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Castledown

Digital competency of university language teachers in Ukraine: A state-of-the-art analysis

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This research examines the digital competency of university language teachers in Ukraine, specifically focusing on instructors who deliver university courses in Ukrainian for Specific Purposes and English or German as Foreign Languages. The DigCompEdu reference framework with CheckIn assessment instrument served as a basis for the questionnaire developed to provide a comprehensive evaluation of university language teachers' digital skills across various dimensions. This survey involved 71 participants from four universities in the west of Ukraine, representing different ages, academic ranks, teaching experiences at all levels of education, and with varying self-perceived digital competency level, which ensured diverse perspectives across different career stages. A mixed-methods approach and statistical analysis (IBM SPSS 20), including correlation and clustering methods, were applied to assess the relationships between various factors influencing digital competency formation. The study aimed to establish a comprehensive understanding of the digital competency levels, gain insights into the current digital teaching landscape, and identify areas for improvement of digital teaching practices. The findings predominantly showed teachers' enthusiasm toward increasing digital engagement in language education despite the challenges such as technical issues due to the ongoing war in Ukraine and the need for continuous development in integrating digital tools for language acquisition and communication.

Keywords: language teacher, higher education, digital competency, DigCompEdu, questionnaire

Introduction

In its multiple aspects, the concept of digital competency (DC), which fosters the effective use of knowledge-generating technologies and advanced communication tools, has gained its utmost significance in higher education. According to the European Commission (2019), "Digital competence involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society" (p.10). The aim to educate digitally empowered and capable citizens emphasizes the need to ensure that the education community is adequately skilled and equipped to use technology effectively in their teaching methods (Decision 2022/2481). Nguyen and Habók (2023) identify teachers' digital literacy as the principal element in the effectiveness of technological innovation (p. 324). The teachers are expected to become agents "who will help students navigate the digital world … in terms of inculcating the behaviors and values necessary to regulate the use of digital devices and adapt to an increasingly data-driven world" (OECD, 2023, p. 4). DC is crucial for teachers to "effectively utilize digital educational tools, enhance the learning process, and engage students" at all levels (Aydin et al., 2024, p. 10). In the context of higher education, the role of educators' DC becomes even more critical since they are tasked with empowering students to critically engage with the digital world in "knowledge production (not mere reproduction)" (Moreira, 2023 et al, p. 1). Considering the higher education teacher "as the main person in charge of" providing their students with the essential competencies for lifelong learning and creating pillars for social sustainability (Chahuán-Jiménez et al., 2025, p. 2), digital learning environments must be effectively integrated into teaching practices (Kupchyk & Litvinchuk, 2021). Karimi and Khawaja (2025) underscore the growing importance of the DC of university faculty who face unique challenges of adapting teaching practices to diverse learning environments, utilizing advanced digital tools, and overcoming barriers such as limited training, opportunities, and institutional support, which remain underexplored (p. 299).

Before the COVID-19 pandemic, there was a growing interest in widespread implementation of digital technology in education. However, the pandemic served as a transition point to fully online teaching and learning (Tang, 2023), accelerating the integration of digital tools and reshaping educational practices on a global scale, when educators had to grapple with uncertainties about the future of teaching and learning (Cahyono et al., 2024). Regarded as "emergency remote teaching", this shift has profoundly changed teaching and learning practices (Broadbent et al., 2023, p. 1) and aligned with the exponential creation of information and unprecedented consumption of digital resources and media (Chahuán-Jiménez et al., 2025). Kallunki et al. (2023) consider this change as a "blessing in disguise in forcing teachers from different academic fields to develop their teaching in online contexts" (p. 10023). While there is an

ongoing debate about the long-term effects and potential for enduring transformations in pedagogical practices (Broadbent et al., 2023), Ukraine's experience with online and mixed-mode learning due to Russia's invasion underscores the necessity of sustaining and developing these approaches. Such challenges as emergency remote teaching and unexpected interruptions in delivering in-class training due to air alerts highlight the priority of technology-enhanced learning environment (Litvinchuk & Kupchyk, 2024), which largely relies on teacher's DC proficiency. What was once seen as an emergency response has now become an essential, sustained priority, ensuring educational resilience in the face of challenges and evolving needs. Therefore, reinforcement of teachers' DC becomes a sine qua non for effective teaching and learning in today's digital society (Aydin et al., 2024), "reconfiguring the pedagogical cultures with the incorporation of new spaces and virtual environments" (Moreira et al., 2023, p. 1) and guaranteeing "learning continuity for distance students" (Basilotta-Gomes-Pablos et al., 2022, p. 3).

As teachers' DC becomes a priority in educational contexts (Rubio-Gragera et al., 2023), it is essential to analyze its current state and identify strengths and weaknesses, or challenges and opportunities, for its enhancement. Acknowledging the indisputable significance and relevance of DC for STEM-related majors (Althubyani, 2024), it is also stressed that science education is closely connected with the arts (Council Recommendations, 2018), which proves the necessity to develop DC through all subjects when organizing the curriculum space. It extends to language education where technological advancements have transformed traditional teaching and learning paradigms, giving rise to such approaches as Information and Communication Technologies (ICT)-based teaching, Computer-Assisted Language Learning (CALL), and Technology-Enhanced Language Learning. Despite having a seemingly solid background in applying digital tools, language teachers are often considered to lack the necessary digital skills to effectively engage with digital-native students (Rahimi, 2024; Rubio-Gragera et al., 2023). Furthermore, many report that their training in CALL is either insufficient or frequently ineffective (Ito, 2024), and they are "unable to face the challenge" feeling the gap in the DC training of university lecturers especially in the use of applications with a didactic purpose (Liesa-Orus et al., 2023, p. 1).

