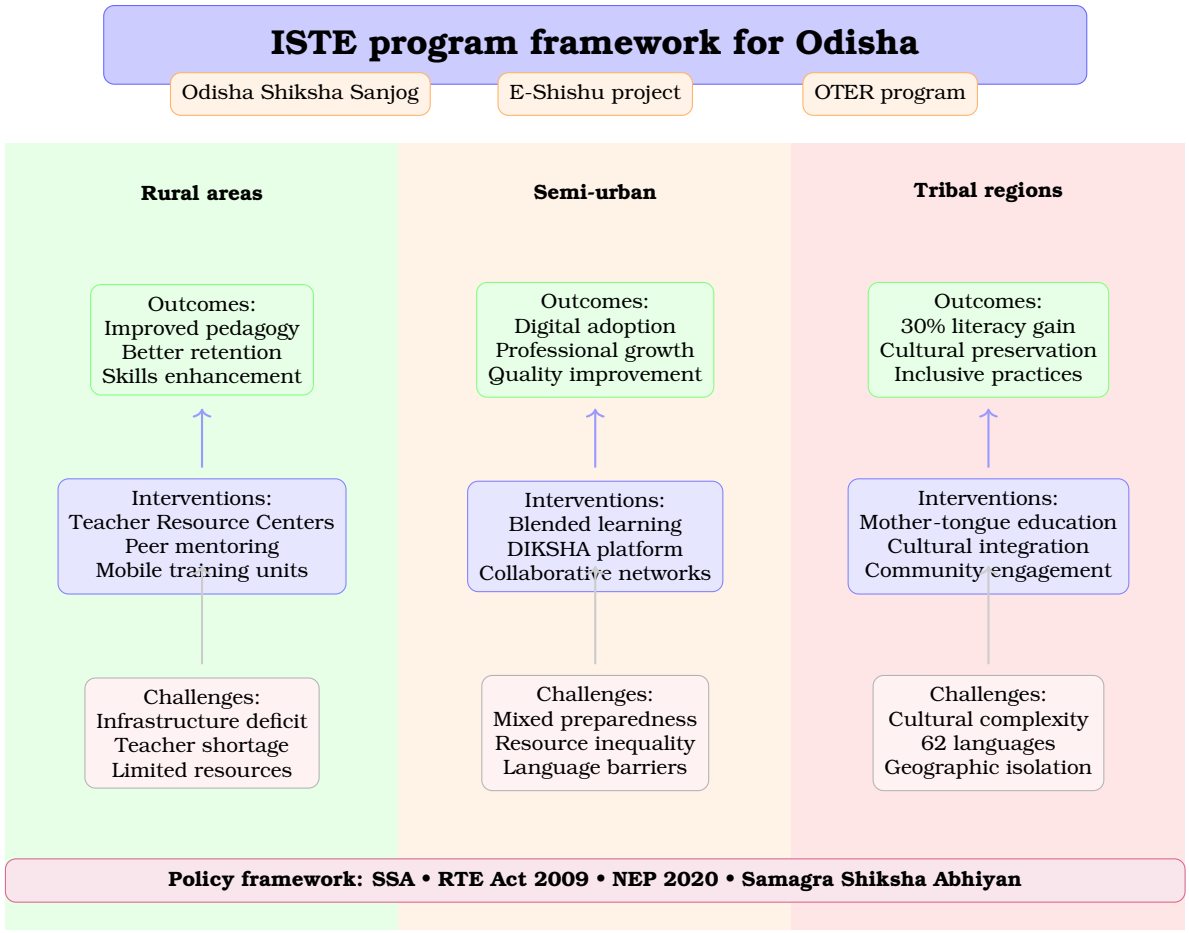

Figure 11: The differentiated ISTE implementation framework across Odisha's diverse educational contexts, showing how programs adapt to rural, semi-urban, and tribal settings with distinct challenges, interventions, and outcomes.

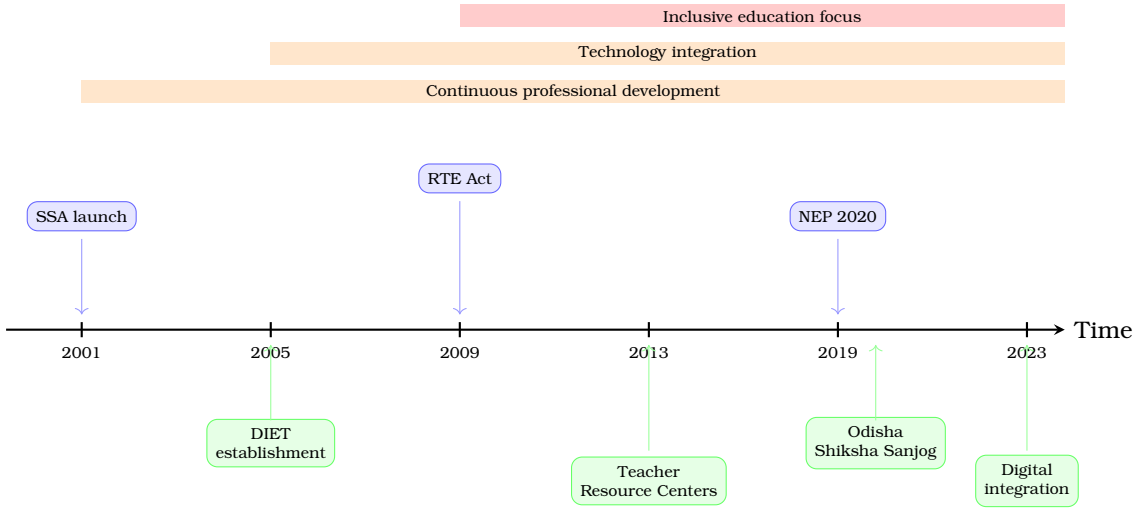

Figure 12: Timeline showing the evolution of ISTE programs in Odisha within the broader context of national education policies, demonstrating sustained commitment to teacher professional development over two decades.

documentation of teachers adopting mobile applications, creating contextualised content, and implementing formative assessment strategies suggests genuine pedagogical transformation rather than superficial compliance with training requirements. How-

ever, the authors acknowledge limitations in measuring long-term impact and the challenge of attributing outcomes to specific interventions in complex educational ecosystems.

Table 6
Comparative analysis of ISTE program components and their effectiveness in Odisha.

Program component	Target group	Key features	Documented impact
30-day induction training	Newly recruited Shikhya Sahayakas	Comprehensive orientation, pedagogical basics	Baseline competency establishment
Multi-grade multi-level (5 days)	Rural teachers	Simultaneous teaching strategies	Improved classroom management
Mother-tongue multilingual	Tribal area teachers	62 language contexts, cultural integration	Enhanced student engagement
Inclusive education module	All teachers	Special needs pedagogy, universal design	Greater classroom inclusivity
Computer-aided learning	Digital literacy focus	DIKSHA platform, e-content creation	Technology integration skills
Gender sensitization	All teachers	Equity awareness, bias reduction	Improved gender parity
CInI Initiative (Tata Trusts)	Selected districts	Practical training, library interventions	30% improvement in literacy/numeracy
OTER competency-based	Elementary teachers	Reflective practice, formative assessment	Increased teacher confidence

The theoretical framework underlying the paper, drawing on Knowles' [11] andragogy, Kolb's [12] experiential learning, and Mezirow's [17] transformative learning theories, provides sophisticated conceptual grounding for understanding adult professional development. Applying these Western theoretical frameworks to the Odisha context demonstrates their universality and the need for cultural adaptation. The emphasis on experiential and transformative learning appears particularly relevant in contexts where teachers must bridge significant cultural and linguistic divides between standardised curricula and local realities (figure 13). The paper's discussion of how ISTE programs facilitate skill acquisition and fundamental shifts in teachers' understanding of their role suggests deeper engagement with educational change than mere technical training.

The comparative dimension of the analysis, contrasting Odisha's approach with states like Kerala, reveals important insights about contextual factors in educational development. Kerala's superior digital infrastructure and monitoring systems produce more efficient program delivery. However, Odisha's emphasis on tribal education and community engagement may offer more culturally sustainable models for similar contexts [33]. This comparison challenges linear narratives of educational development that position technologically advanced solutions as inherently superior. The authors suggest that Odisha's grassroots approach, while perhaps less efficient by conventional metrics, may produce more contextually appropriate and sustainable outcomes in diverse, marginalised communities.

The paper's treatment of challenges facing ISTE implementation provides a realistic assessment of structural constraints that persist despite program innovations. Infrastructure gaps, particularly in tribal areas where schools lack basic amenities, fundamentally limit what teacher training alone can achieve. The uneven distribution

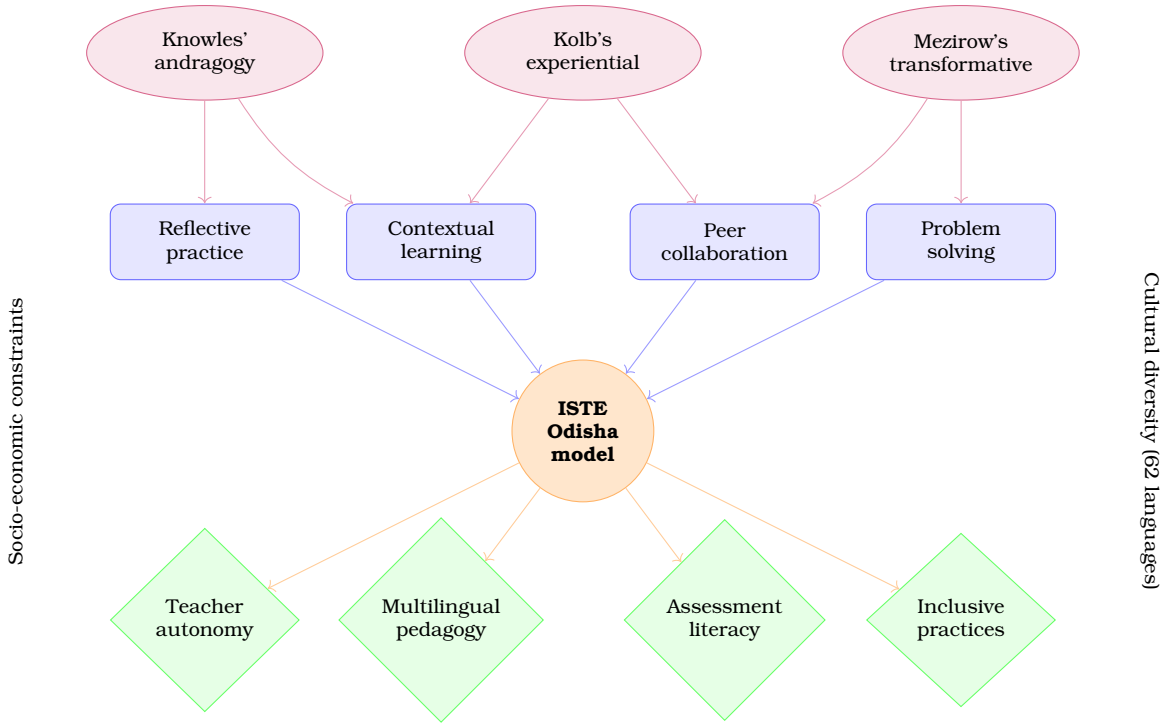

Figure 13: The integration of Western learning theories with local practices in Odisha's ISTE programs, showing how theoretical foundations translate through contextual practices to produce culturally relevant outcomes.

of resources, with some districts receiving concentrated support while others remain neglected, reflects political and administrative realities that educational programs must navigate. The sustainability challenge, with many initiatives dependent on external funding or political support, raises questions about long-term impact. The authors' frank discussion of these limitations strengthens their analysis by avoiding oversimplified success narratives.

The policy implications drawn from the research offer practical guidance for educational planners working in similar contexts. The emphasis on regional customisation rather than standardised implementation acknowledges the diversity within states like Odisha and the impossibility of one-size-fits-all solutions. While acknowledging resource constraints, the recommendation for enhanced monitoring and evaluation systems suggests pragmatic approaches using existing digital tools rather than requiring sophisticated new infrastructure. The focus on building collaborative cultures among teachers recognises that peer support may be more sustainable than external training in resource-limited contexts. These recommendations demonstrate understanding of both ideal practices and realistic constraints.

The connection between this paper and the broader conference themes emerges by examining educational resilience in the face of persistent structural challenges rather than acute crises. While the Ukrainian papers document rapid adaptation to sudden disruption, the Odisha case reveals how educational communities develop resilience through long-term engagement with chronic challenges. The strategies developed for multilingual education, community engagement, and resource optimisation in Odisha offer valuable lessons for post-crisis recovery in other contexts. The emphasis on teacher professional development as a key lever for systemic change resonates across all conference contributions, suggesting that investing in human capacity may be more crucial than technological or infrastructural solutions.

