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MEDICAL SIMULATION AS AN OBJECT OF PEDAGOGICAL RESEARCH

Summary. At the current stage of development of innovative technologies, real prerequisites are created for the search for effective pedagogical methods in the process of training highly qualified specialists who will be competitive in the labor market. In the educational sphere, one of such important methods of training specialists in various fields of professional activity is the introduction of simulation training into pedagogical practice. In particular, simulation training has become particularly widespread in higher education institutions that train specialists for aviation, space industry, military direction, information and communication technologies, medicine, etc. However, it should be noted that simulation training in the process of training medical specialists, in particular nurses, as an object of pedagogical practice has not yet received proper implementation in the pedagogical educational space. Since the subject of the study is medical education, for a deeper understanding of its content and taking into account the features of its application, the problem of theoretical analysis of the evolution of the development of both the medical practice itself and the use of simulation training methods, as well as taking into account the historical experience of various scientific views in medical pedagogy, is being actualized.

The article provides a theoretical analysis of medical simulation as an important object of scientific and pedagogical research through the prism of the need to use its results to increase the effectiveness of teaching simulation training in the field of medical education.

The etymological aspects of the terms "simulation", "medical simulation", which are the basis for interpreting the conceptual and categorical apparatus of this study, as well as studying the evolution of development, periodization of the main stages of simulation training in medical education, are considered.


The author's interpretation of the theoretical content of the concept of "medical simulation" and determining its place in the system of categories of medical pedagogy are proposed.


The literary sources of domestic and foreign scientists are analyzed and the historical patterns of the formation and development of simulation training in medical education are theoretically substantiated, which directly contributes to increasing the level of theoretical knowledge of the complex nature of this pedagogical phenomenon.

The significance of such analysis for the development and implementation of more effective applied methods of training highly qualified specialists for the medical field in higher education institutions is summarized.

Keywords: pedagogy; historical-theoretical analysis; history of medicine; medical pedagogy; medical simulation; simulation-based learning; training of nurses.


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**MODELS OF TECHNOLOGY-ENHANCED LEARNING IN HIGHER EDUCATION:
POSSIBLE APPLICATIONS IN ENGLISH LANGUAGE INSTRUCTION**

The article addresses the issue of Technology-Enhanced Learning (TEL) in Ukrainian pedagogical universities with a special focus on English Language Teaching (ELT).

Specifically, it provides a comparative analysis of three renowned TEL models: Technological Pedagogical Content Knowledge (TPACK), Substitution-Augmentation-Modification-Redefinition (SAMR), and Digital Competence of Educators (DigCompEdu). Possible outcomes are examined from the perspectives of theory, usability, and challenges within the ELT model, particularly in the context of Ukraine's higher education.

TPACK deals with the interaction between technological, pedagogical, and content knowledge in effective teaching. SAMR offers a hierarchical framework to assess these transformative impacts of technology on learning processes. DigCompEdu proposes a guidance for a broad competency-based framework for teachers' digital competences, aligning with European digital education standards.

The paper also underscores the complementary strengths of the models and recommends their joint use for the enhancement of curriculum design, pedagogical innovation, and staff development. Besides, the article debates the challenges unique to Ukraine, including infrastructural limitations and the urgency of digital literacy, and suggests the corresponding remedies such as curriculum alignment, faculty development, and expenditure on digital infrastructure.

The study concludes by advocating an integrated pedagogical framework combining TPACK, SAMR, and DigCompEdu to construct effective digitally literate English language instructors. Future studies embrace longitudinal studies, model localization, inter-disciplinary comparisons, and analysis of students' feedback to optimize TEL deployment in Ukrainian ELT contexts.

Keywords: Technology-Enhanced Learning (TEL); English Language Teaching (ELT); TPACK; SAMR; DigCompEdu; Ukrainian higher education; digital literacy; teacher training; pedagogical innovation; digital competence.