It follows that DC development needs to and can be promoted by implementing good practices in shaping teaching and learning approaches and environments, supporting educational staff, and assessing and validating the state of DC formation (European Commission, 2019, p. 15). Considering the complex nature of DC for educators, it is ascertained to be "not simply gained by using technology, but requires special training for this purpose", and needs improvement and inspection (Suzer & Koc, 2024, p. 22058). The necessity to develop an efficient system for DC evaluation and "clarify which variables moderate" the creation of an effective digital educational environment accentuates the need for a comprehensive approach to language teachers' DC assessment and development (Liesa-Orus et al., 2023, p. 2).

Since university faculty in Ukraine extensively rely on online or mixed-mode

teaching, this study aims to contribute to a deeper understanding of the processes and policies needed to ensure sustainable DC development among Ukrainian university language teachers across various educational contexts. It does so by identifying key challenges, best practices, and strategies for effective implementation.

Teachers' digital competency frameworks

The growing and now indisputable role of technology in education has driven the development of various frameworks to assess and enhance teachers' DC. One of the most comprehensive is *The European Framework for the Digital Competence of Educators* (DigCompEdu) developed by the European Commission's Joint Research Center (Redecker, 2017). This framework provides detailed guidance for educators, with six levels of proficiency, from *Newcomer* to *Pioneer*, aligning with cognitive development stages and serving as a progression model for evaluation and certification of educators' DC proficiency (OECD, 2023).

While DigCompEdu is widely used in European contexts, other global frameworks provide complementary perspectives. UNESCO's ICT Competency Framework for Teachers (UNESCO, 2018) can be regarded as a global framework designed to guide policymakers and educators in integrating ICT into teaching and learning when supporting the United Nations Sustainable Development Goals (SDGs) (Bitegeko et al., 2024), such as SDG 4 (Quality Education), SDG 5 (Gender Equality), or SDG 17 (Partnership for the Goals). This framework emphasizes the role of technology in enhancing pedagogy, improving assessment, and fostering life-long learning. The International Society for Technology in Education (ISTE) developed ISTE standards that focus on educators' roles as digital leaders, designers, facilitators, or collaborators (Crompton, 2023). Furthermore, the Technological Pedagogical Content Knowledge (TPACK) model (Koehler et al., 2013) is valued for its emphasis on the intersection of technological, pedagogical, and content knowledge, guiding how teachers can integrate "technology proportionately and efficiently during the learning process" (Handayani et al., 2023, p.176). Recognized as one of the most comprehensive theoretical frameworks, TPACK "addresses all the key aspects in designing a teaching program for a course" and is particularly relevant in higher education (López-Nuñez et al., 2024, p. 2).

Despite strong theoretical foundations for integrating technology into teaching and the pedagogical, policy-oriented potential of these global frameworks, they lack evaluating and validating instruments for teachers' DC assessment and professional development (López-Nuñez et al., 2024). Hence, researchers conclude that DigCompEdu is the "prominent presence in the digital skills landscape" (Althubyani, 2024, p. 3) and an appropriate model for assessing teachers' DC, "enabling a detailed examination of their digital skills and capabilities in the educational domain" (Aydin et al., 2024, p. 2). This framework allows educators to "identify the areas of improvement and design tailored paths of professional development" (Moreira et al., 2023, p. 4). Specifically designed

to meet educators' needs, it emphasizes "the correct use of the technology in teaching-learning scenarios that are suitable to their educational and research profiles" (Cabero-Almenara et al., 2021, p. 4692).

The DigCompEdu reference framework embraces 22 educator-specific competencies, "showcasing the comprehensive skill set required of teachers in their digital journey" (Moreira et al., 2023, p. 3). These competencies are structured into six interrelated areas: (1) *Professional engagement* – using digital technologies for communication and collaboration, professional development, and reflective practices; (2) *Digital resources* – selecting, creating, modifying, and managing digital content while ensuring protection and accessibility; (3) *Teaching and learning* – integrating digital tools for effective, learner-centered instruction; (4) *Assessment* – leveraging digital strategies to monitor progress, analyze data, and provide feedback; (5) *Empowering learners* – enhancing accessibility, inclusion, engagement, and personalized learning; (6) *Facilitating learners' digital competence* – developing skills in information literacy, digital content creation, and problem-solving (Redecker, 2017).

To evaluate progress, the DigCompEdu CheckIn self-assessment tool uses statements and a scoring system across the 22 competencies. Each response is rated on a scale from 0 to 4, offering valuable insights and practical tips on enhancing proficiency levels in each area (Moreira et al., 2023).

This research adheres to internationally recognized standards, ensuring the comparability of these findings with other studies and contributing to the broader discourse on language teachers' DC development. By incorporating these dimensions in a tertiary-level context, university instruction aims to empower educators and students not only as users or critical thinkers but also as knowledge generators.

Literature review

DC has been extensively researched by scholars and practitioners, who explore various facets of its development. They agree on its crucial role in enhancing the quality of contemporary higher education that has to take on "a leading role contributing to the development of the country" (Chahuán-Jiménez et al., 2025, p. 1) and "ensure adequate capabilities for a more entrepreneurial economy" (Canal et al., 2024, p. 1707). Cabero-Almenara et al. (2021) assessed and analyzed the levels of DC proficiency among Andalusian higher education teachers in different areas of knowledge, having found that teachers in Engineering and Social areas tend to have higher DC profiles compared to those in Arts and Humanities. This disparity could be attributed to the nature of the knowledge they teach and their frequent use of technology, yet Cabero-Almenara et al. (2021) highlighted a lack of digital training across all disciplines. Moreira et al. (2023) argued that teachers were confronted with an additional challenge to "be able to incorporate the digital into their practices in a critical, reflexive and pedagogically intentional way" and had to focus on targeted training efforts for professional development engaging both individual and institutional initiatives (p. 2).