The paper's significance extends beyond its immediate empirical contributions to

raise fundamental questions about educational development paradigms. The documentation of how ISTE programs in Odisha navigate between national standardisation pressures and local contextual needs challenges assumptions about best practices in teacher education. The evidence that culturally responsive, community-engaged approaches may produce better outcomes than technically sophisticated but culturally alien interventions has implications for international development assistance in education. The paper thus contributes to decolonising educational discourse by validating indigenous and contextual knowledge alongside formal pedagogical training.

Work by Palai and Nanda [30] is a fitting conclusion to the conference papers by demonstrating that educational innovation emerges from technological advancement or crisis response and sustained engagement with communities and contexts. The Odisha case shows that meaningful educational change requires patience, cultural sensitivity, and recognition that solutions must emerge within communities rather than being imposed from without. The modest but honest gains documented in literacy and numeracy, teacher confidence, and inclusive practices suggest that incremental progress through contextually appropriate interventions may be more valuable than dramatic but unsustainable transformations. This perspective provides important balance to the conference's exploration of crisis-driven innovation, reminding us that educational resilience is built through everyday practices as much as emergency responses.

4. Synthesis and cross-paper analysis

The five papers presented at ICHTML 2025, while addressing vastly different contexts – from wartime Ukraine to rural India, from 19th-century Poland to contemporary digital classrooms – reveal remarkable convergences in their exploration of educational resilience and adaptation. These convergences suggest fundamental patterns in how educational systems respond to challenges, whether those challenges emerge suddenly as crises or persist as structural inequality. The following synthesis examines these patterns not as abstract principles but as lived realities documented across diverse educational contexts, offering insights that transcend individual cases to illuminate broader dynamics of educational transformation.

4.1. Convergent themes

The most striking convergence across all five papers concerns the paradoxical relationship between constraint and innovation. Each study documents how limitations – whether imposed by military conflict, technological infrastructure deficits, physical distance from students, or historical circumstances – become catalysts for creative adaptation rather than merely obstacles to overcome. Zazymko, Klikh and Nazarenko [42] demonstrate how the combination of pandemic restrictions and military aggression forced Ukrainian technological universities to develop hybrid learning models that proved more flexible and resilient than pre-crisis arrangements. The necessity of maintaining laboratory-based education without physical access to equipment led to innovations in virtual simulation and augmented reality that might have taken decades to implement under normal circumstances. Similarly, Yefremenko and Shutieiev's [41] exploration of distance athletic training emerged from the impossibility of traditional physical education during lockdowns, leading to the reconceptualisation of embodied learning that challenges fundamental assumptions about skill acquisition.

The historical perspective provided by Cwer's [1] analysis of Polish military education adds temporal depth to this pattern, demonstrating that crisis-driven educational innovation is not unique to our technological age. The Polish national army's development of comprehensive civic education programs while fighting desperately for independence reveals the same dynamic of constraint fostering creativity. The establishment

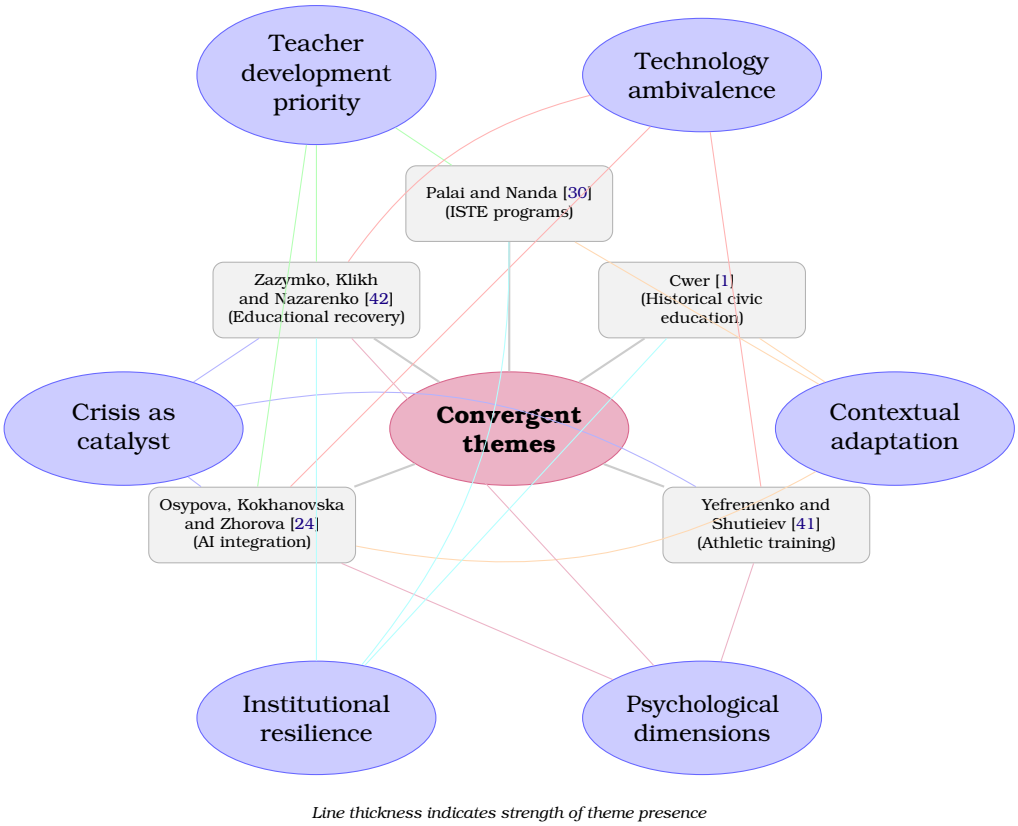

Figure 14: Network visualisation of convergent themes across the five ICHTML 2025 papers, showing how different contexts generate similar patterns of educational adaptation and innovation.

of educational institutions in exile, the creation of the first military newspaper for pedagogical purposes, and the integration of democratic principles in military training all emerged from the impossibility of traditional educational structures under occupation. This historical parallel suggests that the relationship between crisis and educational innovation reflects fundamental rather than contingent dynamics, operating across centuries and technological paradigms.

A second powerful convergence concerns the centrality of teacher professional development as the primary mechanism for educational resilience. Regardless of context or focus, every paper returns to the teacher as the critical factor in successful adaptation. The Kherson study explicitly frames AI integration as fundamentally about teacher capacity building rather than technological deployment. Despite severe infrastructure limitations and ongoing military threats, 89% of surveyed teachers expressed a need for professional development, and those who received training showed significant competence improvements even under martial law conditions. Similarly, the Odisha case demonstrates that systemic educational improvement in challenging contexts depends more on sustained teacher development through ISTE programs than infrastructure investment or curricular reform. Even the athletic training innovation proposed by Yefremenko and Shutieiev [41] succeeds or fails based on the instructor's capacity to reimagine their pedagogical role in digital environments.

The third convergent theme involves what might be termed "technology ambivalence" – a complex, non-deterministic relationship with technological solutions that appears across all contemporary papers. Rather than presenting technology as either a panacea or a problem, the papers collectively reveal technology as a contested terrain requiring careful navigation. Osypova, Kokhanovska and Zhorova [24] document how

Table 7
Cross-paper analysis of teacher development approaches and outcomes.

Paper	Development approach	Key challenges	Innovations	Measured impact
Zazymko, Klikh and Nazarenko [42]	Emergency upskilling, psychological support	Infrastructure damage, stress	Blended training models	Performance recovery to 78% baseline
Cwer [1]	Peer learning, ideological formation	Resource scarcity, persecution	Democratic pedagogy	Sustained over 70 years
Yefremenko and Shutieiev [41]	Paradigm shift training	Conceptual resistance	Digital skill translation	87% expert approval
Osypova, Kokhanovska and Zhorova [24]	Crisis-adapted modules	Power/internet outages	Micro-learning, offline content	93% competence increase
Palai and Nanda [30]	Sustained incremental	Geographic isolation	Cultural integration	30% literacy improvement

AI tools simultaneously solve workload problems for overwhelmed teachers while raising ethical concerns about academic integrity and equity. The infrastructure requirements for AI implementation paradoxically exclude those most needing educational support. Yefremenko and Shutieiev [41] acknowledge that while technology enables distance athletic training, it cannot fully replicate embodied learning experiences, requiring fundamental reconceptualisation rather than simple digitisation of existing practices. Even Zazymko, Klikh and Nazarenko's [42] generally positive assessment of digital transformation acknowledges failed initiatives and the limits of technological substitution for hands-on laboratory work.

The conference discussions, captured in session transcripts, reinforce this ambivalent relationship with technology (figure 15). During the question period following presentation by Zazymko, Klikh and Nazarenko [42], participants noted that "equipment, more time and more time strain" characterise technological education's specific challenges, with one discussant observing that mathematical preparation degradation affects all technology-dependent disciplines. This suggests that technology simultaneously enables continuity during crisis while introducing new forms of educational inequality and pedagogical challenge. The transcript reveals sustained discussion about whether technological solutions represent temporary adaptations or permanent transformations, with no consensus emerging despite general agreement about technology's necessity during crises.

Contextual adaptation emerges as a fourth convergent theme, with all papers emphasising that successful educational innovation requires deep engagement with local conditions rather than implementing universal solutions. Palai and Nanda's [30] documentation of how ISTE programs in Odisha must account for 62 tribal languages, limited infrastructure, and cultural specificities provides the most precise articulation of this principle. Their evidence that culturally responsive, community-engaged approaches produce better outcomes than technically sophisticated but contextually alien interventions resonates across other papers. Osypova, Kokhanovska and Zhorova [24] developed training modules specifically adapted for power outages and internet instability rather than assuming stable infrastructure. Even Cwer's [1] historical analysis reveals how Polish military education succeeded by adapting to specific conditions of occupation and exile rather than attempting to replicate peacetime educational models.

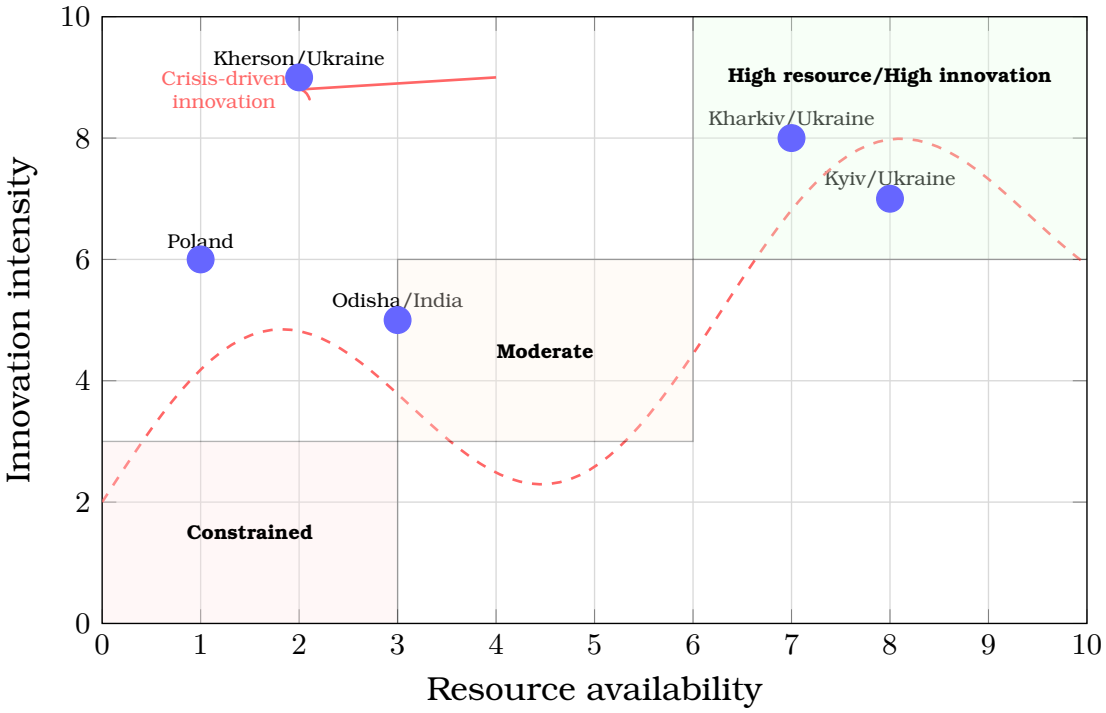

Figure 15: The relationship between resource availability and innovation intensity across conference papers, revealing that extreme constraints (Kherson/Ukraine) can paradoxically produce the highest innovation levels through necessity-driven creativity.