1. Introduction

The rapid advancement of information technologies has transformed the field of higher education, compelling teachers to reconsider their pedagogical practices and adopt innovative approaches to instruction. This transformation is most vivid in English language teaching (ELT), where characteristics of digital technology present unparalleled advantages and challenges in equal measure. In the context of Ukraine, namely in pedagogical universities tasked with instructing teacher-trainees of English, the application of Technology-Enhanced Learning (TEL) is not only an issue of up-dating present-day language teaching, but also a pedagogical requirement.

Notably, TEL refers to strategic use of digital platforms and tools to support and complement the learning process. It goes beyond direct substitution of analogues for digital alternatives to regular standard materials and takes an expansive view toward remodeling the teaching-learning framework. As education institutions globally shift towards more student-centric models, TEL frameworks offer structured pathways for systematic integration of technology with pedagogical objectives and content knowledge. For English teaching specialists in Ukraine's higher education system, specifically in pedagogical universities, this shift not only calls for technical expertise but also for theoretical and reflective underpinnings on how and why technology is to be implemented in specific learning contexts.

Among numerous existing models, three of them are most highly supported by scholarly discourse and practiced in education: Technological Pedagogical Content Knowledge (TPACK), Substitution-Augmentation-Modification-Redefinition (SAMR), and Digital Competence of Educators (DigCompEdu). Each of these frameworks argues a unique perspective on integrating technology and has been utilized across the board. However, none of the models have been systematically synthesized and compared in terms of their application in language departments in Ukrainian universities.

The aforementioned given, this paper presents a comparative analysis of TPACK, SAMR, and DigCompEdu, each critiqued on their theoretical basis, key components, and possible usage in actual practice for the English language training in tertiary education. In particular, a special emphasis is placed on the realities faced by the Ukrainian teaching community: infrastructural limitations, curricular requirements, linguistic policy changes, and growing prioritization of digital literacy. By critical

analysis of the referred three models, this article seeks to provide a practical guidance and evidence-based recommendations for the effective embedding of TEL in teaching English in present-day universities.

2. The TPACK Model

2.1. Conceptual Foundations of the TPACK Model

Technological Pedagogical Content Knowledge (TPACK) is viewed as a framework for elucidating how teachers can integrate technology into their teaching. Building on Lee Shulman's (1986) concept of Pedagogical Content Knowledge (PCK), the TPACK framework introduces Technological Knowledge (TK) as a third core area, along with Pedagogical Knowledge (PK) and Content Knowledge (CK). Teaching with technology, as argued in Punya Mishra and Matthew Koehler's foundational text, depends on a synergistic combination of these domains rather than considering them in isolation (Mishra, Koehler, 2006, p. 1029).

It is commonly acknowledged that effective technology integration does not follow from the simple addition of new tools. Instead, efficacious teaching is a function of the substantive intersection of CK, PK, and TK in specific teaching contexts. It is the interaction of these domains that enables instructors to make knowledgeable decisions about tool application, instructional design, and content dissemination. The TPACK model promotes a situated view of teacher knowledge, where CK and PK are mediated through technological affordances and constraints (Koehler, Mishra, 2013, p. 15).

2.2. Application of the TPACK Model in English Language Teaching

The application of the TPACK model in English Language Teaching (ELT) enables intentional integration of technology with language pedagogy and content. In ELT, CK is composed of grammar, vocabulary, and characteristics of discourse, whereas PK is comprised of language pedagogy and classroom management, and TK is the ability to select and use digital tools that scaffold communication and language acquisition. Voluminous studies expose how highly TPACK-level teachers construct lessons to get students engaged in deep, interactive, and collaborative learning experiences, rather than applying technology to replace the conventional routine of completing tasks (Koh, Chai, Tsai, 2013, p. 798). To instantiate, language teachers who draw from TPACK can employ digital narrative, online platform-supported interactive writing, and technology-enhanced formative assessment, all toward communicative and cognitive learning goals (Valtonen, 2017, p. 16).

Furthermore, technology use in ways that encourage autonomy, critical thinking, and real-world language use reflects a deeper understanding of the TPACK domains and areas of overlap to enable the fostering of both digital and linguistic abilities (Koh, Chai, Tsai, 2013, p. 798).

