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DIGITAL PEDAGOGICAL RESILIENCE: FRAMEWORK FOR EFL PRE-SERVICE TEACHERS IN CRISES' CONTEXT

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Abstract. This article presents a theoretical framework for developing pedagogical resilience among pre-service EFL teachers in context characterized by ongoing uncertainty and disruption. Drawing on constructivist learning theory, technological content knowledge and crisis pedagogy literature, the study proposes a conceptual model that integrates digital competency development with psychological preparedness for teaching under conditions. The framework is grounded in empirical evidence from two district teacher preparation programs at Vasyl Spefanyk Carpathian National University and Uzhhorod National University, where 62 students participated in specialized courses addressing digital teaching competencies. Comparative analysis reveals that while both pedagogical and linguistic approaches to teacher preparation yield significant improvements in digital readiness, they cultivate different dimensions of professional resilience. Education-focused programs enhance emotional regulation and crisis adaptability, whereas linguistics-oriented programs strengthen technological creativity and learner-centered innovation. The proposed Digital Pedagogical Resilience framework encompasses four interconnected dimensions: technical agility, methodological flexibility, emotional intelligence, and contextual awareness. Empirical validation through pre-post survey analysis demonstrates statistically significant growth across all dimensions with large effect sizes. Qualitative analysis of student reflections illuminated the transformation from technology-as-tool to technology-as-pedagogy perspectives, indicating fundamental shifts in professional identity formation. The framework offers practical implications for curriculum design in teacher education programs, particularly those operating in conflict zoned or areas experiencing systemic educational loss. The study contributes to emerging scholarship on crisis pedagogy by demonstrating that resilience in digital teaching contexts requires simultaneous development of technical, pedagogical, emotional. And adaptive capacities rather than isolated skill acquisition.

Keywords: digital pedagogical resilience, EFL teacher education, crisis pedagogy, TRACK framework, teacher preparation, emergency remote teaching.

Problem statement. The current educational landscape, especially in regions experiencing conflicts, climate disruption or public health crises, requires a rethinking of teacher training that goes beyond the traditional framework of competence. The COVID-19 pandemic has identified systemic vulnerabilities in teacher education programs around the world, showing that technical mastery of digital tools is insufficient when educators must simultaneously navigate pedagogical, emotional, and contextual challenges [Carrillo, Flores 2020, p. 466–487; La Velle et al. 2020, p. 596–608]. This insufficiency becomes particularly acute in foreign language teaching, where the communicative foundations of teaching require dynamic interpersonal interaction that digital environments fundamentally transform, rather than simply mediate [Lo 2023; Teh 2021, p. 65–71].

The Ukrainian experience, especially since the beginning of the full-scale war in 2022, demonstrates how educational systems can function under conditions of long-term uncertainty. Institutions of higher education are forced to constantly switch from face-to-face education to a hybrid and fully remote format, often without warning, in conditions of power outages and disruption of the Internet connection. Such a reality requires a rethinking of traditional approaches to the training of future teachers, since classical models are designed for a stable educational environment with a reliable technical infrastructure, which Ukrainian universities cannot guarantee today.

This paper proposes a theoretical framework called *Digital Pedagogical Sustainability* (DPS), which synthesizes conclusions from constructivist learning theory, models of technological pedagogical content knowledge and new scientific literature on crisis pedagogy. Unlike the existing frameworks, which consider digital competence and professional sustainability as separate domains, the proposed model conceptualizes them as fundamentally interconnected dimensions of modern teacher identity.

Analysis of the previous research. Traditional models of teacher training operate within assumptions of environmental stability, linear trajectories of professional development, and perceived access to educational resources [Darling-Hammond 2006]. These assumptions are eroded under conditions of constant uncertainty, where educators must continuously adapt to changing circumstances while maintaining the pedagogical effectiveness and well-being of students [König et al. 2020, p. 608–622]. The very notion of preparedness requires a rethinking from a state of preparedness for known scenarios to the capacity for adaptation in unpredictable contexts.