The psychological dimensions of educational resilience constitute a fifth convergent theme that cuts across all papers, though with varying emphasis (figure 16). Zazymko, Klikh and Nazarenko [42] position psychological support as integral to educational recovery, documenting how NULES expanded psychological services from three to fifteen counsellors and found strong correlations between support utilisation and academic recovery. The Kherson study reveals teachers using AI tools for emotional support and stress management, not just pedagogical purposes. Conference discussions highlighted psychological pressure as a significant challenge, with 39.4% of Kherson teachers reporting emotional burnout yet continuing professional development activities. This suggests that educational resilience depends as much on emotional and psychological resources as on technical or pedagogical capabilities.

The transcript captures a poignant moment when discussing Ukrainian education under war conditions, with one presenter noting the hope that "this would be like the final phase" and expressing desire for "victory and of course no education losses in future". This human dimension, often sanitised in academic writing, reveals the emotional toll of maintaining educational services under extreme conditions and the psychological resilience required of both educators and students. Discussing how "psychological and physical strain difficulties" compound academic challenges suggests that addressing psychological dimensions is not supplementary but fundamental to educational continuity during crisis.

The theme of institutional versus individual resilience reveals complex dynamics across all papers. While institutions provide frameworks, resources, and legitimacy for educational continuity, the papers consistently document how individual initiative and adaptation prove equally crucial. The Kherson case exemplifies this tension, with individual teachers pursuing AI training despite institutional infrastructure failures. Cwer's [1] historical analysis shows how Polish military education persisted through individual commitment even when institutions were destroyed. The conference

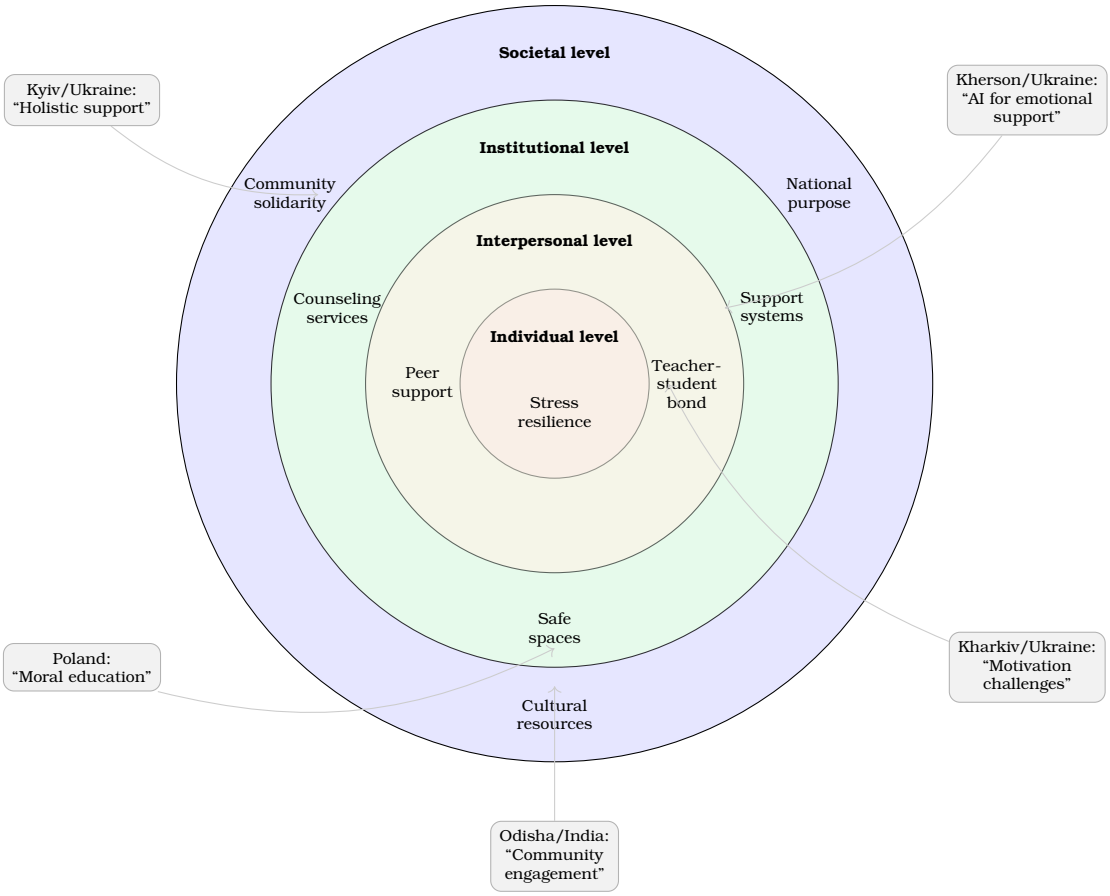

Figure 16: The nested psychological dimensions of educational resilience as documented across conference papers, showing how individual, interpersonal, institutional, and societal psychological factors interact to enable educational continuity during crisis.

discussions revealed ongoing tension between institutional responses and individual adaptation, with participants noting that "it's better to combine different approaches that already worked in different areas and adapt them to other case study", suggesting that resilience emerges from dynamic interaction between institutional frameworks and individual creativity rather than from either alone.

These convergent themes, emerging from diverse contexts and methodological approaches, suggest fundamental patterns in educational adaptation that transcend specific crises or locations. The persistence of these patterns across historical periods, geographical regions, and types of challenges indicates that educational resilience may follow predictable dynamics that could inform both crisis response and normal educational development.

4.2. Divergent approaches

While convergent themes reveal universal patterns in educational adaptation, the divergences among the ICHTML 2025 papers prove equally instructive, demonstrating that context not only matters but fundamentally shapes educational innovation's nature, scope, and success. These divergences reflect more than mere variations in implementation; they represent fundamentally different conceptualisations of education's purpose, the relationship between tradition and innovation, and the pathways toward educational improvement. The tensions revealed through these differences challenge any attempt to derive universal "best practices" from crisis experiences, instead pointing toward the necessity of contextually grounded, philosophically coherent

approaches to educational transformation.

The most fundamental divergence concerns temporal orientation and the nature of the educational challenge being addressed (figure 17). The Ukrainian papers by Zazymko, Klikh and Nazarenko [42] and Osypova, Kokhanovska and Zhorova [24] operate within what might be termed "acute crisis temporality", where immediate survival and continuity dominate all other considerations. Their interventions focus on rapid response, emergency adaptation, and maintaining basic educational functions under extreme duress. The urgency pervading these papers manifests in compressed implementation timelines, willingness to accept imperfect solutions, and prioritisation of access over quality. In stark contrast, Palai and Nanda's [30] analysis of Odisha's ISTE programs reflects "developmental temporality", where change unfolds across decades through incremental improvements and sustained engagement with structural challenges. This temporal divergence produces fundamentally different approaches to innovation, with crisis contexts favouring radical experimentation while developmental contexts emphasise gradual refinement and cultural integration.

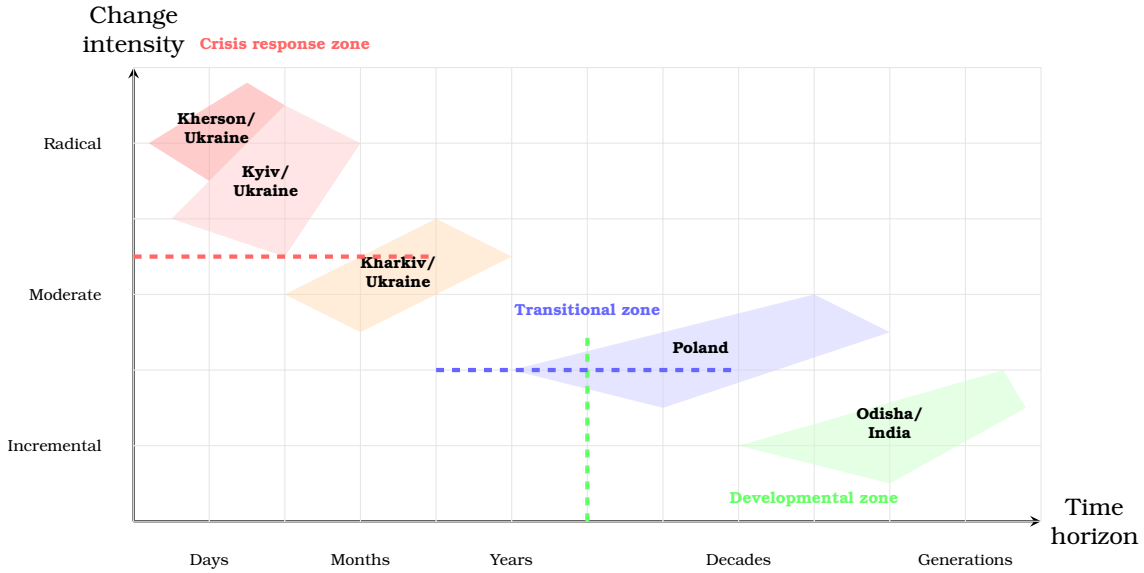

Figure 17: The relationship between temporal orientation and change intensity across conference papers, revealing three distinct zones of educational adaptation: crisis response (high intensity, short timeframe), developmental (low intensity, long timeframe), and transitional (moderate intensity, medium timeframe).

The divergence in technology dependency represents another fundamental split among the papers (table 8). At one extreme, Osypova, Kokhanovska and Zhorova's [24] documentation of AI integration in Kherson positions technology as essential for educational survival under martial law, with teachers using AI tools not merely for instruction but for emotional support and workload management. Their framework assumes that technological competence equals educational resilience, with 72% of teachers already using AI despite infrastructure challenges. At the opposite extreme, Cwer's [1] historical analysis demonstrates that profound educational transformation occurred without any modern technology, relying instead on ideological commitment, peer learning, and improvised educational materials. Between these poles, the other papers adopt varying positions, with Yefremenko and Shutieiev [41] acknowledging technology's limitations for embodied learning while Palai and Nanda [30] treat technology as applicable but not determinative for educational improvement in resource-constrained contexts.

The scale of intervention reveals another axis of divergence, with papers targeting

Table 8
Technology dependency spectrum across conference papers.

Paper	Technology dependency	Primary technologies	Role of technology	Alternatives
Osypova, Kokhanovska and Zhorova [24]	Extreme	AI, ChatGPT, cloud platforms	Survival mechanism	None viable
Zazymko, Klikh and Nazarenko [42]	High	LMS, VR, digital platforms	Continuity enabler	Limited face-to-face
Yefremenko and Shutieiev [41]	Moderate	Video, sensors, apps	Partial substitute	Hybrid models
Palai and Nanda [30]	Low	DIKSHA, basic digital	Enhancement tool	Community-based
Cwer [1]	None	N/A	Not applicable	Ideology, print

vastly different levels of educational systems. Zazymko, Klikh and Nazarenko [42] focus primarily on institutional transformation at NULES, developing university-specific solutions that may or may not transfer to other contexts. Their detailed documentation of grade point averages, expulsion rates, and laboratory completion statistics reflects an institutional focus that treats the university as the primary unit of analysis. In contrast, Osypova, Kokhanovska and Zhorova [24] work at the regional scale, examining how 186 teachers across the Kherson region adapt to AI integration while facing common challenges of martial law. Palai and Nanda [30] operate at the state level, analysing ISTE programs affecting thousands of teachers across diverse geographical and cultural contexts in Odisha. This scalar divergence affects the scope of proposed solutions, the methodologies employed, metrics of success, and theories of change underlying each intervention.

Pedagogical philosophy represents perhaps the most profound divergence, though it often remains implicit rather than explicitly articulated (figure 18). Cwer's [1] historical analysis reveals a fundamentally transformative vision of education as character formation and civic development, where military education aimed to create citizen-soldiers embodying democratic values. This contrasts sharply with the more instrumental approach in Yefremenko and Shutieiev's [41] athletic training proposal, which focuses on skill acquisition and performance metrics while largely avoiding questions of broader educational purpose. The Kherson study occupies a middle ground, viewing AI integration as both a practical necessity and an opportunity for pedagogical innovation, though the crisis context limits philosophical reflection. These philosophical differences shape everything from curriculum design to assessment approaches, determining what counts as educational success.