2.3. *Challenges in the TPACK Model Development*

Despite its simplicity, actualizing the TPACK framework still remains to be a significant challenge for university instruction. Most teacher training courses keep technology instruction separate from pedagogy of subject matter in such a way that resulting fragmented knowledge does not actually get involved into instructional practice. Should technological skills be taught in isolation, the instructor would be proficient in tool usage but be unaware of how such tools connect to and ensure the achievement of instructional goals (Lim, Chai, Churchill, 2011, p. 70).

Additionally, another challenge frequently encountered by teachers may be the overemphasis on TK, often at the expense of PK and CK. Educators with reliance on utilizing technology may not have the sufficient training to apply it successfully within pedagogical and content frameworks. In accordance with the convincing findings, teachers may rate themselves well on digital fluency, yet their own implementation remains at simple substitution activities because pedagogical design skills are not enough developed (Koh, Chai, Tsai, 2013, p. 799).

2.4. *Strategies for Developing the TPACK Model in Teacher Education*

In order to build robust TPACK, teacher education is supposed to ensure scaffolded experiences related to a target discipline. Practice may turn out efficacious through collaborative planning of lessons, teaching simulations, and reflective functioning in digitally mediated environments. Such experiences allow for the transfer of TPACK to practice.

It is considered that educators who model TPACK integration intentionally – by teaching and justifying why and how they select definite technologies in terms of content and instruction – create more effective pre-service teacher learning environments. Modeling in this case serves the purpose to make preservice teachers aware of the justification in online decision-making and advances their ability to do so independently. For example, embedding digital tools into language-centered activities such as interactive exercises in grammar or mobile vocabulary builders is a demonstration not merely of

technical proficiency but also of pedagogical fit (Lim, Chai, Churchill, 2011, p. 75). At that, systematic exposure to integrated technology use, iterative feedback, and collaborative inquiry are essential for potential teachers to develop TPACK as adaptive expertise.

3. *The SAMR Model*

3.1. *Conceptual Underpinnings of the SAMR Model*

Today, it is often the case that the TPACK model is contrasted with the other popular prominent framework, the SAMR, which is an acronym for Substitution, Augmentation, Modification, and Redefinition. Created by Ruben Puentedura, the SAMR offers a framework for the design and analysis of technology integration in teaching practice. This model promotes four interrelated **levels**: Substitution, where technology is used as a replacement without altering function; Augmentation, where technology provides functional enhancement; Modification, where technology ensures massive task redesign; and Redefinition, where technology allows creating a new task not previously seen (Puentedura, 2006).

Besides, SAMR is typically employed as an assessment tool for educators, assessing not only the manner in which technology is used in class, but also how much it alters learning (Koh, Chai, Tsai, 2013, p. 802). Thus, the shift from enhancement (Substitution and Augmentation) to transformation (Modification and Redefinition) mirrors contemporary goals in digital pedagogy that welcome higher-order thinking and actual learning experiences.

3.2. *Application of the SAMR Model in English Language Teaching*

The SAMR model provides language teachers with an opportunity to design, execute, and measure technology-enhanced activities in ELT. Specifically, in the Substitution phase, there is word processing as a replacement for handwritten essays. Augmentation can embed in-built spelling-checkers or group annotation. Modification allows students to compose and edit a narrative together online, while Redefinition makes accessible activities such as digital storytelling with multimedia, global peer review, or interactive blogs connecting students worldwide (Nair, Chuan, 2021, p. 375).

Substantial empirical studies in the area of higher education have indicated that the SAMR model could be applied for developing ELT activities above substitutional application of technology. For instance, technology-enabled instruction based on the SAMR model resulted in higher student engagement, richer language capacity, and additional

opportunities for formative feedback (Nair, Chuan, 2021, p. 376).

3.3. *Criticisms and Challenges to the SAMR Model*

While its utility yields excellent results, yet the SAMR model is criticized as being linear in approaching and emphasizing transformation as a versatile technology use. The contention is that not every learning environment should be shifted to the level of “Redefinition” and that in certain instances effective technology integration can be at the Substitution or Augmentation level, especially in language learning environments that are at the foundational skills level (Koh, Chai, Tsai, 2013, p. 803).