The urgency of this issue was heightened by the COVID-19 pandemic, which forced educational institutions worldwide to transition to online and hybrid modes of instruction, and "students and instructors had to rapidly adjust to online learning platforms" (Bojórquez-Roque et al., 2024, p. 87597). Myyry et al. (2022) examined the DC development among academic teachers at a time of shifting teaching to digital distance learning under pandemic conditions. They analyzed the key factors driving the need to enhance digital teaching competency, including the rapid adoption of digital tools, the demand for effective online pedagogy, and the challenges of maintaining student engagement and learning outcomes in a virtual environment (Myyry et al., 2022). Rubio-Gragera et al. (2023) described the pandemic's impact as having "positive repercussions in terms of acquisition of digital skills by teachers" and leading to "a transformation of their initial attitudes regarding the use of technologies for education" (p. 3).

Beyond the pandemic, another critical reason for teachers to develop technological proficiency and effectively apply online learning tools is the increasing frequency of global crises. Given the occurrence of other emergencies becoming more common, online education is unlikely to disappear in the future and will remain "an attractive alternative to acquiring knowledge and skills in technology" (Ito, 2024, p. 14). Imran et al. (2023) emphasized the importance of blended learning modes in higher education calling them highly flexible, adaptable, and inclusive to meet the needs of all students. Tang (2023) formulated some recommendations for future educational practices "to weather the storms" of this shift by adapting curricula, concurring diverse learning modalities, and enhancing support (p. 26). Bojórquez-Roque et al. (2024) in their literature review of students' DC development in higher education came up with a comprehensive approach to creating a DC learning ecosystem integrating selecting tools, utilizing digital learning environments, and adjusting methodologies. Kupchyk and Litvinchuk (2021) emphasized the role of constructing technology-enhanced learning environments in fostering personalized learning, where teachers' DC is key to selecting tools, incorporating digital resources, and adapting methodologies.

Considering DC as an imperative, Kiryakova and Kozhuharova (2024) surveyed Bulgarian teachers to determine the extent of their use of digital technologies and ability to provide effective and relevant education in the digital age. Meniado (2023) raised the question of how digital language teaching will influence language curriculum, instruction, and assessment in the post-pandemic digital age, and what technologies and practices will be adopted in language education to align with the evolving purposes.

Regarding the need to develop a highly effective digital education ecosystem supported by enhanced teachers' DC and skills for digital transformation, Moreira et al. (2023) endorsed the DigCompEdu CheckIn as a reliable and effective assessment tool. When evaluating the DC level of Portuguese university faculty, they attempted to identify the DC areas with greater weaknesses and offer possible training responses (Moreira et al., 2023). López-Nuñez et al. (2024) made a systematic review of teachers' DC assessment tools "with regard to the

competences most in need of reinforcement in higher education", ascertaining the fact that DigCompEdu remained the most widely used instrument (p. 15). Rubio-Gragera et al. (2023) surveyed Andalusian language teachers and emphasized the importance of integrating digital resources in foreign language learning, arguing that neglecting them means ignoring students' existing reality. Their findings underscored the need to train language teachers not only in facilitating students' DC development but also in effectively using digital tools for collaborative learning (Rubio-Gragera et al., 2023). Marisa et al. (2024) investigated the factors contributing to the DC development of English as a Foreign Language (EFL) teachers' professional identity and evaluated the DC potential in developing pedagogical and reflective practices when considering EFL teachers' "multiple identities" (p. 22). Litvinchuk and Kupchyk (2024) stressed the necessity for language instruction curriculum designers to integrate technology-driven teaching strategies and be prepared to engage with and effectively utilize emerging digital tools.

Despite institutional requirements to use technology, many language teachers in Japan were found by Ito (2024) to rely on self-directed learning through online resources given little or no support at the workplace and "left on their own to decipher ways to learn how to teach using technology" (p. 16). Danish scholars emphasized the need for teachers "to conceive of digital competence as part of their disciplines – and not only to have a detached technological and pedagogical aim" (Caviglia et al., 2024, p. 19).

The development of teachers' DC in Ukraine has been explored in several studies. Ovcharuk and Ivaniuk (2021) surveyed secondary school teachers' DC using DigComp 2.0 and 2.1, and DigCompEdu in the context of life-long learning. Noskova et al. (2021) focused on different ways of DC professional development identifying the significance of all-round support for teachers' training at personal and institutional levels. Maiier and Koval (2021) investigated DC development in pre-service foreign language teachers at a Kyiv university, highlighting the need "to boost the skillfulness of educators" when implementing technologies (p. 11). Biletska et al. (2021) analyzed and described the process of developing digital skills in future foreign language teachers prioritizing the necessity for developing digital teaching practices.

With previous research acknowledging the importance of educators' DC, the DC of language teachers at tertiary level in Ukraine remains insufficiently researched. This study highlights the significance of language teachers' digital proficiency and its continuous development in response to global trends and specific challenges faced in Ukraine's educational landscape. Given the country's ongoing reliance on online and mixed-mode learning, it aims to analyze university language teachers' DC, framed by the following research questions:

RQ 1: What is the overall DC level of university language teachers according to the assessment generally based on DigCompEdu reference framework?

RQ 2: What statistical patterns can be identified in university language teachers' DC, and how do demographic and professional factors influence similarities, differences, correlations, and clusters?

RQ 3: What challenges do university language teachers face in integrating

digital technology, and how do they envision its future use in their professional activities?

Method

The research employed a convergent parallel mixed-methods design, allowing for the concurrent collection of quantitative and qualitative data on university language teachers' DC. Their analysis was conducted independently, then the results were compared and merged. Since Dawadi et al. (2021) described mixed-methods research as complementary and apt, there was an added value in combining quantitative and qualitative analytical approaches to get a complete picture and provide rich insights into the state of DC in language teachers at the tertiary level in the west of Ukraine.