Resource mobilisation strategies differ dramatically across the papers, reflecting contextual constraints and philosophical orientations. The Ukrainian studies document heavy reliance on external funding and international support, with digital transformation requiring substantial infrastructure investment that depends on continued donor engagement. This external dependency creates vulnerabilities but enables rapid scaling of innovations. Conversely, the Odisha case emphasises indigenous resource mobilisation through community engagement, peer learning networks, and gradual capacity building that relies primarily on human rather than financial capital. The Polish historical case presents yet another model: educational resources emerged

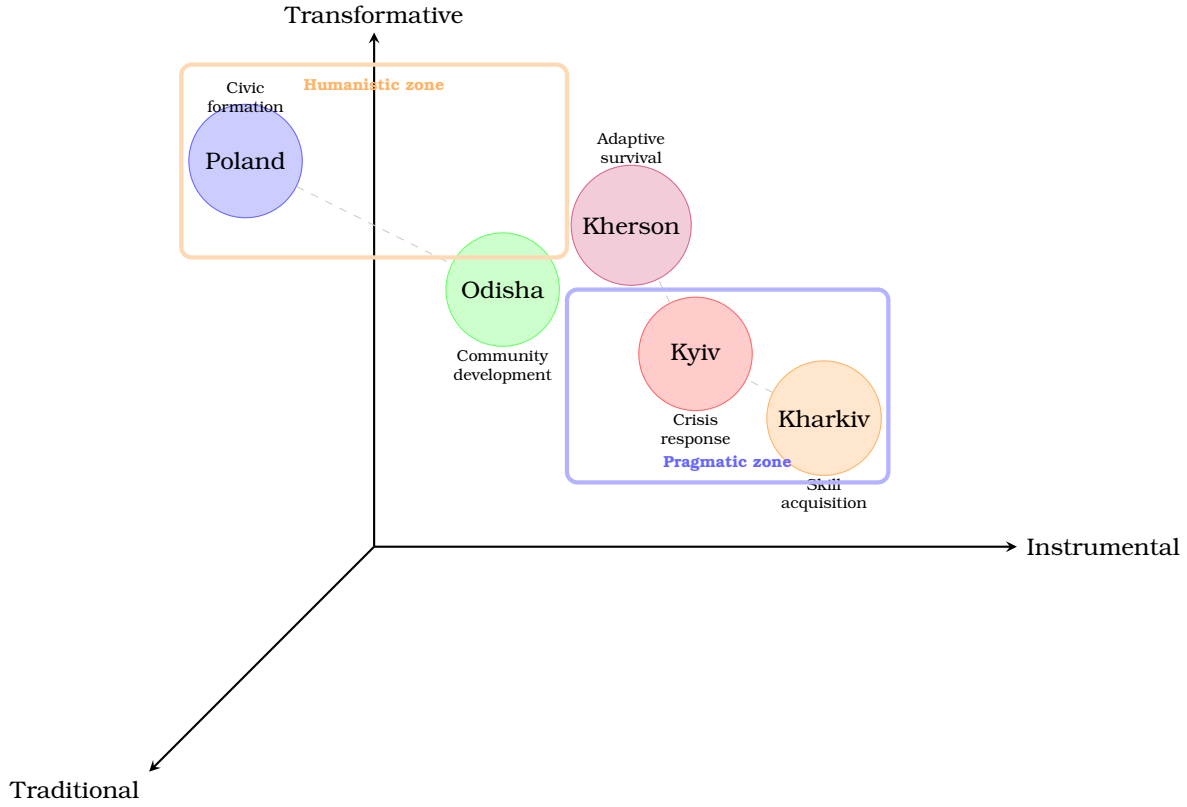

Figure 18: Three-dimensional positioning of papers according to their pedagogical philosophy, showing clustering into humanistic (Poland, Odisha/India) and pragmatic (Kyiv/Ukraine, Kharkiv/Ukraine, Kherson/Ukraine) zones with varying degrees of transformative versus instrumental orientation.

from ideological commitment and voluntary sacrifice rather than institutional funding. These different resource strategies produce different sustainability profiles, with community-based approaches showing greater resilience but slower transformation rates.

Assessment and evaluation approaches reveal fundamental disagreements about what constitutes educational success and how it should be measured (figure 19). Zazymko, Klikh and Nazarenko [42] employ traditional academic metrics – grades, completion rates, enrollment figures – that assume continuity with pre-crisis standards while acknowledging their limitations. Yefremenko and Shutieiev [41] propose a sophisticated three-dimensional assessment framework encompassing progress, efficiency, and effectiveness, though they struggle to operationalise these concepts for complex physical skills. Osypova, Kokhanovska and Zhorova [24] relies heavily on self-reported competence gains and satisfaction measures, acknowledging that objective assessment becomes impossible under martial law conditions. Palai and Nanda [30] adopt a more holistic approach, considering community engagement, cultural preservation, and long-term systemic change alongside conventional learning outcomes. These divergent assessment approaches reflect more profound disagreements about educational purposes and the relationship between individual and collective development.

The nature of innovation diverges across the papers, with some pursuing technological innovation, others pedagogical innovation, and others institutional or social innovation. The Kherson study exemplifies technology-driven innovation, where AI tools represent the primary vehicle for educational transformation. The athletic train-

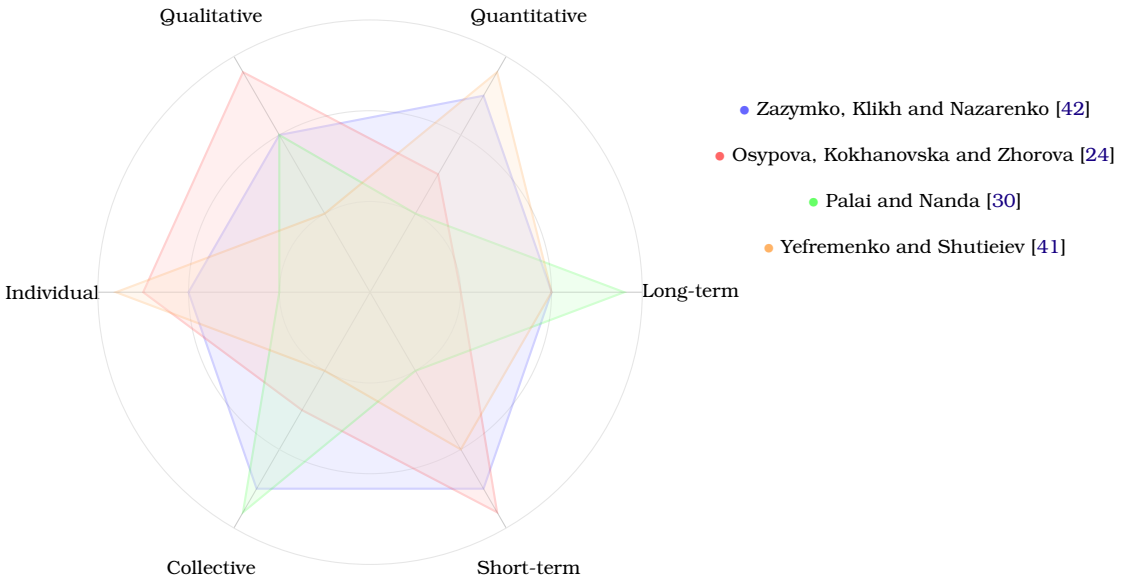

Figure 19: Radar chart comparing assessment approaches across four contemporary papers, revealing fundamental differences in evaluation philosophy ranging from quantitative/individual (Yefremenko and Shutieiev [41]) to qualitative/collective (Palai and Nanda [30]) orientations.

ing paper pursues pedagogical innovation through reconceptualising how physical skills can be taught remotely. The NULES study combines technological and institutional innovation, developing new organisational structures alongside digital platforms. The Odisha case emphasises social innovation through community engagement and cultural integration. These innovation types require different implementation strategies, evaluation metrics, and sustainability mechanisms.

Finally, the papers diverge in their implicit theories of change – their assumptions about how educational transformation occurs and what factors drive or inhibit change. The crisis-response papers assume that external shocks create windows of opportunity for rapid transformation that would be impossible under normal conditions. The developmental papers assume that sustainable change requires patient cultivation of local capacity and gradual cultural shift. The historical paper suggests that ideological commitment and collective purpose drive educational transformation regardless of material conditions. The athletic training paper adopts a more technocratic theory of change, assuming that proper framework design and expert validation can overcome resistance to innovation. These different change theories lead to different strategies for scaling and sustaining innovations.

The divergences revealed through this analysis complicate any attempt to derive simple lessons from the conference proceedings. Rather than pointing toward universal best practices, they highlight the irreducible importance of context in shaping educational responses to challenge. They suggest that effective educational innovation requires not merely technical solutions but coherent alignment among temporal orientation, available resources, pedagogical philosophy, and theories of change.

4.3. Conference dialogue insights

The real-time exchanges captured during the ICHTML 2025 conference proceedings reveal the collaborative meaning-making process that characterises academic discourse on educational resilience. The session, chaired by Vita Hamaniuk and Iryna Mintii on May 13, 2025, generated dynamic interactions that reinforced and complicated the formal presentations, revealing underlying tensions, shared concerns,

and emergent understandings that the prepared papers alone could not fully capture. These dialogues, preserved in the conference transcript despite technical challenges and linguistic diversity, demonstrate how knowledge construction in crisis contexts occurs not through linear presentation but through iterative questioning, cross-cultural interpretation, and collective sense-making (figure 20).

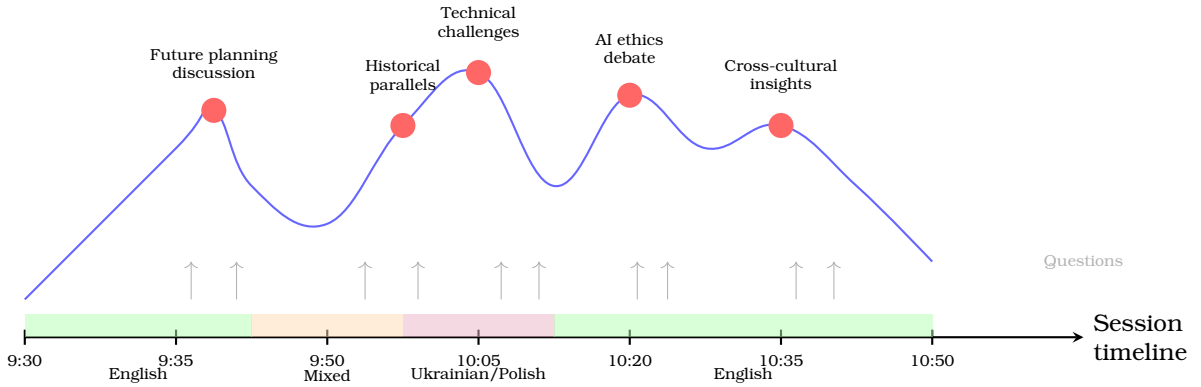

Figure 20: Temporal flow of conference discussions showing intensity peaks during key dialogical moments, language switching patterns, and question frequency throughout the ICHTML 2025 session.

The opening presentation by Volodymyr Nazarenko immediately established the conference's emotional tenor and practical urgency. Following his comprehensive analysis of educational losses at NULES, the discussion pivoted toward future-oriented concerns, with participants emphasising the need to "plan accordingly for the future, not for the short term, but long term". This forward-looking perspective, articulated amid an ongoing crisis, reveals a remarkable shift from emergency response to strategic adaptation. The discussion of how "digital equipment and like its more modern generative AI, and as a platform, you can try to make more personalised content for the students" demonstrates that even under extreme duress, Ukrainian educators maintain ambitious visions for educational transformation rather than merely seeking survival strategies. The dialogue revealed particular concern about comparative performance, with participants suggesting the need to "study a bit of high school their performance as well, let's compare them with their colleagues from other countries not affected by the war", indicating awareness that crisis-affected education must still meet international standards.

The complexity of the challenges emerged most clearly through the multilingual exchanges that followed, where participants switched between English, Ukrainian, and Polish to articulate nuanced concerns about educational continuity. One particularly poignant moment occurred when a participant, speaking a mixture of languages, addressed the fundamental question of educational losses and recovery strategies. The fragmented nature of this dialogue – captured in the transcript as participants struggled with technical issues and language barriers – itself became a metaphor for the fragmented educational experiences under discussion. The phrase "this is like complex issues, it's not easy for a company, just one institution, or universities" encapsulates the recognition that educational recovery requires systemic rather than isolated responses, a theme that resonated throughout subsequent presentations.