Furthermore, the model has been critiqued on failing to embrace pedagogical reasoning, content alignment, and context (Hamilton, Rosenberg, Akcaoglu, 2016, p. 434). It appears that without integration with models such as TPACK, technology is in danger of being an end in itself for teachers rather than a tool enabling learning outcomes.

3.4. *Teacher Education Implementation Strategies*

It is maintained that the SAMR model can be efficiently applied in teacher education via systematic reflection, collective inquiry, and context-fitted implementation. In particular, incorporating SAMR in lesson planning and staff development may help pre-service and in-service teachers critically evaluate the goal and impact of digital tools (Nair, Chuan, 2021, p. 379). Combining SAMR with TPACK in teacher training programs may facilitate a more advanced process of technology integration so that pedagogical and content knowledge trigger the use of digital tools at every level (Koh, Chai, Tsai, 2013, p. 804).

That given, professional development activities should be structured to enable teachers to design, deliver, and evaluate technology-integrated lessons, moving fluidly through the levels of the SAMR model as needed to specific language learning requirements and classroom environments.

4. *The DigCompEdu Model*

4.1. *Conceptual Foundations of the DigCompEdu Model*

The Digital Competence of Educators (DigCompEdu) framework, developed by the European Commission’s Joint Research Centre, provides a comprehensive model for describing and assessing educators’ digital competence across all levels of education. This framework is seen as the one identifying six competence *areas* (Redecker, Punie, 2017, p. 16):

1. *Professional Engagement*: this area focuses on how teachers employ digital technologies and resources to facilitate professional communication with students,

parents, colleagues, and stakeholders. The key elements of this area include self-reflection on teaching methodologies, critical evaluation of professional performance, and pursuit of continuous professional development.

2. *Digital Resources*: this dimension pertains to teachers’ capacity to effectively engage with digital content. It comprises making use of readily available resources, adapting them to specific needs, and creating original materials. It also emphasizes the ability to discerningly select digital resources based on learning objectives, manage them systematically, and ensure safe and responsible deployment.

3. *Teaching and Learning*: this aspect encompasses the strategic use of digital technologies to enhance instruction, provide mentorship, structure student interactions, and promote learner autonomy throughout the educational process.

4. *Assessment*: this facet involves the strategic application of digital technologies across the assessment cycle, from implementing various assessment strategies and analyzing their results to planning and delivering effective feedback to learners.

5. *Empowering Learners*: this key constituent centers on how teachers leverage digital technologies to create inclusive and accessible educational environments, personalize learning pathways, and facilitate active student engagement in the learning process.

6. *Facilitating Learners’ Digital Competence*: this area outlines a targeted approach for enhancing students’ digital capabilities. It incorporates raising their level of information awareness and media literacy, advancing skills in digital communication and cooperation, enabling the creation of digital content, enhancing problem-solving abilities within digital environments, and promoting thoughtful and responsible use of technology.

Each area is further divided into specific competencies, resulting in a holistic view of what it means for teachers to be digitally proficient in modern educational environments. DigCompEdu is grounded on a progression model with six proficiency levels, ranging from Newcomer to Pioneer, which allows for self-assessment and tailored professional development (Redecker, Punie, 2017, p. 17). This step-by-step and incremental approach supports lifelong learning for educators and aligns with broader European digital skills initiatives.

4.2. *Implementation of DigCompEdu in Higher Education*

In tertiary education, DigCompEdu is utilized both as a self-assessment tool and as

an institutional strategy template for the embedding of digital transformation. Its application within contexts of universities has been found in various European research studies, as revealed by its applicability for teacher professional development, curriculum change, and digital policy (Caena, Redecker, 2019, p. 358).

Basically, the DigCompEdu model for teachers' digital competences draws its foundation from the DigComp framework (Ovcharuk, 2020, p. 28), a citizen-focused model that has undergone recent revisions and updates to address the proliferation of artificial intelligence, the industrial Internet, remote work, and other contemporary developments shaped by the digital transformation of global economies (Caena, Redecker, 2019, p. 358).