Recent research distinguishes between emergency distance learning and planned online education, emphasizing that the former represents a crisis response rather than deliberate pedagogical choices [Hodges et al. 2020]. However, this distinction loses its meaning in contexts where the emergency becomes permanent.

For example, Ukrainian teachers have been working in conditions of continuous educational violations for more than ten years, so what was initially a temporary crisis reaction turned into a permanent working reality. In such a situation, the division into «emergency» and «planned» training is artificial.

Research in foreign language teaching documents the various challenges English teachers face when moving to online platforms. The studios show that teachers struggle with supporting student engagement, adapting interactive classes, and providing effective feedback in virtual environments [Cheung 2021, p. 55–70; Wong et al. 2022, p. 1–10]. Studies from other contexts indicate that technical difficulties, pedagogical uncertainties and increased workload are common problems among language teachers adapting to online teaching [Rahman 2020, p. 179–194].

The theoretical foundation for understanding the challenges of online language learning lies in social constructivist approaches to education that emphasize the importance of social interaction in knowledge construction. Vygotsky's concept of a near-term development zone becomes particularly relevant in online contexts where support typically provided through peer interaction and teacher guidance should be redefined for digital platforms [Hamat, Embi 2010, p. 237–246]. The main challenge is to preserve the social nature of language learning, where students and teachers work through digital tools that have both their limitations and new opportunities for communication.

Recent developments in distance learning for the training of foreign language teachers highlight the importance of systematic competence development and quality assurance measures. Research indicates that effective online language learning requires not only technical skills but also a deep understanding of pedagogical principles to adapt methodologies to digital environments [Petrov, Atanasova 2020, p. 139–148]. The integration of synchronous and asynchronous learning elements, often called mixed or hybrid approaches, appears to be particularly promising for supporting engagement while meeting the diverse needs of learners and technological constraints.

Distance learning technologies in foreign language teaching have evolved significantly, with a focus on quality assurance in education through comprehensive pedagogical design rather than merely technological implementation [Ismailov, Chiu 2017, p. 374–389]. Research has identified specific strategies that prove effective in online English teaching contexts, including the strategic use of videoconferencing to develop speaking skills, instant messaging applications for written interaction, and gamification strategies to increase motivation [Gozcu, Caganaga 2016, p. 126–135; Ma 2018, p. 46–48].

The psychological impact of online teaching on educators has also emerged as a significant issue. Studies indicate that teachers experience increased stress, workload and isolation when switching to online learning, especially when this transition occurs quickly without adequate training or support [Mheidly et al. 2020]. These findings suggest that teacher training programs should address not only the technical and pedagogical aspects of online teaching, but also psychological preparedness and stress management strategies.

Despite the growing body of literature on digital pedagogy and crisis learning, limited research offers comprehensive theoretical frameworks that integrate the technical, pedagogical, emotional and contextual dimensions of teaching sustainability. Most existing research focuses on the adaptation of teachers during service during acute emergencies, with less emphasis on proactively preparing future teachers for an uncertain future.

Research aim and objectives. The main goal of this article – is to present and empirically substantiate the theoretical framework of Digital Pedagogical Sustainability for training teachers of English as a foreign language in crisis contexts. Specific tasks include: to develop a conceptual model that integrates the four dimensions of sustainability; to empirically validate the framework through a comparative analysis of two teacher training programmes; to identify the mechanisms through which digital pedagogical sustainability develops; to investigate how disciplinary orientation affects the trajectories of sustainability development; to provide practical guidance for curriculum development.

The existing model of technological pedagogical content knowledge, although valuable, provides limited understanding of how teachers support work performance when technological infrastructures fail, the student experiences stress, or educational contexts change rapidly. Available frameworks often view digital competence as a technical skill rather than a multidimensional ability encompassing emotional and adaptive elements.

Methods and techniques of the study. The study was conducted at Uzhhorod National University during the 2023–2024 academic year in wartime conditions, where educational institutions are exposed to frequent power outages, air alarm signals and population movements. The comparative design of the study studied two teacher training programs: Case 1 included 28 fourth-year students majoring in «Secondary education (English and foreign literature)» registered in the course «Distance learning of foreign languages». Case 2 involved 34 third-year students majoring in «Applied Linguistics» participating in the course «Digital Tools for Teaching English as a Foreign Language».