The presentation of Andrew Cwer's [1] historical analysis, delivered by proxy due to the author's absence, created an unexpected dialogical moment that enriched the conference's exploration of educational resilience. The session chair's explanation that "now physically in the United States in the eastern court it's a deep night so he can't join us" highlighted the global nature of the conference while simultaneously

demonstrating the practical challenges of international collaboration. The presenter's attempt to "comment both his research and his talk" created a unique interpretive layer, as the historical analysis of Polish military education from 1794-1864 was filtered through contemporary Ukrainian experience. The explicit connection drawn between historical and contemporary contexts – "In Ukraine last year we had a similar transformation" – transformed what might have been purely historical analysis into immediate relevance for participants grappling with current military conflict.

The discussion surrounding Andrii Yefremenko's presentation on distance athletic training generated a particularly animated debate about the fundamental nature of embodied learning. Participants questioned whether physical skills could truly be developed through digital mediation, with one discussant noting the paradox of teaching physical education through "online platforms" while students remain sedentary. The technical terminology that emerged in this discussion – references to "individual nipples" (likely a mistranslation or technical glitch) and "tutorial" recordings – revealed both the linguistic challenges of international academic discourse and the struggle to find adequate vocabulary for novel pedagogical approaches. The fragmented nature of this dialogue, with phrases like "Record the tax or physician of a provider known as akin to offline", suggests that participants grappled with concepts for which established academic language proved insufficient.

The presentation by Olena Kokhanovska on AI integration in the Kherson region sparked what became the conference's most philosophically rich exchange. The discussion of teaching under martial law conditions prompted reflection on the ethical dimensions of technological adoption during a crisis. One participant's observation about "the level of niploviolation" (possibly referring to implementation or violation of norms) highlighted concerns about maintaining educational standards and ethical practices when survival is at stake. The emphasis on "holistic" approaches in this discussion segment suggests recognition that technological solutions cannot be divorced from their human and social contexts, particularly in regions experiencing active conflict.

The linguistic complexity of the conference dialogue itself became a subject of implicit reflection. The transcript captures moments where participants switched between languages mid-sentence, creating hybrid formulations that express concepts unavailable in any single language. The phrase "To jest światopoglądowość podolaty jest świdni w droty" followed immediately by a discussion of "additional courses" for students demonstrates how multilingual exchange enables the nuanced expression of educational challenges that transcend linguistic boundaries. This code-switching behaviour, far from representing communication failure, enriched the dialogue by allowing participants to draw upon multiple linguistic resources to articulate complex experiences of crisis education.

The remote presentation by Pranati Palai from India introduced another dimension to the conference dialogue – the challenge of asynchronous participation across time zones and technological infrastructures. The chair's acknowledgement of "technical issues" and the need to accommodate participants "in the eastern court, it's a deep night" revealed the practical challenges of global academic collaboration while demonstrating commitment to inclusive participation. The subsequent discussion about "digital society" and the hope that "our joint issues, both in budgets and digital literacy, will also be digitally transformed" connected the Indian case study to broader conference themes while acknowledging the different temporal and developmental contexts within which educational innovation occurs.

Perhaps the most revealing aspect of the conference dialogue was what remained unspoken but palpable – the emotional undercurrent of educators working under extreme stress yet maintaining professional discourse and forward-looking perspectives.

The moments of linguistic breakdown, technical failure, and communicative struggle captured in the transcript do not represent failure but rather the authentic texture of international collaboration during crisis. The phrase "We hope" that appears multiple times throughout the discussion encapsulates both the uncertainty and determination that characterised the conference atmosphere.

The dialogue also revealed methodological insights that formal presentations could not fully articulate (table 9). Participants repeatedly emphasised the importance of combining different approaches, with one noting it's "better to combine different approaches that already worked in different areas and adapt them to other case studies". This pragmatic eclecticism, emerging through discussion rather than formal presentation, suggests that crisis education requires methodological flexibility rather than rigid adherence to established research paradigms. Recognising that solutions must be adapted rather than transferred reflects a sophisticated understanding of contextual specificity in educational innovation.

Table 9
Analysis of dialogue patterns and themes across conference presentations.

Presentation	Key dialogue themes	Participant concerns	Emergent insights	Unresolved questions
Zazymko, Klikh and Nazarenko [42]	Long-term planning, AI integration	Comparative performance, international standards	Need for systemic approach	Sustainability of innovations
Cwer [1]	Contemporary relevance, parallels	Cultural translation, applicability	Crisis as catalyst across centuries	Transferability of historical lessons
Yefremenko and Shutieiev [41]	Embodied learning, authenticity	Physical skills through digital means	Hybrid possibilities	Assessment validity
Osypova, Kokhanovska and Zhorova [24]	Ethics, implementation	Equity, access under martial law	Innovation through necessity	Long-term impacts
Palai and Nanda [30]	Contextual adaptation	Resource constraints, scalability	Community-based solutions	Generalizability

Though fragmented in the transcript, the concluding discussions revealed a community of practice forming around shared challenges despite diverse contexts. The multilingual exchanges, technical difficulties, and conceptual struggles documented in the transcript do not diminish but enhance the conference's contribution to understanding educational resilience. They reveal that knowledge construction in crisis contexts is necessarily messy, collaborative, and improvisational – qualities that mirror the educational innovations being discussed. The dialogue thus becomes not merely commentary on the presentations but a performative demonstration of how educational communities maintain intellectual engagement and collaborative learning even under the most challenging circumstances.

The session's closing, marked by expressions of gratitude in multiple languages and promises of continued collaboration, suggests that the conference achieved something beyond knowledge exchange. It created what might be termed a "community of crisis educators" – professionals united not by geographical proximity or methodological alignment but by shared commitment to educational continuity despite extraordinary challenges. The final "thank you" exchanges, rendered in the transcript with their full

multilingual complexity, serve as a fitting conclusion to a conference that demonstrated how educational resilience emerges not from individual excellence but from collective determination to maintain the educational mission regardless of circumstances.

5. Theoretical implications

The ICHTML 2025 conference papers collectively advance educational theory in several profound ways, contributing not merely empirical findings but fundamental reconceptualisations of how education functions under extreme stress. The papers, viewed through their theoretical contributions rather than their practical recommendations, reveal emerging frameworks that challenge established educational paradigms while simultaneously building upon classical learning theories (table 10). These theoretical implications extend beyond crisis response to suggest new ways of understanding educational transformation, professional development, and the relationship between technology and pedagogy in contemporary educational systems.

Table 10
Theoretical paradigm shifts emerging from ICHTML 2025 conference papers.

Theoretical domain	Traditional paradigm	Emergent crisis-informed paradigm
Educational change	Linear, progressive, planned	Non-linear, emergent, adaptive
Technology integration	Tool-based, additive, optional	Mediational, transformative, essential
Professional development	Gradual, structured, individual	Rapid, networked, collective
Pedagogical innovation	Expert-driven, top-down	Necessity-driven, distributed
Assessment	Standardized, comparative, summative	Contextual, adaptive, formative
Institutional development	Bureaucratic, hierarchical, stable	Networked, flexible, dynamic
Knowledge construction	Transmitted, canonical, disciplinary	Co-constructed, pragmatic, transdisciplinary

The most significant theoretical contribution emerges from the collective challenge to linear educational development models. Traditional educational theory, rooted in assumptions of progressive improvement and cumulative knowledge building, presumes stable institutional contexts and predictable trajectories of change. The conference papers, however, document educational systems that experience radical discontinuities, recursive adaptations, and non-linear transformations. Zazymko, Klikh and Nazarenko' [42] documentation of educational recovery at NULES reveals that crisis does not simply interrupt educational progress but fundamentally alters the nature of educational processes themselves. Their framework suggests that educational systems exhibit what complexity theorists would recognise as emergent properties – characteristics that arise from the interaction of multiple components under stress but cannot be predicted from understanding individual elements alone. This insight challenges deterministic models of educational change and suggests the need for theoretical frameworks that accommodate uncertainty, emergence, and adaptive capacity as central rather than peripheral concepts.

The papers contribute to a theory of educational resilience that differs markedly from psychological resilience as traditionally conceived (figure 21). While individual resilience focuses on personal capacity to overcome adversity, the educational resilience documented across these studies simultaneously operates at multiple nested

levels. The Kherson case demonstrates how institutional resilience emerges from the interaction between individual teacher agency, technological affordances, community support structures, and systemic adaptation mechanisms. This multi-level conceptualisation aligns with ecological systems theory but extends it by showing how crisis conditions create unique feedback loops between levels that do not exist under normal circumstances. For instance, individual teachers' adoption of AI tools under martial law conditions simultaneously transforms institutional capacity, reshapes professional identity, and alters systemic expectations for educational delivery. This recursive relationship between levels suggests that educational resilience cannot be understood through reductionist approaches but requires theoretical frameworks capable of capturing complex interdependencies.

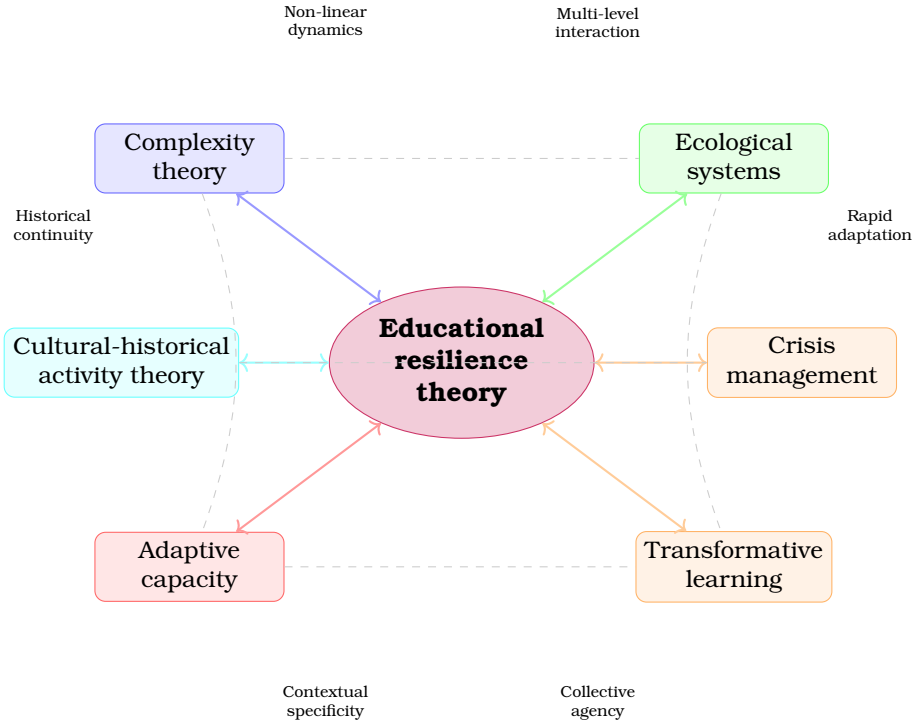

Figure 21: The emergence of educational resilience theory from synthesising multiple theoretical traditions, showing how crisis-driven research integrates complexity, ecological, adaptive, transformative, cultural-historical, and crisis management perspectives.

The reconceptualisation of technology's role in education represents another significant theoretical contribution. Rather than viewing technology as either a deterministic force or a neutral tool, the conference papers suggest a more nuanced theoretical position that might be termed "contextual technological mediation". Yefremenko and Shutieiev's [41] exploration of distance athletic training demonstrates that technology does not simply transmit existing pedagogical practices through new channels but fundamentally reconstructs the nature of educational experiences. Their three-block framework suggests that successful educational technology integration requires simultaneous transformation of epistemological assumptions (what counts as knowledge), pedagogical practices (how learning occurs), and assessment paradigms (how achievement is measured). This tripartite transformation cannot be explained through existing models of technology adoption, which typically focus on single dimensions of change. The theoretical implication is that educational technology in crisis contexts operates not as an addition to existing systems but as a catalyst for comprehensive systemic reorganisation.

The papers also advance theoretical understanding of professional development by documenting what might be termed "crisis-accelerated professionalisation". Traditional models of teacher professional development, whether based on Knowles' [11] andragogy or Kolb's [12] experiential learning, assume relatively stable professional contexts where learning can be gradually integrated into practice. The Kherson study, however, reveals professional development occurring under extreme uncertainty, where teachers simultaneously learn new technologies, adapt to crisis conditions, and reconstruct professional identities. This compressed professionalisation process suggests the need for new theoretical frameworks that account for rapid, multi-dimensional professional transformation. The finding that 93% of Kherson teachers reported competence increases despite ongoing conflict challenges assumptions about optimal conditions for professional learning and suggests that crisis may activate latent learning capacities that remain dormant under normal conditions.