Ample scholarly literature indicates that when higher learning institutions adopt DigCompEdu, educators express increased confidence to integrate digital tools, augmented capability to facilitate students' digital literacy, and enhanced ability to use technology in the evaluation and differentiation (Cabero-Almenara, Palacios-Rodriguez, 2020, p. 216). In the context of ELT, the emphasis of the framework on learner empowerment and learners' own digital competences is particularly relevant because language teachers are supposed to train learners to communicate in technologically driven environments (Caena, Redecker, 2019, p. 359).

4.3. Criticism and Challenges in Implementation

Despite its comprehensive design, the DigCompEdu model is subject to criticism. Specifically, some researchers tend to assert that the scope of the framework complexifies the implementation of this model for institutions or teachers without adequate support or resources (Cabero-Almenara et al., 2021, p. 9). Moreover, even as DigCompEdu provides clear descriptors, translating competencies into practice requires vigorous contextual adaptation, especially in non-EU settings or in under-resourced universities (Caena, Redecker, 2019, p. 366).

Aside from this, challenges may also arise when institutional digital policies lag behind the classroom environment, resulting in superficial compliance rather than real integration of digital competencies (Caena, Redecker, 2019, p. 366). The self-assessment instruments may also overestimate teachers' digital competencies unless confirmed through observation or peer review.

4.4. Recommendations for Practice

To realize the maximum possible effect of DigCompEdu on higher education, it seems

appropriate for institutions to incorporate the framework into continuous professional development, peer cooperation, and reflective practice. Implementation is based on context-adaptation of the framework descriptors, continuous professional development, and institutional leadership dedicated to digital innovation (Cabero-Almenara et al., 2021, p. 10).

For language teachers, integrating DigCompEdu into discipline models like TPACK can provide a more targeted guideline for digital transformation in language instruction (Redecker, Punie, 2017, p. 28). Developing a digital culture both among students and educators alongside solid infrastructure and support are essential to actualizing the transformative vision imagined by DigCompEdu Model.

5. Comparative Analysis of TPACK, SAMR, and DigCompEdu Models

In evaluating TEL models for higher education and, more particularly, English language instruction, a comparison of the relative weaknesses and strengths of the three predominant models – TPACK, SAMR, and DigCompEdu – is critical. While having the common goal of promoting digital integration in education, these models vary in their structural, focal, and practical applications.

The subsequent section provides a detailed comparative analysis drawn from research literature and Ukrainian pedagogical institutions' TEL needs.

5.1. Theoretical Foundations and Orientation

The TPACK framework, proposed by Mishra and Koehler (2006), extends Shulman's (1986) Pedagogical Content Knowledge by adding technological knowledge (Mishra, Koehler, 2006, p. 1025). It has an epistemological foundation emphasizing the dynamic integration of technological, pedagogical, and content knowledge for informed instructional decisions (Chai, Koh, Tsai, 2013, p. 32).

The SAMR model, developed by Puentedura (2006), adopts a hierarchical, task-centered approach, primarily concerned with technology's functional impact on learning activities, progressing from mere enhancement (Substitution and Augmentation) to substantial transformation (Modification and Redefinition) (Hamilton, Rosenberg, Akcaoglu, 2016, p. 435).

Conversely, the DigCompEdu framework, established by Redecker (2017), is competency-based, emphasizing educator performance across six domains that integrate pedagogical, professional, and ethical dimensions. It stems from European digital education policy and frameworks designed for lifelong learning and competence development (Caena, Redecker, 2019, p. 358).

5.2. Application Scope and Usability

TPACK efficiently suggests a cognitive schema suited for teacher education programs, particularly initial teacher training at Ukrainian pedagogical universities, emphasizing integrated knowledge (Scherer, Siddiq, Tondeur, 2018, p. 21). Nevertheless, its theoretical abstraction limits operational guidance, presenting challenges for practical implementation (Chai, Koh, Tsai, 2013, p. 32).