Participants

The study was conducted in the period from December 14, 2024, to December 29, 2024, at four state universities located in the west of Ukraine: Lesya Ukrainka Volyn National University (VNU) in Lutsk; Lutsk National Technical University (LNTU); The National University of Water and Environmental Engineering (NUWEE) in Rivne; and Ternopil Volodymyr Hnatiuk National Pedagogical University (TNPU). They trained students in different fields of study ranging from arts and humanities to sciences and technology.

This study adopted a snowball sampling technique, allowing the Google Form survey questionnaire to be shared among the volunteering academic staff from the language departments of the aforementioned universities. Ethical principles were upheld by ensuring anonymity, voluntary participation, and obtaining informed consent. A total of 71 university language teachers participated via Google Forms. The study was conducted according to the guidelines outlined in the Declaration of Helsinki. Thus, the participants, whose demographics are presented in Table 1, were given no encouraging incentive.

The majority of the academic staff surveyed were female (95.8%) and primarily held the rank of associate professor (54.9%). The participants had an average age of 45.1 years and 14.8 years of teaching experience, with most (45.05%) having over 20 years in the profession. They claimed an average of 7.2 years of digital teaching experience, and all had some familiarity with digital tools. Most participants taught language courses (Ukrainian, English, or German) at the Bachelor's level, with some also delivering instruction to Master's and PhD students.

Table 1. Participants' demographic variables

Variables	Groups	f	%	Mean	SD
University	LNTU	5	7.05	-	-
	NUWEE	23	32.4		
	TSNU	5	7.05		
	VNU	38	53.5		
Academic rank	Assistant lecturer	4	21.1	-	-
	Senior lecturer	15	18.3		
	Associate professor	39	54.9		
	Professor	4	5.6		
Gender	Male	2	4.2	-	-
	Female	69	95.8		
Age	under 25	1	1.4	45.1	1.025
	25–29	2	2.8		
	30–39	15	21.1		
	40–49	32	45.1		
	50–59	14	19.7		
	over 60	7	9.9		
Language taught	Ukrainian	9	12.7	-	-
	English	39	54.9		
	German	23	32.4		
Teaching experience, in years	1-3	8	11.3	14.8	1.439
	4–5	5	7.05		
	6–9	5	7.05		
	10–14	5	7.05		
	15–19	16	22.5		
	over 20	32	45.05		
Digital teaching experience, in years	No experience	-	-	7.2	1.766
	less than 1	2	2.8		
	1–3	16	22.5		
	4–5	22	31		
	6–9	9	12.7		
	10–14	12	16.9		
	15–19	10	14.1		
	over 20	-	-		
Students' profile	Bachelor's	59	83.1	-	-
	Bachelor's & Master's	8	11.3		
	Bachelor's & PhD	1	1.4		
	Bachelor's, Master's, & PhD	3	4.2		

The snowball sampling technique is highly likely to result in having biased samples as it may include respondents with similar characteristics and exclude others (Mouselli & Massoud, 2018). However, given the diversity in the languages taught, academic ranks, ages, professional backgrounds, and digital teaching

skills, common biases associated with this sample – such as difficulties in generalizing beyond the studied group – may be mitigated by considering "the similarities among participants and the setting" (Younas & Durante, 2023, p. 180).

Instruments

Quantitative data was collected using the self-assessment questionnaire based on the DigCompEdu CheckIn (Redecker, 2017), which is a "scientifically sound background framework" applicable to all levels and types of education (Redecker, 2017, p. 4), though with some alterations. To encourage and facilitate participation, the authors translated the DigCompEdu questionnaire from English into Ukrainian, ensuring accessibility for language teachers of Ukrainian and German who might have had difficulty understanding the survey questions in English.

The questionnaire consisted of 46 questions and was structured as follows:

Section 1 (Q1–Q7, Q34) included closed-ended questions on participants' demographic information, such as their higher education institution, rank, gender, age, work experience, subject taught (English, German, or Ukrainian), students' profile (Bachelor's, Master's, and/or PhD), and experience with digital teaching.

Section 2 reflected the DigCompEdu framework questions, with slight alterations, across such areas as Professional Engagement (Q8–Q11), Digital Technology in Teaching (Q12–Q14), Teaching and Learning (Q15–Q18), Assessment (Q19–Q21), Empowering Learners (Q22–Q24), Facilitating Learners' Digital Competence (Q25–Q29), Personal Experience of Using Digital Technology (Q30–Q34), and Self-Evaluation of Digital Technology Use (Q35–Q44). Questions Q8–Q34 were closed-ended, allowing respondents to select one or multiple answers based on provided instructions. Questions Q35–Q43 required participants to self-evaluate their digital technology use. Except for Q30–Q32 and Q34, a five-point Likert scale was used for Q8–Q43. Additionally, Q44 asked respondents to assess their digital competency level on a scale from A1 ("Newcomer") to C2 ("Pioneer").

Section 3 included two open-ended research questions (Q45–Q46) to collect qualitative data:

1) What difficulties do you encounter when implementing digital technology more extensively?

2) How do you envision using digital technologies in your future professional activities?