The historical perspective provided by Cwer's [1] analysis introduces temporal depth to these theoretical considerations, suggesting that crisis-driven educational innovation follows recurring patterns across centuries. The parallel between 19th-century Polish military education and contemporary Ukrainian experiences indicates that certain dynamics of educational transformation under existential threat may be universal rather than historically specific. This insight challenges presentist assumptions about the uniqueness of contemporary educational challenges and suggests the value of developing trans-historical theoretical frameworks that can account for both continuity and change in educational responses to crisis. For instance, the concept of the "soldier-citizen" developed in Polish military education prefigures contemporary discussions about holistic education and the integration of civic, moral, and technical competencies.

The conference papers also contribute to emerging theories of "pedagogical improvisation" that challenge scripted, standardised educational approaches. The documentation of teachers creating educational solutions in real-time, without adequate resources or clear guidelines, reveals improvisation not as deviation from best practice but as fundamental educational competency. This aligns with jazz-based organisational theories that view improvisation as skilled practice requiring deep knowledge, keen awareness, and creative adaptation. The theoretical implication is that effective crisis education may depend less on following established protocols than on developing improvisational capacity at individual, institutional, and systemic levels. This shifts focus from implementation fidelity to adaptive expertise as the key marker of educational quality.

The implications for learning theory itself are substantial. The conference papers collectively suggest that extreme conditions reveal aspects of learning that remain hidden under normal circumstances (figure 22). The ability of students to maintain academic progress despite severe disruptions, the capacity of teachers to acquire complex technological skills rapidly, and the emergence of peer learning networks in isolation all point toward latent learning capacities that existing theories inadequately address. This suggests the need for what might be termed "extreme learning theory" – frameworks that account for learning under high stress, limited resources, and existential threat. Such theories must integrate insights from trauma-informed pedagogy, resilience psychology, and crisis management while focusing on education rather than survival outcomes.

Furthermore, the papers contribute to the theoretical understanding of educational equity in crisis contexts. Traditional equity frameworks focus on equal access to resources and opportunities, but the conference papers reveal that crisis conditions require reconceptualising equity in terms of differential support based on varying vulnerabilities. The Odisha case demonstrates that educational equity in diverse

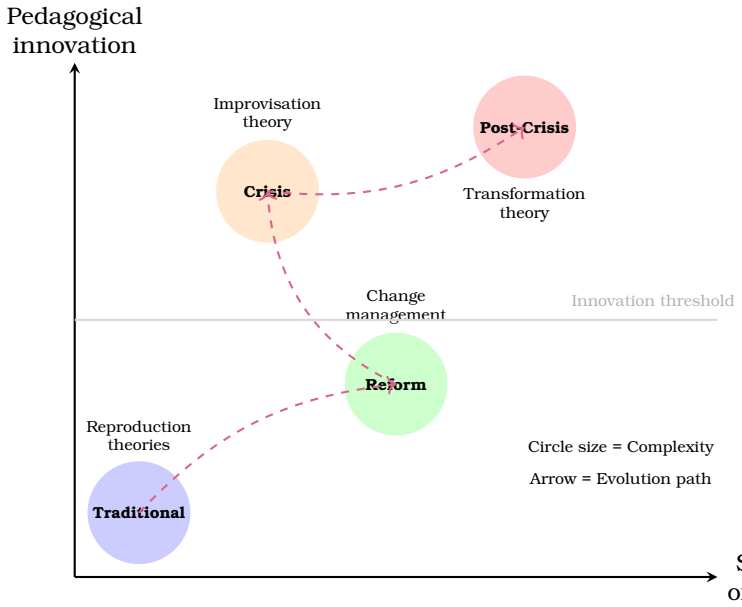

Figure 22: The theoretical evolution of educational paradigms showing how crisis conditions push educational systems beyond traditional innovation thresholds, necessitating new theoretical frameworks for understanding pedagogical transformation.

contexts cannot be achieved through standardised approaches but requires culturally responsive, community-engaged strategies that recognise and build upon local strengths. This suggests moving from distributive equity models (equal allocation of resources) toward capability-based models that focus on enabling diverse communities to achieve valued educational outcomes through different pathways.

The conference also advances theoretical understanding of the relationship between individual and collective agency in educational transformation. While traditional educational theory tends to focus on either individual agency (constructivist approaches) or structural determination (critical theory), the conference papers reveal complex interactions between individual initiative and collective action. The success of AI integration in Kherson, for instance, depended simultaneously on individual teacher initiative, peer support networks, institutional facilitation, and systemic adaptation. This suggests the need for theoretical frameworks that capture what might be termed "distributed agency" – the capacity for educational transformation that emerges from the interaction of multiple actors operating at different scales without central coordination.

Finally, the theoretical implications extend to fundamental questions about the purpose and nature of education itself. The conference papers suggest that crisis reveals education's essential rather than instrumental value – its role in maintaining human dignity, preserving cultural identity, and sustaining hope under the most adverse conditions. This existential dimension of education, largely absent from instrumental theories focused on human capital development or social reproduction, emerges as central when educational systems face existential threats. The theoretical challenge is to develop frameworks that account for both education's practical functions and existential significance, recognising that these dimensions are not separate but deeply intertwined. The conference thus contributes not merely to crisis education theory but to fundamental reconsideration of education's role in human flourishing under all conditions.

6. Practical recommendations

The insights emerging from ICHTML 2025 translate into concrete recommendations that address the immediate needs of educational systems under stress while building long-term resilience capacity (figure 23). These recommendations, derived from the convergent experiences documented across diverse contexts, offer practical guidance for stakeholders at multiple levels of educational systems. Rather than prescriptive solutions, they represent adaptive strategies that acknowledge contextual variation while identifying transferable principles that enhance educational resilience across different crisis scenarios.

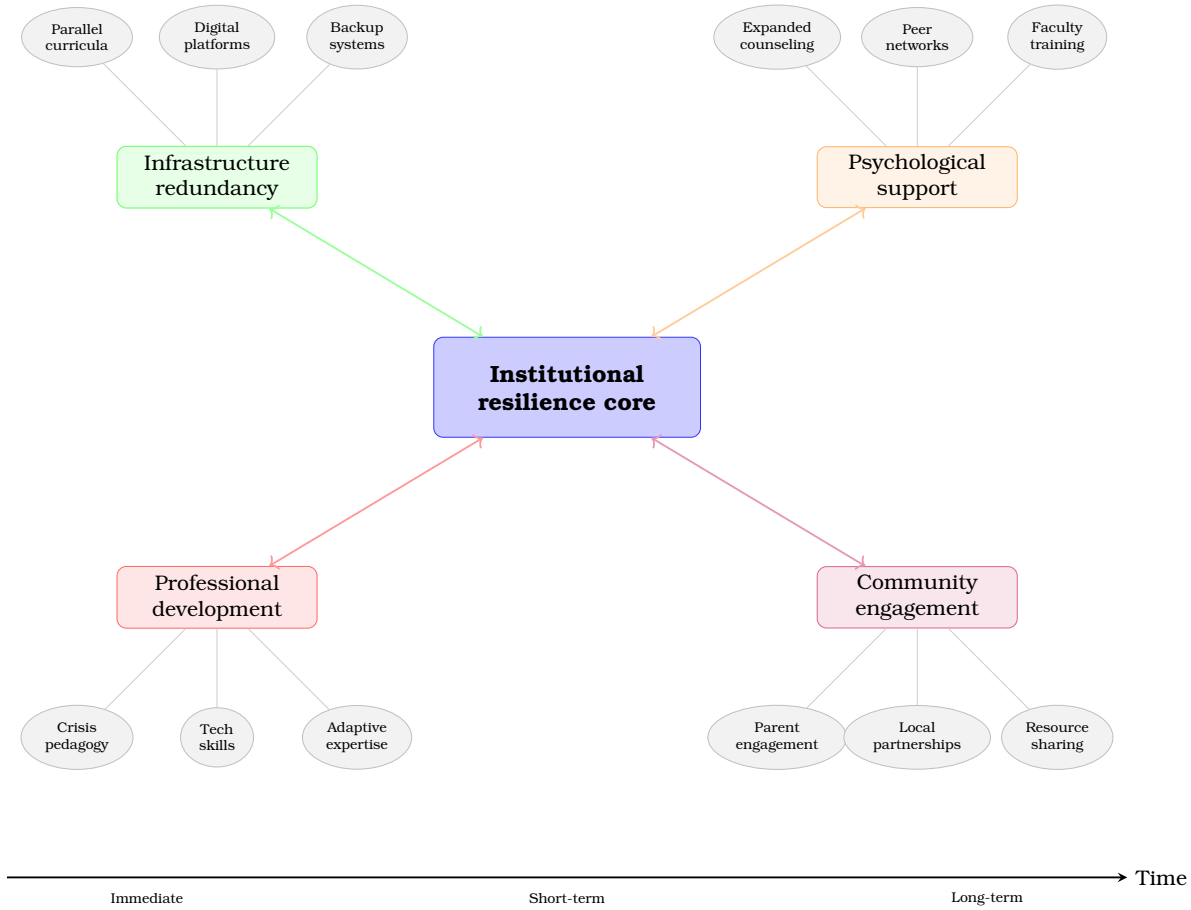

Figure 23: A comprehensive framework for institutional resilience showing four interconnected pillars and specific implementation recommendations across different time horizons.

6.1. Recommendations for educational institutions

Educational institutions facing crisis conditions or preparing for potential disruptions should prioritise developing what the conference papers collectively suggest might be termed "institutional elasticity" – the capacity to rapidly shift between different operational modes while maintaining educational quality and institutional identity. The NULES experience demonstrates that successful crisis response requires pre-positioned capabilities rather than reactive measures. Institutions should establish parallel curriculum structures that can be activated as conditions change, maintaining both traditional and digital delivery mechanisms even during periods of normalcy. While appearing inefficient from a resource optimisation perspective, this redundancy proves essential when rapid transitions become necessary.

Developing a comprehensive psychological support infrastructure emerges as a non-negotiable institutional priority. The correlation between psychological support

utilisation and academic recovery documented at NULES suggests that mental health services should be integrated into core educational provision rather than treated as supplementary student services. Institutions should expand counselling capacity before crisis strikes, train faculty in basic psychological first aid, and establish peer support networks that can function even when professional services become overwhelmed. The finding that students accessing regular counselling showed 23% better academic performance improvement indicates that psychological support represents a high-return investment in educational quality.

Technology infrastructure requires strategic rather than reactive investment. The Kherson experience of teachers adopting AI tools despite infrastructure failures demonstrates that motivation can partially overcome resource constraints, but institutions should not rely on individual heroism. Educational institutions should invest in offline-capable technologies, develop mobile-optimised platforms that function on limited bandwidth, create downloadable content repositories accessible during connectivity interruptions, and establish equipment lending programs to address digital divide issues. The finding that 48.9% of Kherson teachers faced internet instability yet maintained educational continuity suggests that robust technical infrastructure, while important, matters less than having multiple technological pathways available.

Institutions must also reconceptualise assessment and credentialing for crisis conditions. Traditional examination systems often become impossible during disruptions, yet maintaining academic standards remains essential for credential validity. The conference papers suggest developing competency-based assessment frameworks that emphasise mastery over time-bound performance, creating multiple assessment pathways that accommodate different crisis scenarios, establishing clear minimum standards that preserve program integrity, and developing secure remote assessment capabilities before they become necessary. The athletic training paper's three-dimensional assessment model [41] – progress, efficiency, and effectiveness – offers a template for comprehensive evaluation that transcends simple performance metrics.

6.2. Recommendations for policymakers

Policy frameworks must evolve from crisis response to crisis preparedness, establishing regulatory environments that enable rather than constrain adaptive educational practices (table 11). The conference papers reveal that existing policy structures often impede necessary innovations, requiring emergency waivers or workarounds during crises. Policymakers should proactively establish regulatory flexibility zones that automatically activate during declared emergencies, removing bureaucratic barriers to rapid adaptation while maintaining essential quality safeguards.

Funding mechanisms require fundamental restructuring to support resilience building rather than merely crisis response. The current pattern of emergency funding followed by austerity creates cycles of vulnerability that compound over time. Policymakers should establish dedicated resilience funds that institutions can access for preparedness activities, create incentive structures that reward institutions for maintaining redundant capabilities, support regional coordination mechanisms that enable resource sharing during crises, and fund research into crisis-resistant educational models. The Odisha case demonstrates that sustained, incremental investment in teacher development produces more lasting results than sporadic emergency interventions.

Teacher professional development policies need a comprehensive revision to reflect crisis realities. The finding that 89% of Kherson teachers needed training despite 72% already using AI tools indicates that crisis conditions create unique professional development needs. Policymakers should mandate crisis pedagogy training in initial teacher education, establish continuous professional development requirements that

Table 11
Policy framework recommendations across different governance levels.