SAMR's practical orientation is beneficial for educators needing a clear evaluative tool for TEL lesson design. Its simplicity and clarity have gained favor among in-service teachers (Hamilton, Rosenberg, Akcaoglu, 2016, p. 436). However, its hierarchical structure has faced criticism for implicitly suggesting that the Redefinition stage represents the ultimate pedagogical ideal, irrespective of contextual needs (Hamilton, Rosenberg, Akcaoglu, 2016, p. 438).

DigCompEdu furnishes a comprehensive framework suitable for professional development, featuring clear descriptors and progression levels, thus serving effectively in institutional self-assessment, policy planning, and broad-scale training (Ovcharuk, Ivaniuk, 2021, p. 85). Despite these strengths, it is considered that its extensive breadth can be overwhelming, and its utility may rely heavily on local adaptation and resource availability

(Cabero-Almenara, Palacios-Rodriguez, 2020, p. 215).

5.3. Focus on English Language Teaching (ELT)

In ELT contexts, especially within Ukrainian higher education, each framework offers distinct *benefits*, specifically:

1. TPACK emphasizes integrating subject content and pedagogy, ideal for designing English teacher training programs that balance grammatical accuracy, communicative skills, and suitable digital tools (Lim, Chai, Churchill, 2011, p. 72).

2. SAMR promotes transformative task design, enabling authentic, multimodal language practice essential for developing listening, speaking, reading, and writing competencies (Tunjera, Chigona, 2020, p. 136).

3. DigCompEdu addresses professional digital identity, resource management, crucial for EFL instructors managing diverse hybrid or remote classrooms (Ovcharuk, Ivaniuk, 2021, p. 86).

Thus, TPACK enriches instructional design, SAMR fosters pedagogical innovation, and DigCompEdu supports professional and systemic growth (the strengths and weaknesses of the described models are charted in table 1).

Table 1

Comparative Strengths and Weaknesses of TEL Models

Framework	Strengths	Weaknesses
TPACK	integrates teacher knowledge; suitable for pre-service training;	– too abstract, lacking practical implementation guidance;
SAMR	possesses clear visualization; supports reflective and innovative pedagogy;	– overly hierarchical; – neglects the focus on teacher knowledge;
DigCompEdu	comprehensive, competency-based; addresses professional engagement and ethics.	– limits specific subject applicability.

The comparative exposition of the discussed TEL models indicates how they supplement rather than replace each other. For instance, SAMR may help English teachers develop innovative speaking activities, while TPACK ensures that these innovations are pedagogically sound, and DigCompEdu provides teachers with an opportunity to test them professionally. All these schemes combined make a robust and adaptable blueprint for developing effective digital pedagogies within Ukrainian universities' English language instruction.

6. Discussion

The integration of digital technology into English language education in the higher education environment has no longer been an option – it has become a necessity of modern pedagogy. For Ukrainian pedagogical

universities training foreign teacher-trainees, the models presented in this article – TPACK, SAMR, and DigCompEdu – offer complementary frameworks for effective and reflective utilization of TEL. This discussion synthesizes their output and details implications for teacher education, institution-level policy, and resulting research.

6.1. Complementary Nature of TEL Models

Although often treated independently, TPACK, SAMR, and DigCompEdu should be seen not as mutually exclusive, but as complementary tools that operate at different levels of pedagogical planning and development, in particular:

1. TPACK provides the cognitive foundation for understanding how to integrate technology into subject-specific teaching: it helps

educators design lessons where pedagogy, content, and technology are in alignment (Mishra, Koehler, 2006, p. 1025).

2. SAMR offers a reflective model to evaluate how digital tools transform the learning experience from simple substitution to deep redefinition (Puentedura, 2013, p. 3).

3. DigCompEdu enables institutional and personal development planning, suggesting a roadmap for the continuous improvement of teachers' digital competence (Redecker, Punie, 2017, p. 9).

Taken together, the presented frameworks address the cognitive (TPACK), pedagogical-practical (SAMR), and professional-developmental (DigCompEdu) layers of digital education. This three-pronged approach may appear especially useful in the context of Ukraine's ongoing educational reform and integration into the European Higher Education Area (Ovcharuk, Ivaniuk, 2021, p. 78).