Data analysis and statistical procedures

The collected quantitative data was analyzed using IBM Statistical Package for the Social Sciences (SPSS) version 20 software. Cronbach's alpha coefficient (α-coefficient), as the most common indicator regarding the validity of the assessment tool (Nguyen & Habók, 2023), was used to assess the internal consistency of the survey scale. In this study, the overall Cronbach's α-coefficient

was 0.895, indicating high internal consistency and interrelatedness of the survey items, which suggests a low degree of random measurement error and reliability of the survey data (Edelsbrunner et al., 2025). Pearson's chi-square test was used to identify statistical patterns in the DC of language teachers at the universities in the west of Ukraine, examining the relationships between various demographic and professional characteristics. The application of correlation analysis helped to reveal interconnections between technological practices and professional strategies. The correlation coefficients were interpreted according to Cheddock's scale: 0–0.1 (none), 0.1–0.3 (weak), 0.3–0.5 (moderate), 0.5–0.7 (noticeable), 0.7–0.9 (close), 0.9–0.99 (strong), and 0.99–1 (functional) (Turan, 2020). Finally, hierarchical clustering using Ward's method with Euclidean distances was applied to group similar data points. Ward's minimum variance method allowed for the creation of homogeneous clusters and the identification of distinct patterns within the data (Strauss & von Maltitz, 2017). The open-ended questions were analyzed qualitatively employing inductive content analysis, which is useful in qualitative research with "loosely defined themes" (Kyngäs, 2020, as cited in Batac et al., 2021, p. 231) and implies "developing conclusions from collected data by weaving together new information into theories" (Bengtsson, 2016, pp. 9–10). Finally, quantitative and qualitative findings were merged and compared to "develop a comprehensive understanding" (Creswell & Plano Clark, 2018, as cited in Younas & Durante, 2023, p. 179) of the need for DC in university language teachers.

Results

The DC of the academic staff is a multidimensional system encompassing seven interrelated areas, collectively allowing for an assessment of their technological readiness for the modern educational environment.

The results are based on the research questions.

RQ1: What is the overall DC level of university language teachers according to the assessment generally based on DigCompEdu reference framework?

To address RQ 1, university language teachers from four universities in the west of Ukraine responded to the questions addressing different DC areas and DC descriptors generally based on DigCompEdu (Redecker, 2017) via Google form. The mean values of DC for each area and descriptor are presented in Table 2.

Table 2. Assessment of DC level in university language teachers

Area	DC descriptors	Code	Item mean value	Area mean value
Professional engagement	Systematic use of different digital channels to enhance communication with students and fellow academics	Q8	3.4	3.4
	Use of digital technologies for collaboration inside and outside your educational organization	Q9	3.1	
	Systematic and active development of personal digital teaching skills	Q10	4.0	
	Participation in online training opportunities, such as online courses, massive open online courses, webinars, etc.	Q11	3.1	
Digital resources	Use of various websites and search strategies to find and select diverse digital resources	Q12	3.1	3.2
	Creation of personal digital resources and modifying the existing ones to adapt them to specific needs	Q13	3.3	
	Effective protection of confidential content, such as exams, students' grades, and their personal data	Q14	3.1	
Teaching and learning	Consideration of how, when, and why to use digital technologies in lessons to ensure their added value	Q15	3.2	3.3
	Monitoring student activity and interactions in collaborative online environments	Q16	3.3	
	Use of digital technologies to collect and document information and data during group or team projects	Q17	3.3	
	Use of digital technologies and resources (e.g., self-assessment tests, e-portfolios, online diaries) to enable students to plan, document, and monitor their learning	Q18	3.3	
Assessment	Use of digital assessment formats to monitor students' progress	Q19	2.9	3.2
	Analysis of all available data (performance, grades, attendance, activity, and social interaction in online environments) to identify students who require additional support in a timely manner	Q20	3.3	
	Use of digital technologies to provide effective feedback	Q21	3.5	
Empowering learners	Addressing potential technical difficulties when designing digital assignments	Q22	2.8	3.0
	Use of digital technologies to offer students personalized learning opportunities	Q23	3.6	
	Use of digital technologies to engage students in active participation in class or online learning	Q24	2.6	

Facilitating learners' digital competence	Teaching students how to evaluate the reliability of information and identify misinformation or biases	Q25	3.1	3.2
	Designing tasks that require students to use digital tools for communication and collaboration with peers or outside audiences	Q26	3.3	
	Designing tasks that require students to create digital content, such as videos, photos, digital presentations, blogs, or wikis	Q27	2.7	
	Teaching students to behave safely and responsibly online	Q28	3.0	
	Encouraging students to creatively use digital technologies to solve specific problems, such as overcoming obstacles or challenges emerging in the learning process	Q29	4.6	
Level of digital technology use in the workplace	Use of generative technologies (e.g., artificial intelligence) in language teaching	Q33	3.14	3.6
	Ease of working with computers	Q35	4.4	
	Competent and systematic use of the Internet.	Q36	4.1	
	Openness to new applications, programs, and resources	Q37	3.7	
	Active membership and engagement in social networks	Q38	3.5	
	University investment in infrastructure	Q39	4.1	
	Provision of technical support by the university	Q40	3.1	
	Student access to digital tools	Q41	3.4	
	Reliable and fast internet connection	Q42	3.2	
	University support for developing digital competence	Q43	4.1	

It was found that the most pronounced DC ability was encouraging students to creatively use digital technologies to overcome obstacles and challenges emerging in the learning process (Q29, 4.6 points), which indicated an awareness of the transformative potential of technology in education. Teachers demonstrated a high level of basic technological skills, including the ease of working with computers (Q35, 4.4 points), competent use of the internet (Q36, 4.1 points), and systematic university support for DC development.

While the overall findings within each area, showing mean value 3.0 and above, indicated positive trends, some items required attention. Specifically, engagement through digital technologies remained a significant challenge, with low levels of student active participation (Q24, 2.6 points), insufficient consideration of technical issues in the design of digital tasks (Q22, 2.8 points), and limited opportunities for students to generate their digital content (Q27, 2.7 points). A positive aspect was teachers' recognition of the need to develop DC, coupled with their willingness for continuous learning and strong infrastructural support from universities, as evidenced by high self-assessment scores.

RQ 2: What statistical patterns can be identified in university language teachers'

DC, and how do demographic and professional factors influence similarities, differences, correlations, and clusters?