Governance level	Immediate actions	Medium-term initiatives	Long-term strategies
National	Emergency education protocols, funding mechanisms	Digital infrastructure investment, teacher training standards	Educational resilience legislation, systemic reform
Regional	Resource coordination networks, support systems	Professional development programs, technology platforms	Inter-institutional partnerships, shared services
Local	Crisis response teams, communication channels	Community engagement structures, parent programs	Sustainable funding models, cultural integration
Institutional	Parallel curricula, psychological support	Faculty development, assessment reform	Organizational culture change, innovation capacity

include emergency teaching competencies, create rapid credentialing pathways for emergency educators, and support peer learning networks that can function without formal institutional structures. The success of micro-learning modules in Kherson suggests that professional development policies should accommodate flexible, modular approaches rather than requiring traditional course structures.

International cooperation mechanisms require strengthening to enable knowledge transfer and resource sharing during crises. The conference, conducted in a hybrid format with participants from multiple countries facing different challenges, demonstrates the value of cross-border collaboration. Policymakers should establish international education emergency response protocols, create mechanisms for rapid credential recognition across borders, support the development of open educational resources accessible globally, and fund comparative research on crisis education approaches. Poland's historical perspective reminds us that educational innovation during crises has transnational and transtemporal relevance.

6.3. Recommendations for educators

Individual educators facing crisis conditions require practical strategies that balance immediate survival needs with educational goals. The conference papers consistently emphasise that teacher agency remains crucial even when institutional support falters. Educators should develop personal professional learning networks that extend beyond institutional boundaries, acquiring crisis-relevant skills before they become necessary. The rapid AI adoption by Kherson teachers demonstrates that self-directed learning can compensate for absent formal training, though this should not become the expected norm.

Pedagogical adaptation requires embracing uncertainty while maintaining educational purpose. The athletic training framework's emphasis on "belief" in distance learning possibilities suggests that the educator's mindset significantly influences adaptation success. Teachers should develop crisis-adapted pedagogical strategies, including asynchronous learning designs that accommodate interrupted participation, assessment methods that emphasise growth over achievement, collaborative approaches that build peer support networks, and trauma-informed practices that acknowledge student circumstances. The success of project-based learning in maintaining engagement during disruptions indicates that authentic, meaningful tasks may matter more than curriculum coverage.

Professional development should be reconceptualised as continuous adaptation rather than periodic updating. The conference papers suggest that crisis conditions accelerate professional learning, creating opportunities for rapid skill acquisition and pedagogical innovation. Educators should document and share crisis innovations for broader adoption, engage in action research on their adaptive practices, participate in peer observation and feedback even remotely, and contribute to developing crisis pedagogy as a legitimate field of study. The finding that teachers experiencing conflict showed higher motivation for professional development challenges assumptions about optimal learning conditions.

7. Critical discussion

The ICHTML 2025 conference papers, while offering insights into educational resilience and innovation under crisis conditions, reveal significant contributions and notable limitations that warrant critical examination. The collective body of work advances understanding of how educational systems respond to extreme disruption, yet simultaneously exposes fundamental gaps in theory, methodology, and practice that limit the generalizability and applicability of findings. This critical analysis examines the strengths and weaknesses of the conference contributions while identifying unaddressed challenges and establishing priorities for future research that could strengthen the emerging field of crisis education studies.

7.1. Strengths of conference contributions

The conference's most significant strength lies in its documentation of real-time educational innovation under extreme conditions, providing what might be termed "hot case" data rarely captured with such immediacy and detail in educational research. The papers collectively offer unprecedented access to educational transformation as it occurs, rather than retrospective reconstructions that often characterise crisis education studies. The Kherson study's documentation of AI adoption under martial law, conducted while the region remained an active military threat, exemplifies this strength. The ability to capture teacher motivations, challenges, and adaptations while they navigate ongoing crises provides insights into human resilience and creativity that retrospective studies cannot fully recapture. This immediacy of documentation creates a historical record while contributing to the theoretical understanding of crisis-driven innovation processes.

The methodological diversity across the conference papers constitutes another major strength, demonstrating that crisis education research need not be constrained to single methodological approaches. Integrating historical archival analysis, survey research, expert validation, institutional data analysis, and policy review within a single conference program creates rich triangulation opportunities rarely achieved in educational research. This methodological pluralism proves particularly valuable given the complexity of crisis education phenomena, which resist reduction to single dimensions or perspectives. The conference thus models how diverse methodological traditions can contribute complementary insights to understanding educational resilience, with each approach revealing aspects invisible to others.

The contextual richness of the conference papers provides a granular understanding of how global phenomena manifest in specific localities. Rather than treating a crisis as a uniform experience, the papers reveal how factors such as infrastructure availability, cultural values, institutional capacity, and community resources shape educational responses. The Odisha case's attention to linguistic diversity and tribal contexts, for instance, demonstrates that effective crisis response cannot be divorced from cultural specificity. This contextual sensitivity challenges universal prescriptions while simultaneously revealing patterns that transcend specific contexts. The conference

thus achieves a delicate balance between documenting particularity and identifying transferable insights.

Furthermore, the conference's emphasis on practitioner perspectives and experiences represents a significant strength in bridging the persistent research-practice divide in education. The papers consistently foreground educator voices and experiences, treating teachers not as research subjects but as knowledge creators navigating complex challenges. This practitioner-centred approach generates findings with immediate practical relevance while contributing to theoretical understanding grounded in lived experience. Despite the high participation rates in surveys, despite crisis conditions – 186 teachers in Kherson, 20 experts for athletic training validation – suggest that educators recognise the value of contributing to knowledge creation about their practices.

7.2. Identified gaps and limitations

Despite these strengths, significant limitations constrain the conference contributions' impact and generalizability (figure 24, table 12). The most fundamental limitation concerns the temporal scope of investigation, with all studies capturing relatively short periods within ongoing crises. The absence of longitudinal data prevents understanding of whether documented innovations persist beyond immediate crisis periods or represent temporary adaptations abandoned once normal conditions return. The NULES study's five-year timeframe provides the longest perspective, yet even this remains insufficient for understanding lasting educational transformation. Without extended follow-up, educational resilience or sustainable innovation claims remain speculative rather than empirically grounded.

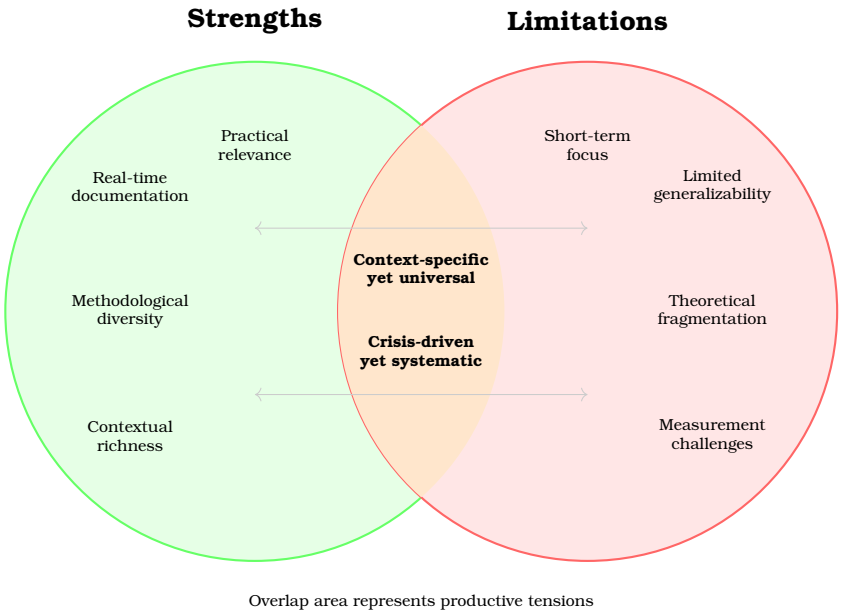

Figure 24: Venn diagram illustrating the relationship between conference strengths and limitations, with the overlap area representing productive tensions that could drive future research development.

Theoretical fragmentation represents another critical limitation permeating the conference papers. While each paper draws upon established theoretical frameworks – from andragogy to complexity theory – little effort appears toward theoretical integration or synthesis. The papers exist as isolated theoretical islands rather than contributing to cumulative theory building about crisis education. This fragmentation impedes the development of crisis education as a coherent field of study, leaving re-

Table 12
Critical analysis of methodological limitations across conference papers.

Methodological dimension	Identified limitations	Potential impacts	Mitigation strategies
Sampling	Self-selection bias, convenience sampling, limited representation	Skewed findings toward motivated participants	Stratified sampling, incentivized participation
Measurement	Self-reported data, unstandardized instruments, crisis-affected validity	Questionable reliability, incomparable results	Validated instruments, multiple measures
Temporal scope	Cross-sectional designs, short observation periods	Cannot assess sustainability or long-term impact	Longitudinal studies, repeated measures
Contextual control	Confounding variables, multiple simultaneous crises	Unclear causation, attribution problems	Comparative designs, statistical controls
Ethical constraints	Limited access, vulnerable populations, crisis conditions	Incomplete data, protection concerns	Adaptive protocols, community partnerships

searchers without shared conceptual frameworks for understanding and investigating educational responses to disruption. The absence of cross-referencing between papers presented at the same conference suggests missed theoretical dialogue and integration opportunities.

Methodological limitations further compromise the robustness of conference findings. The reliance on self-reported data, particularly in the Kherson and athletic training studies, raises questions about response bias and social desirability effects. Teachers reporting high satisfaction with AI training or experts validating distance athletic training may be influenced by perceived expectations or professional pressures rather than genuine assessment. The absence of objective outcome measures – actual student performance data, behavioural observations, skill demonstrations – leaves claims about educational effectiveness unsubstantiated. While crisis conditions constrain methodological options, lacking triangulation with objective measures weakens confidence in reported findings.

The conference papers also reveal significant gaps in addressing educational equity, a curious omission given that crises typically exacerbate existing inequalities. While the Odisha paper explicitly addresses marginalised populations and the Kherson study acknowledges infrastructure disparities, most papers treat their populations as relatively homogeneous. The absence of disaggregated data by socioeconomic status, gender, disability status, or other vulnerability markers obscures the differential impacts of crisis and innovation. The athletic training paper's assumption that students have access to recording devices and internet connectivity for video submission ignores the reality of the digital divide. This equity blindness risks perpetuating or deepening educational inequalities under the guise of innovation.

7.3. Unaddressed challenges

Beyond specific limitations, the conference papers collectively fail to address several fundamental challenges facing crisis education. The question of educational quality versus educational access remains unexamined, mainly, with papers implicitly assuming that maintaining any form of educational provision constitutes success. However,

the relationship between crisis adaptations and actual learning outcomes remains empirically unestablished. The shift to distance athletic training may maintain program enrollment, but does it produce athletes with comparable skills to traditional training? Adopting AI tools by Kherson teachers may enable content delivery, but does it support deep learning and critical thinking development? These quality questions require longitudinal outcome studies currently absent from the crisis education literature.

The psychological toll of crisis education on educators themselves represents another unaddressed challenge. While papers document teacher resilience and innovation, they largely ignore the personal costs of maintaining educational services under extreme stress. The conference transcript's brief mentions of "psychological and physical strain difficulties" only hint at deeper wellness concerns. The sustainability of crisis education may depend less on technological or pedagogical innovation than on preventing educator burnout and trauma. The absence of systematic investigation into educator wellbeing represents a critical gap that could undermine long-term educational resilience (figure 25).

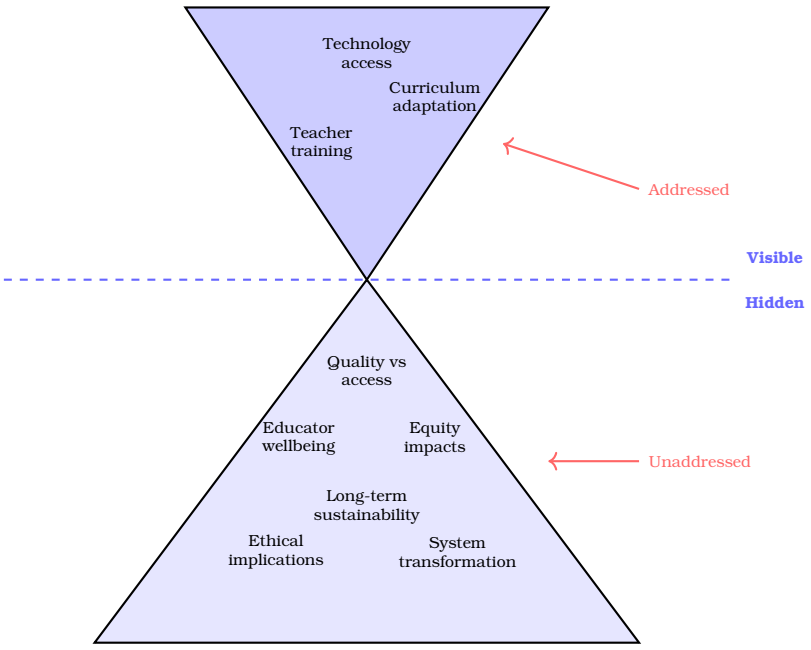

Figure 25: Iceberg model showing visible challenges addressed by conference papers versus hidden challenges that remain largely unexamined, suggesting that current research captures only surface-level phenomena.