6.2. *Implications for Teacher Education in Ukraine*

The application of the described above TEL frameworks in Ukrainian pedagogical universities requires strategic alignment with national standards and the realities of local infrastructure, specifically:

1. Curriculum Development: teacher training programs may embed TPACK principles in method courses, helping preservice teachers internalize the intersection of pedagogy, content, and digital tools (Koh, Chai, Tsai, 2014, p. 190).

2. Instructional Design: using SAMR, faculty can mentor teacher-trainees in designing TEL-enhanced tasks that progress from conventional exercises to innovative, student-centered activities (Tunjera, Chigona, 2020, p. 129).

3. Professional Reflection: as part of practicum and portfolio development, preservice and in-service teachers may use DigCompEdu self-assessment tools to evaluate their digital strengths and growth areas (Cabero-Almenara, Palacios-Rodríguez, 2020, p. 215).

A major benefit of such integration is that it shifts teacher training from a technology-as-tool approach to a more critical, strategic, and values-based pedagogy (Falloon et al., 2020, p. 2452).

6.3. *Institutional and Policy-Level Considerations*

In order to support meaningful implementation, educational policymakers and university administrators must take proactive steps such as:

1. Digital Infrastructure: investment in reliable Internet access, licensed educational software, and updated hardware is fundamental. Without this, even the most advanced models will remain theoretical (Caena, Redecker, 2019, p. 359).

2. Faculty Development: structured, longitudinal professional development programs aligned with DigCompEdu levels (A1-C2) can help university faculty grow systematically in their digital competence (Redecker, Punie, 2017, p. 35).

3. Assessment and Accreditation: TEL integration has to be reflected in national teacher accreditation standards, not only in terms of knowledge but also practice and ethics (Gallego-Arrufat, Torres-Hernández, Pessoa, 2019, p. 60).

By institutionalizing these models, Ukrainian universities can both meet European digital education benchmarks and enhance the quality of English language instruction.

6.4. *Future Research Directions*

Several areas of inquiry emerge from the application of TEL models in Ukrainian higher education. We see their realization in the following:

1. Longitudinal Studies: tracking how TPACK, SAMR, and DigCompEdu affect teaching effectiveness and learner outcomes over time in EFL contexts.

2. Localization of Models: adapting DigCompEdu to be suitable for Ukrainian contexts or employing hybrid frameworks that reflect national curriculum goals and cultural specifics.

3. Interdisciplinary Comparisons: exploring how TEL frameworks function differently across disciplines (e.g., ELT vs. STEM) to inform targeted training.

4. Satisfaction of Growing Needs: examining student perspectives on TEL integration in English language classes, especially regarding engagement, motivation, and perceived learning gains.

6.5. *A Unified Pedagogical Strategy*

It deems plausible to suggest that rather than adopting one model in isolation, Ukrainian pedagogical institutions should pursue a layered integration and make use of: TPACK to train future educators in lesson design; SAMR as a scaffold for evaluating digital task complexity; DigCompEdu to guide faculty development and institutional accountability. This unified strategy will align with Ukraine's national ambitions for digitalization in education while maintaining the integrity of pedagogical theory and practice.

7. Conclusion

To summarize, the integration of TEL models in English language instruction in higher education is viewed as a high-priority agenda for institutions intent on training students to engage with a globally connected and digitally mediated world. This holds particularly true in Ukrainian pedagogical universities, where teacher-trainees of English have to be equipped with relevant knowledge, skills, and competencies expedient for efficaciously integrating technology in diverse teaching environments.

This paper has provided an in-depth description of three dominant TEL models: Technological Pedagogical Content Knowledge or TPACK, Substitution–Augmentation–Modification–Redefinition or SAMR, and the Digital Competence of Educators Framework or DigCompEdu. All of the presented TEL frameworks represent a distinct concept of technology integration: TPACK addresses the knowledge intersections required to effectively integrate technology and is most applicable to curriculum design and teacher preservice education; SAMR offers a balanced approach to deconstructing the revolutionary power of digital tools to plan and deliver effectual and productive lessons; DigCompEdu suggests a comprehensive proficiency model focusing on advancing teachers' digital pedagogical competence.