To respond to RQ 2, statistical patterns in university language teachers' DC were identified. Analysis by age groups, using Pearson's chi-square test, revealed statistically significant differences ($p<0.05$) in DC (Table 3). Younger teachers (under 29 years old) showed greater engagement in systematically developing digital skills, using educational digital resources, and applying Internet technologies. Notably, there was a decline in readiness to adopt generative technologies (AI) among older teachers, particularly those over 60 years old.

Table 3. Differences in DC based on university language teacher's age

			Score according to respondent's age						Statistics significance values	
DC descriptors	**Code**	**Mean value**	**Below 25**	**25–29**	**30–39**	**40–49**	**50–59**	**over 60**	**Pearson Chi-Square value**	**Pearson Chi-Square Asymp. Sig. (P)**
Systematic and active development of personal digital teaching skills.	Q10	4.0	3.0	4.0	3.0	3.2	3.1	2.9	44.648	0.001
Use of digital technologies and resources to enable students to plan, document, and monitor their learning.	Q18	3.3	5.0	4.0	3.1	3.6	3.1	2.8	37.994	0.009
Competent and systematic use of the Internet.	Q36	4.1	5.0	5.0	4.7	4.4	3.9	3.6	30.986	0.009
Use of generative technologies (e.g., artificial intelligence) in language teaching.	Q33	3.1	4.0	4.0	3.5	3.5	2.7	1.4	31.701	0.047

Teaching experience significantly impacted professional engagement in the digital environment (Table 4). Teachers with 10–19 years of experience demonstrated the highest degree of DC in using digital technologies for collaboration

and generating communicative tasks, reflecting more advanced development of digital skills that were increasingly integrated into their pedagogical practices.

Table 4. Differences in DC based on teaching experience

			Teaching experience						Statistics significance values	
DC descriptor	**Code**	**Mean value**	**1–3**	**4–5**	**6–9**	**10–14**	**15–19**	**Over 20**	**Pearson Chi-Square Value**	**Pearson Chi-Square Asymp. Sig. (P)**
Systematic use of different digital channels to enhance communication with students.	Q9	3.5	3.3	3.8	4.0	3.8	3.4	3.4	24.756	0.053
Use of digital technologies for collaboration.	Q10	3.4	2.8	3.0	3.6	4.2	3.8	3.2	46.019	0.001
Designing tasks that require students to use digital tools for communication and collaboration with peers or external audiences.	Q27	3.3	2.4	3.4	3.4	4.0	3.3	3.3	37.089	0.011

The study observed some differences in the degree of DC based on the language of instruction, though these were not particularly significant (Table 5). Ukrainian language teachers consistently showed higher proficiency in using digital communication channels and providing feedback.

Table 5. Differences in DC based on language of instruction

DC descriptor	Code	Mean value	Language taught			Statistics significance values	
			Ukrainian	English	German	Pearson Chi-Square value	Pearson Chi-Square Asymp. Sig. (P)
Systematic use of different digital channels to enhance communication with students and fellow academics	Q8	3.4	3.8889	3.4737	3.3478	14.399	0.025
Use of digital technologies to provide effective feedback	Q21	3.5	3.6667	3.3421	3.1304	22.737	0.004

Statistical analysis using Pearson's chi-square test revealed statistically significant differences ($p<0.05$) in DC indicators among language teachers at higher education institutions in Ukraine, based on age, professional experience, and linguistic environment.

Correlation analysis revealed statistically significant correlation relationships and notable interconnections between technology usage and professional strategies, enabling the interpretation of the intensity of interdependencies between the DC indicators (Table 6).

Table 6. Correlation matrix* of university language teachers' DC descriptors

	Q12	*Q15*	*Q17*	*Q19*	*Q25*	*Q35*	*Q36*	*Q37*	*Q39*	*Q40*	*Q42*
Q15	*0.53*										
Q18			*0.51*								
Q21				*0.55*							
Q23		*0.55*									
Q28					*0.55*						
Q36						***0.73***					
Q37						*0.6*	*0.64*				
Q38							*0.51*	*0.7*			
Q40									*0.68*		
Q41									*0.54*	*0.55*	
Q42									*0.56*	*0.59*	
Q43									*0.63*	*0.66*	*0.65*

Note. * Correlation is significant at the 0.01 level (2-tailed).

The most notable correlations were observed between professional practices in using digital technologies. In particular, there was a close correlation between competent internet use and ease of working with computers (r=0.73), confirming the integrated nature of digital professional engagement. Statistically significant correlations were also found between openness to new applications, programs and resources, and membership and active engagement in social networks (r=0.7). An important finding of the study was the presence of multiple correlations embracing both technical and infrastructural issues, and university support for developing DC, all between r=0.54 and r=0.68, which indirectly suggested a systematic approach to developing a digital educational environment. Special attention should be paid to correlations in pedagogical practices. Statistically significant relationships were identified between student activity monitoring and the use of technology for student engagement to provide effective feedback (r=0.55), as well as between offering students' personalized learning environments and considerations of how, when, and why to use digital technologies in class to ensure their added value (r=0.55). The results revealed that university language teachers' DC represented a complex interconnectedness of professional practices, digital skills, and institutional infrastructure and support.

A tree clustering analysis using Ward's method with Euclidean distances was implemented in the form of a dendrogram (Figure 1). The analysis of factor clustering based on the dendrogram allowed for identifying four main clusters.