A 25-point Digital Pedagogical Sustainability Scale was developed to measure the four dimensions of the framework. The instrument used 5-point Likert scales with five points per dimension plus five global stability points. Psychometric validation through exploratory factor analysis confirmed a four-factor structure with strong internal consistency for each subscale. The scale was administered at three time points: pre-intervention (week 1), mid-intervention (week 8) and post-intervention (week 16).

Semi-structured reflective essays collected in weeks 2, 9, and 15 encouraged students to articulate their evolving understanding of digital teaching, de-

scribe the challenges faced, and reflect on personal transformation. The two focus group discussions per case provided a deeper look into the collective processes of meaning-making and the interpersonal dynamics shaping resilience development.

Quantitative data analysis included repeated measures of analysis of variance to study changes within groups through time points. Qualitative data underwent a systematic thematic analysis following the approach of Brown and Clark, which included familiarization with the data, systematic open coding, focused coding to organize previous topics, reviewing topics to ensure coherence, and producing a report with examples of citations.

Presentations of the basic material. *Conceptual model of Digital Pedagogical Sustainability.* The Digital Pedagogical Sustainability framework integrates four interrelated dimensions that collectively ensure effective teaching in unstable environments.

Technical agility encompasses not just the mastery of specific digital tools, but the ability to quickly learn new technologies, eliminate unexpected problems, and seamlessly navigate across platforms as circumstances change. This dimension goes beyond instrumental competence, including technological self-efficacy and adaptive problem solving.

Methodological flexibility represents the ability to redefine pedagogical approaches for digital environments, rather than simply porting face-to-face methods to online platforms. This dimension requires a deep understanding of how learning processes differ between modalities and a creative adaptation of learning strategies to harness digital opportunities while mitigating constraints [Hazaymeh 2021, p. 501–518].

Emotional intelligence includes recognizing and managing both students' own emotional responses to uncertainty and affective needs during disruptions. This dimension encompasses stress management, empathy cultivation, and the ability to maintain pedagogical relationships despite physical distance and technological mediation.

Contextual awareness refers to understanding how broader social, political, and infrastructural factors shape educational opportunities and constraints. This dimension includes recognition of digital equality issues, sensitivity to students' diverse access to technology and enabling learning environments, and adaptation of expectations to contextual realities.

These four dimensions interact dynamically rather than functioning independently. Technical agility without methodological flexibility produces technologically sophisticated but pedagogically inefficient learning. Emotional intelligence without contextual awareness can lead to empathic responses that do not address structural barriers to learning.

Quantitative results of sustainability development. The analysis revealed a substantial and statistically significant increase in digital pedagogical sustainability in both programs. The results are presented in Table 1.

Table 1

Dynamics of development of digital pedagogical sustainability by programs (n=62)

Dimension	Education programme (n=28)			Linguistics programme (n=34)		
	Pre-course M±SD	Post-course M±SD	Cohen's d	Pre-course M±SD	Post-course M±SD	Cohen's d
Technical ability	2,3±0,8	4,1±0,6	2,51***	2,6±0,7	4,4±0,5	2,76***
Methodological flexibility	2,1±0,7	4,3±0,5	3,14***	2,2±0,8	4,2±0,6	2,89***
Emotional intelligence	2,4±0,9	4,5±0,6	2,67***	2,5±0,8	4,3±0,7	2,43***
Contextual awareness	2,2±0,8	4,0±0,7	2,37***	2,3±0,9	4,1±0,6	2,29***
Overall DPR	2,3±0,7	4,2±0,5	2,89***	2,4±0,7	4,3±0,5	2,71***

Примітка: M – mean; SD – standard deviation; ЦПС – Dogital Pedagogical Resilience; *** p<0,001

Both programs demonstrated large effect sizes in all dimensions, indicating significant practical significance along with statistical significance. Repeated ANOVA measurements confirmed meaningful time effects without meaningful program-time interactions, suggesting that both approaches effectively cultivated resilience despite disciplinary differences.