The ethical dimensions of crisis-driven educational innovation receive insufficient attention across the conference papers. The rapid adoption of AI tools, distance learning platforms, and digital assessment systems raises profound questions about data privacy, algorithmic bias, and technological dependency that papers acknowledge but do not systematically investigate. The Kherson study's mention of academic integrity concerns only scratches the surface of ethical challenges. When educational institutions adopt commercial platforms and AI tools under crisis pressure, they may inadvertently compromise student privacy, enable surveillance, or create dependencies on proprietary systems. The absence of systematic ethical analysis represents a dangerous gap given the lasting implications of crisis-driven technological adoption.

Furthermore, the conference papers fail to explore the relationship between individual and systemic resilience adequately. While documenting individual teacher innovations and institutional responses, the papers do not examine how these levels interact or potentially conflict. Individual teacher resilience might compensate for

institutional failures, but at what cost? Conversely, robust institutional responses might inadvertently suppress individual creativity and adaptation. Understanding these dynamics requires multi-level analysis, which is currently absent from the conference contributions. The assumption that individual and institutional resilience necessarily align may obscure tensions that could undermine long-term sustainability.

7.4. Future research priorities

The critical analysis of conference contributions reveals urgent research priorities for advancing crisis education as a field of study (figure 26). Longitudinal research tracking educational innovations across complete crisis cycles – from emergence through acute phase to recovery – represents the most pressing need. Such studies should examine whether innovations persist and how they evolve as conditions change. Do emergency adaptations become institutionalised, abandoned, or transformed into something entirely different? Understanding these trajectories requires research designs spanning years rather than months, with multiple observation points capturing dynamic rather than static phenomena.

Figure 26: Research priority matrix positioning future studies according to theoretical contribution and practical impact, with the red zone indicating the highest priority areas requiring immediate attention.

Comparative research across different crisis types and contexts could identify universal principles versus context-specific responses. The conference papers address pandemic and conflict separately, yet many regions face compound crises combining multiple stressors. How do educational responses differ when communities face simultaneous conflict, climate disasters, and economic collapse? Do successful adaptations in one crisis type transfer to others? Systematic comparative analysis could reveal whether crisis education requires crisis-specific strategies or if general

resilience principles apply across disruption types.

Research on educational equity during a crisis must move beyond acknowledgement to systematic investigation. How do crisis adaptations differentially impact students based on socioeconomic status, disability, language, gender, and other factors? Which innovations reduce versus exacerbate inequalities? What mechanisms ensure equitable access to crisis education? These questions require sophisticated research designs that disaggregate data, employ intersectional analyses, and centre marginalised voices. The tendency to treat crisis-affected populations as homogeneous obscures critical equity dimensions that determine whether educational resilience serves all or only privileged subgroups.

Methodological innovation represents another research priority, as traditional research methods often prove inadequate for crisis contexts. How can researchers maintain rigour when randomised trials become impossible and control groups unethical? What alternatives to conventional validity and reliability measures apply when measurement instruments must be rapidly adapted? How can participatory approaches centre affected communities while maintaining systematic inquiry? Developing and validating crisis-appropriate research methodologies could strengthen the evidence base while ensuring ethical and contextually sensitive investigation.

At last, theoretical development must advance beyond borrowing from established fields to constructing frameworks specific to crisis education. What distinguishes crisis learning from normal learning? How do established pedagogical principles apply or fail under extreme conditions? What new theoretical constructs emerge from crisis education experiences? Building crisis education theory requires systematic conceptual work synthesising insights across cases, identifying recurring patterns, and developing testable propositions. The conference papers provide raw material for such theory building, but the intellectual work of theoretical construction remains largely undone.

The critical examination of ICHTML 2025 contributions reveals a field in early development, characterised by valuable documentation of crisis responses but lacking theoretical coherence, methodological sophistication, and systematic attention to fundamental challenges. While celebrating the resilience and innovation documented in these papers, the academic community must acknowledge substantial work ahead in establishing crisis education as a rigorous field of study. The urgency of this work cannot be overstated – as global disruptions intensify, education systems worldwide require evidence-based guidance for maintaining quality and equity under extreme conditions. The conference represents an important step in this journey, but the destination remains distant. The challenge is building upon these foundations through sustained, systematic, and collaborative research that transforms crisis education from reactive adaptation to proactive preparation for an uncertain future.

8. Conclusion

The ICHTML 2025 conference papers represent a watershed moment in the documentation and theorisation of educational resilience under extreme duress, capturing educational transformation at a critical juncture when multiple global crises intersect to reshape fundamental assumptions about teaching, learning, and institutional survival. The five papers presented, complemented by rich conference dialogues, advance understanding of how educational communities navigate seemingly impossible circumstances while maintaining commitment to educational purposes that transcend immediate survival. This concluding synthesis reflects on the conference's contributions to educational discourse, the insights gained about crisis-driven transformation, and the imperatives for continued research and innovation in an era where disruption

increasingly characterises the educational landscape.

The conference's most profound contribution lies in demonstrating that educational resilience emerges not from predetermined crisis response protocols but from the creative intersection of human agency, technological possibility, and institutional adaptation. The documented experiences from Ukraine's war-torn regions, India's marginalised communities, and historical precedents from 19th-century Poland reveal that educational communities possess a remarkable capacity for innovation when confronted with existential challenges. The Kherson teachers adopting AI tools despite infrastructure collapse, the NULES community maintaining laboratory education without physical laboratories, and the Odisha educators bridging linguistic divides through community engagement testify to an educational resilience that transcends technical solutions. These cases suggest that a crisis tests educational systems and potentially catalyses transformations that peaceful conditions might never produce.

The temporal breadth of the conference – spanning from 1794 to 2025 – provides a crucial perspective on the recurring nature of educational crisis and adaptation (figure 27). Cwer's [1] historical analysis demonstrates that contemporary challenges of maintaining educational quality during conflict, preserving cultural identity through pedagogy, and democratising education under authoritarian pressure have deep historical roots. The parallel between Polish military educators creating citizen-soldiers in the 19th century and Ukrainian educators maintaining civic education under 21st-century Russian invasion suggests that certain educational imperatives persist across centuries and technologies. This historical consciousness challenges presentist assumptions about the uniqueness of contemporary crises while offering hope that current educational innovations may similarly inspire future generations facing yet-unknown challenges.

Figure 27: The evolutionary spiral of educational crisis and innovation showing how each crisis builds upon previous adaptations, creating increasingly sophisticated responses to disruption while maintaining core educational purposes.

The conference reveals fundamental tensions in how educational communities conceptualise and respond to crisis, tensions that prove productive rather than paralysing. The simultaneous pursuit of educational continuity and transformation, the balance between individual resilience and institutional support, the integration of technological innovation with humanistic values, and the negotiation between global knowledge and local wisdom all emerge as creative tensions that drive innovation. Rather than resolving these tensions through binary choices, the successful cases documented in the conference maintain them as generative forces. The Kherson region's AI adoption, for instance, simultaneously embraces cutting-edge technology while preserving teacher autonomy and professional judgment. The Odisha ISTE programs balance national standardisation with local cultural adaptation. These examples suggest that educational resilience emerges from eliminating tensions and creatively navigating them.

The methodological and theoretical contributions of the conference, while revealing significant gaps, establish important foundations for crisis education as an emerging field of study. The diversity of approaches – from historical archival research to real-time survey studies, from institutional case analysis to regional comparative studies – demonstrates that crisis education research requires methodological pluralism rather than paradigmatic orthodoxy. The theoretical frameworks employed, ranging from andragogy to complexity theory, from transformative learning to cultural-historical activity theory, suggest that understanding crisis education requires theoretical bricolage rather than single-theory explanations. Rather than representing fragmentation, this methodological and theoretical diversity reflects the multifaceted nature of the educational crisis that resists reductionist analysis.

The practical implications of the conference extend far beyond immediate crisis response to suggest fundamental reconsiderations of educational design and delivery. The success of micro-learning modules in Kherson, the three-block structure for distance athletic training, the integration of psychological support at NULES, and the community-based approaches in Odisha all point toward more flexible, responsive, and humane educational models. These innovations, born from necessity, may prove superior to traditional approaches even under normal conditions. The conference thus suggests that crisis-driven innovations should not be abandoned when emergencies pass but rather refined and integrated into educational practice as permanent enhancements.

The human dimension of the conference – captured in the multilingual exchanges, technical difficulties, and emotional undercurrents of the discussions – reminds us that education remains a human endeavour that technology can support but not replace. The dedication of educators maintaining professional development under bombardment, the creativity of instructors reimagining physical education without physical presence, and the persistence of communities preserving indigenous knowledge despite systemic marginalisation all testify to education's existential rather than merely instrumental value. The conference demonstrates that educational resilience ultimately depends not on systems or technologies but human commitment to the educational mission.

Looking forward, the conference establishes clear imperatives for continued research and innovation in crisis education. The need for longitudinal studies tracking innovations across complete crisis cycles, comparative research identifying universal versus context-specific patterns, equity-focused investigations ensuring inclusive resilience, and theoretical development specific to crisis contexts all emerge as priorities. However, beyond these research imperatives lies a more fundamental challenge: reconceptualising education not as a stable system occasionally disrupted by crisis but as an inherently adaptive enterprise continuously navigating uncertainty. The conference

suggests that building educational resilience requires preparing for specific crises and cultivating adaptive capacity that enables creative responses to unforeseeable challenges.

The conference also raises profound questions about the future of education in an era of compound crises. As climate change, technological disruption, political instability, and social transformation accelerate, the exceptional may become normal, and crisis response may become the primary mode of educational operation. The innovations documented at ICHTML 2025 – from AI-assisted teaching to community-based resilience strategies – may represent not temporary adaptations but glimpses of education's future. The challenge facing educational communities globally is not returning to pre-crisis normalcy but evolving toward forms of education capable of thriving amid continuous change.

The limitations and gaps identified through critical analysis of the conference contributions should inspire continued effort and not diminish appreciation for what has been achieved. The absence of longitudinal data, theoretical fragmentation, methodological constraints, and equity blind spots represent not failures but opportunities for growth. The emerging field of crisis education requires sustained scholarly attention, increased research funding, international collaboration, and – most importantly – continued documentation of how educational communities worldwide navigate unprecedented challenges. The ICHTML 2025 conference provides a foundation upon which future research can build, but the edifice of crisis education knowledge remains largely unconstructed.

The ICHTML 2025 conference is a testament to educational resilience under extraordinary circumstances, documenting how communities maintain educational purpose when everything else fails. The conference demonstrates that education is not a luxury to be suspended during a crisis but an essential human activity providing meaning, structure, and hope when needed. The innovations documented – technological, pedagogical, institutional, and social – offer practical guidance for immediate challenges and theoretical insights for long-term educational transformation. Nevertheless, the conference's most significant contribution demonstrates that educational communities possess a remarkable capacity for creative adaptation when confronted with seemingly impossible challenges.

This conference's call for continued innovation and research is not merely academic but urgently practical. As global disruptions intensify and intersect, educational systems worldwide require evidence-based guidance for maintaining quality and equity under extreme conditions. The conference provides initial answers while revealing how much remains unknown. The journey toward understanding and supporting educational resilience has barely begun, yet the stakes could not be higher. Education's capacity to maintain human development, preserve cultural knowledge, and prepare future generations even under the most adverse conditions may determine individual futures and civilisational continuity. The ICHTML 2025 conference, conducted under the shadow of war and pandemic, demonstrates that this capacity exists. The challenge now is to understand, support, and strengthen it for future disruptions. The conference thus closes not with conclusions but with invitations – to continued research, sustained innovation, and unwavering commitment to education's transformative potential even in humanity's darkest hours.

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