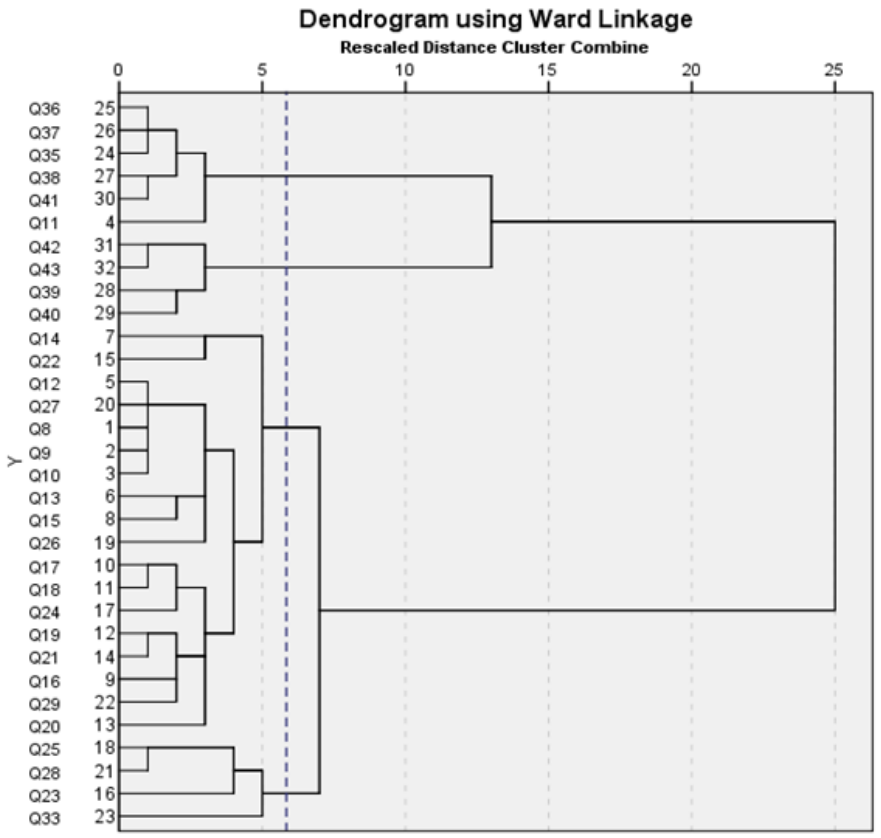

Figure 1. Dendrogram of clustering indicators using Ward's method

Based on the dendrogram from Ward's clustering method, the DC descriptors were grouped into the clusters displayed in Table 7 (below).

The first cluster, with the highest mean value (3.7), encompassed basic digital competencies and personal engagement of instructors in the digital space. It included aspects such as participation in online learning, confidence in using computers, and familiarity with the Internet and social media. Notably high scores were observed in basic computer literacy (4.4) and systematic Internet use (4.1).

The second cluster, with a mean value of 3.6, reflected institutional support for digitalization. Key indicators in this category included university infrastructure provision and technical support. The highest-rated indicators in this cluster were university investments in infrastructure and support for developing DC (both 4.1).

The third cluster was the largest, encompassing competencies with a mean value of 3.2. This cluster covered a broad spectrum of skills, ranging from digital communication with students to content creation and assessment. The highest-rated aspect within this cluster was the creative use of digital technologies (4.6).

The fourth cluster embraced the critical and safe use of digital technologies, with a mean value of 3.2. It included skills related to media literacy, online safety, and emerging technologies applications, such as artificial intelligence. While the highest-rated indicator in this cluster was the personalization of learning opportunities through digital technologies (3.6), media safety received a lower rating (3.0), suggesting a gap in awareness or application of safety measures in digital environments.

Table 7. Clusters of DC descriptors

Cluster	DC descriptor	Code	Item mean value	Cluster mean value
1	Participation in online training opportunities, such as online courses, massive open online courses (MOOCs), webinars, etc.	Q11	3.1	3.7
	Ease of working with computers	Q35	4.4	
	Competent and systematic use of the Internet	Q36	4.1	
	Openness to new applications, programs, and resources	Q37	3.7	
	Membership and active participation in social networks	Q38	3.5	
	Student access to digital tools	Q41	3.4	
2	University investment in infrastructure	Q39	4.1	3.6
	Provision of technical support by the university	Q40	3.1	
	Reliable and fast internet connection	Q42	3.2	
	University support for developing digital competence	Q43	4.1	

	Systematic use of different digital channels to enhance communication with students and fellow academics	Q8	3.4	
	Use of digital technologies for collaboration inside and outside your educational organization	Q9	3.1	
	Systematic and active development of personal digital teaching skills	Q10	4.0	
	Use of various websites and search strategies to find and select diverse digital resources.	Q12	3.1	
	Creation of personal digital resources and adaptation of existing ones to meet specific needs	Q13	3.3	
	Effective protection of confidential content, such as exams, student grades, and personal data	Q14	3.1	
	Consideration of how, when, and why to use digital technologies in lessons to ensure their added value.	Q15	3.2	
	Monitoring student activity and interactions in shared online environments	Q16	3.3	
	Use of digital technologies to collect and document information and data during group or team projects	Q17	3.3	
3	Use of digital technologies and resources (e.g., self-assessment tests, e-portfolios, online diaries) to enable students to plan, document, and monitor their learning	Q18	3.3	3.2
	Use of digital assessment formats to monitor students' progress	Q19	2.9	
	Analysis of all available data (performance, grades, attendance, activity, and social interaction in online environments) to identify students who require additional support in a timely manner	Q20	3.3	
	Use of digital technologies to provide effective feedback	Q21	3.5	
	Addressing and resolving potential technical issues when designing digital tasks	Q22	2.8	
	Use of digital technologies to engage students in active participation during lessons	Q24	2.6	
	Designing tasks that require students to use digital tools for communication and collaboration with peers or external audiences	Q26	3.3	
	Designing tasks that require students to create digital content, such as videos, photos, digital presentations, blogs, or wikis	Q27	2.7	
	Encouraging students to creatively use digital technologies to solve specific problems, such as overcoming obstacles or challenges	Q29	4.6	
	Teaching students how to evaluate the reliability of information and identify misinformation or biases	Q25	3.1	
	Teaching students to behave safely and responsibly online	Q28	3.0	
4	Use of generative technologies (e.g., artificial intelligence) in language teaching	Q33	3.14	3.2
	Use of digital technologies to offer students personalized learning opportunities	Q23	3.6	

Overall, this clustering reflected a comprehensive approach to assessing university language teachers' DC, considering personal skills, institutional support, and pedagogical applications of digital technologies. Notably, basic digital

competencies had higher values compared to more complex pedagogical applications of digital technologies, indicating a need for further DC development.