Qualitative mechanisms for the development of sustainability. Thematic analysis of reflective essays revealed three overarching processes through which students developed digital pedagogical resilience.

Cognitive restructuring. Students have progressed from considering technology as a complement to recognizing it as a transformation of pedagogical relationships. Initial reflections characterized digital tools as ways to deliver content online or substitutes for physical classes. Later reflections revealed a more refined understanding. One education student in week 15 wrote: «I used to think that teaching online meant taking my lesson plans and putting them on Zoom. Now I understand that digital environments create completely different learning spaces where students interact with

content, with me and with each other in fundamentally new ways».

A linguistics student in week 15 reflected: «As a linguist, I came to understand digital tools not as technology, but as language capabilities. They create new contexts for authentic communication, new genres of written interaction, new ways of linguistic expression». These reflections show a movement from instrumental to constitutive understanding of technology, recognizing digital environments as fundamentally changing, rather than merely mediating, pedagogical processes.

Experimental learning through productive failure. Students have repeatedly emphasized the importance of dealing with technological challenges and recovering from failures. Rather than viewing failures as setbacks, successful sustainability development included redefining them as learning opportunities. Education student in week 9 shared: «When my Zoom froze during a hands-on lesson, I panicked. But then I realized that my students could continue to work at Google Doc, which we shared, and I could join from my phone. That moment taught me more about digital sustainability than any lecture could.

Community support and mutual learning. Students consistently identified peer interaction as crucial to developing resilience, describing how collaborative problem solving reduced anxiety and expanded decision repertoires. An education student in week 15 wrote: «Working with classmates has shown me that there are always several ways to solve technological problems. When I got stuck, someone always had a different approach. It helped me understand that digital teaching is not about owning all the answers – is about ingenuity and asking for help».

Disciplinary variations in the expression of sustainability. While both programs cultivated overall digital pedagogical resilience, qualitative analysis found that students of education and linguistics expressed resilience through slightly different professional identities.

Education students often formulated digital teaching through the lenses of student well-being, inclusive practice, and emotional connection. One student in week 15 wrote: «The biggest challenge for me was not learning Zoom – it was figuring out how to make students feel noticed and cared for through the screen. I had to develop new ways of checking, new signals for when someone was fighting, new approaches to building a cool community».

Linguistics students were more likely to discuss digital teaching through a framework of linguistic interaction, communicative authenticity, and creative use of language. One student in week 15 wrote: «What fascinated me the most was the discovery of how digital tools create new contexts for real communication. Students can interact with authentic texts online, interact with native speakers from other countries, document their language learning travels through digital portfolios».

Practical recommendations for pedagogical education. Based on empirical findings, several recommendations for teacher training programs emerge. Programs should integrate digital teaching preparation throughout methodological, evaluative and practical experiences, rather than offering separate technology courses. Such integration emphasizes that digital teaching represents an excellent pedagogical approach, which requires a rethinking of basic teaching practices.

Curricula must consciously create opportunities for students to face and overcome authentic technological challenges in supported environments. Instead of presenting polished demonstrations, training should model troubleshooting, recognize technological failures, and promote collaborative problem solving. Such experiences build emotional regulation and adaptive capacity that are essential for resilience.

Programs should explicitly address the affective aspects of teaching in uncertainty, including stress management, empathy cultivation, and maintaining professional relationships despite physical distance. Equally important is the development of contextual awareness of digital equality, infrastructure constraints and sociopolitical factors shaping educational opportunities.

Interdisciplinary collaboration in teacher training enriches students' professional development by exposing them to a variety of digital teaching perspectives. Universities can create joint courses, collaborative projects or mutual mentoring schemes that connect students from different majors to promote integrated understanding.

Conclusions. This research advances the theoretical understanding of teacher training for uncertain contexts, proposing and validating the Digital Pedagogical Sustainability framework. The findings demonstrate that effective digital teaching in unstable environments requires the simultaneous development of technical agility, methodological flexibility, emotional intelligence and contextual awareness of – dimensions that interact dynamically rather than function independently.