Integrated, the models make up a tiered complementary structure. TPACK takes into account teaching's design and cognition; SAMR enables pedagogical shift through digital task redescription; and DigCompEdu ensures institutional planning benchmarking as well as continuous professional growth.

On balance, the effective implementation of TEL models in the Ukrainian context requires: their strategic embedding within pre-service and in-service teacher training programs, continuous investment in digital infrastructure and open-access materials, conformity with the European education standards, specifically DigCompEdu, for both national development as well as global cooperation.

It is clear therefore that in present-day education, TEL is becoming not only a matter of using tools, but an instrument of radically transforming pedagogical practice aimed at learners' becoming more capable of utilizing languages in digital, intercultural, and real-life contexts. For teachers, the discussed models prove to be a practical means of upgrading teaching, fostering digital skills, and enhancing learner engagement.

This study though far from being conclusive yet offers several insights into the issue of employing TEL in Ukrainian educational environments. Future research endeavors may focus on the contextual applicability of TEL models within Ukrainian educational institutions specifically considering such key areas as measurable student outcomes, ethical integration of technology in pedagogy, and teacher agency. Provided TEL frameworks are implemented with conscious pedagogical intent and receive institutional support, they may serve as effective mechanisms for boosting both the professional competence and digital literacy of prospective educators in Ukraine.

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МОДЕЛІ СУЧАСНИХ ТЕХНОЛОГІЙ У ВИЩІЙ ОСВІТІ: МОЖЛИВІ ЗАСТОСУВАННЯ У НАВЧАННІ АНГЛІЙСЬКОЇ МОВИ

Анотація. У статті досліджується проблема освіти в українських педагогічних університетах із використанням сучасних технологій з особливою увагою на їхню значущість для викладання англійської мови. У роботі представлено порівняльний аналіз трьох ключових моделей, які можуть бути успішно інтегровані технології в навчальний процес: *Technological Pedagogical Content Knowledge (TPACK)*, *Substitution-Augmentation-Modification-Redefinition (SAMR)* та *Digital Competence of Educators (DigCompEdu)*. Кожна з моделей розглядається з позиції її теоретичного підґрунтя, практичної цінності та потенційних викликів, особливо в контексті навчання англійської мови та системи вищої освіти України.

Зокрема, модель TPACK висвітлює взаємодію технологічних, педагогічних і змістових знань для ефективної навчальної діяльності. SAMR пропонує ієрархічну структуру для оцінювання трансформаційного впливу технологій на навчальні результати. DigCompEdu, своєю чергою, забезпечує комплексну компетентнісно-зорієнтовану основу для розвитку цифрових компетенцій викладачів, що відповідає європейським стандартам цифрової освіти.

У статті зазначаються взаємодоповнювальні переваги означених моделей, рекомендуючи їх інтегроване використання для вдосконалення навчальних

програм, стимулювання педагогічних інновацій та підвищення професійного рівня викладачів. Також обговорюються виклики, характерні для закладів вищої освіти України, зокрема інфраструктурні обмеження та загальна потреба в підвищенні цифрової грамотності викладачів. Для їх подолання пропонуються такі шляхи, як узгодження навчальних програм, розвиток викладацького потенціалу та інвестиції в цифрову інфраструктуру.

Метою дослідження є обґрунтування інтегрованої педагогічної стратегії, що поєднує TPACK, SAMR та DigCompEdu, аби сприяти формуванню ефективних, цифрово грамотних викладачів англійської мови. Напрями майбутніх досліджень включають довгостроковий аналіз, локалізацію моделей, міждисциплінарні порівняння та врахування зворотного зв'язку від студентів для оптимізації впровадження технологій у контексті викладання англійської мови в Україні.

Ключові слова: навчання з використанням технологій; викладання англійської мови; TPACK; SAMR; DigCompEdu; українська вища освіта; цифрова грамотність; підготовка викладачів; педагогічні інновації; цифрова компетентність.

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