Both education – and linguistics-focused approaches to teacher training prove effective in cultivating resilience, albeit through slightly different developmental trajectories reflecting disciplinary emphases. Education students showed stronger growth in emotional intelligence and emphasized pedagogical relationships, while linguistics students showed greater gains in technical agility and focused on communicative innovation.

The research contributes to the science of crisis pedagogy, demonstrating that adaptive capacity can be consciously cultivated through systematic training, rather than arising only reactively through crisis experiences. This conclusion is of particular importance for regions experiencing constant violations, where the proactive training of future teachers is essential to support the functioning of the educational system.

The consequences extend beyond conflict zones to any context where traditional assumptions about educational stability no longer apply –, whether due to climate change, pandemics, economic instability, or rapid technological transformation. As uncertainty becomes normalized rather than exceptional, teacher training must evolve from learning for known scenarios to cultivating the ability to continuously adapt in unpredictable futures.

The Digital Pedagogical Sustainability Framework offers both theoretical advancement and practical guidance for this evolution, providing conceptual tools for understanding sustainability as multidimensional and practical recommendations for curriculum development. Future research, expanding and refining the framework in a variety of contexts, will further strengthen its contribution to the training of educators capable of maintaining the quality of education despite persistent disabilities.

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РАМКА ДЛЯ ПІДГОТОВКИ ВИКЛАДАЧІВ АНГЛІЙСЬКОЇ МОВИ ЯК ІНОЗЕМНОЇ В УМОВАХ КРИЗИ

Анотація. Стаття представляє теоретичну рамку для розвитку цифрової педагогічної стійкості серед майбутніх викладачів англійської мови як іноземної в контекстах, що характеризуються постійною невизначеністю та порушеннями освітнього процесу. Спираючись на конструктивістську теорію навчання, модель технологічного педагогічного змістового знання та літературу з кризової педагогіки, дослідження пропонує концептуальну модель, яка інтегрує розвиток цифрової компетентності з психологічною готовністю до викладання в нестабільних умовах. Рамка грунтується на емпіричних даних двох різних програм підготовки вчителів Ужгородського національного університету та Карпатського національного університету імені Василя Стефаника, де 62 студенти брали участь у спеціалізованих курсах, спрямованих на розвиток цифрових педагогічних компетентностей. Порівняльний аналіз показує, що педагогічний та лінгвістичний підходи до підготовки вчителів дають значні покращення цифрової готовності, але культивують різні виміри професійної стійкості. Програми, орієнтовані на освіту, посилюють емоційну регуляцію та адаптивність у кризових ситуаціях, тоді як програми, орієнтовані на лінгвістику, зміцнюють технологічну креативність та інновації, орієнтовані на учня. Запропонована рамка цифрової педагогічної стійкості охоплює чотири взаємопов'язані виміри: технічну спритність, методологічну гнучкість, емоційний інтелект та контекстуальну обізнаність. Емпірична валідація через аналіз опитувань до та після курсів демонструє статистично значуще зростання у всіх вимірах з великими роз-

мірами ефекту. Якісний аналіз рефлексій студентів висвітлює трансформацію від розуміння технології-як-інструменту до технології-як-педагогіки, що вказує на фундаментальні зміни у формуванні професійної ідентичності. Запропонована концептуальна основа має важливе практичне значення для розробки навчальних програм у системі педагогічної освіти, зокрема для підготовки вчителів, які працюватимуть у зонах збройного конфлікту чи регіонах із системними порушеннями функціонування системи освіти. Дослідження вносить внесок у нову науку про кризову педагогіку, демонструючи, що стійкість у контекстах цифрового викладання вимагає одночасного розвитку технічних, педагогічних, емоційних та адаптивних здібностей, а не ізольованого набуття навичок.

Ключові слова: цифрова педагогічна стійкість, підготовка викладачів англійської мови, кризова педагогіка, модель TPACK, екстрене дистанційне навчання.

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