Two survey questions (Q31, Q32) were excluded from the statistical analyses due to their different format, allowing multiple responses, compared to other questions with a single-answer format. As of Q31 ("Which digital tools have you and your students already used for teaching and learning?"), the respondents reported that the most commonly employed tools in language classrooms were video watching/audio listening and online communication tools like Zoom, Teams, GoogleMeet, and Skype (both 90.1%), followed closely by presentation tools (88.7%). Other frequently used tools included digital quizzes and polls via Kahoot! or Mentimeter (69%), online/virtual learning environments such as Moodle (66.2%), and content creation tools for videos or audio recordings (50.7%), all of which exceeded 50%. However, digital posters, mind maps, and planning tools (26.8%), as well as blogs or wikis (22.5%) were used significantly less. Notably, only 1.4% of respondents reported having no experience with university-level digital language teaching.

In response to Q32 (Do you have the following digital technologies for teaching/learning provided by your university?), 87.3% of respondents reported access to a virtual learning environment (e.g. Moodle), 80.3% used synchronous communication tools (Zoom, Teams, Skype, GoogleMeet, etc.), and 76.4% used asynchronous communication tools (email, instant messaging). Two other options – Student Group Enrollment and Grading System (56.3%) and Electronic Document Management System (53.5%) – received lower, yet still significant, ratings, both exceeding the 50% threshold.

In response to Q44, participants assessed their DC on a scale from A1 to C2, yielding the results shown in Figure 2. The results suggested that the majority of participants had an intermediate DC level. The largest group (28 teachers) were Integrators (B1), accounting for 40% of the respondents. This indicated that many teachers felt comfortable integrating digital tools into their teaching but may still need further development to reach advanced levels. Additionally, 28.6% of teachers (20) identified themselves as Experts (B2), suggesting they were proficient in using digital technologies effectively. Meanwhile, a smaller but still significant portion (8.6%, 6 teachers) positioned themselves as Leaders (C1), meaning they not only used digital tools efficiently but also guided and supported their peers in digital integration. On the lower end, 21.4% of teachers (15) classified themselves as Explorers (A2), indicating basic digital skills with some confidence in usage, while only 1.4% (one teacher) rated themselves as Newcomers (A1), showing minimal digital competency.

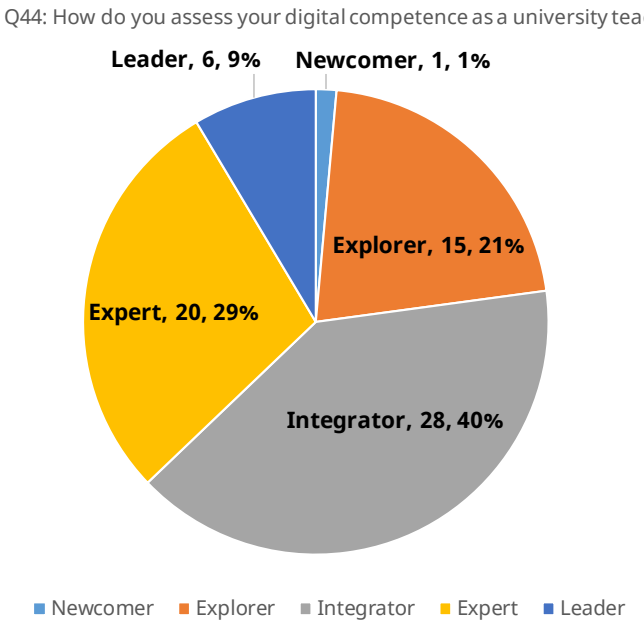

Figure 2. Self-assessment of university language teachers' DC

RQ 3: What challenges do university language teachers face in integrating digital technology, and how do they envision its future use in their professional activities?

To address RQ 3, we analyzed the responses to two open-ended questions (Q45, Q46) that encouraged the respondents to contemplate the difficulties they experienced in using digital technologies and perspectives in the context of emerging generative technologies.

When responding to Q45, the participants mentioned:

- technical issues:
  Rn: Unstable/poor Internet connection (16 responses);
  Rn: Electricity cut-offs (5 responses);
  Rn: Disrupted academic processes due to air alerts (2 responses);
  Rn: Insufficiently technologically equipped classrooms (5 responses);
  Rn: Devices students work with are outdated or absent (3 responses);
- lack of student motivation, and their inadequate digital skills:
  Rn: 1st-year students have to familiarize with the University's digital ecosystem, so there is difficulty in offering students to work with additional ones like digital terminological databases, corpora, etc. (1 response);
  Rn: Low student motivation in learning foreign languages (2 responses);
- seeking balance between the use of digital technologies and live communication:
  Rn: There is less time left for live communication with students (2 responses);

Rn: It is necessary to balance different formats (traditional and digital) (1 response);
Rn: It is useless to over-nurture the class with digital technologies (1 response);

– lack of up-to-date digital skills in university language teachers:
Rn: Lack of competency and confidence in employing digital technologies (1 response);
Rn: Lack of competency in instructing students how to use digital technologies (1 response).

The provided responses to Q46 almost unanimously reflected the intention to digitalize the language classroom, e.g.:

Rn: I am actively working in this direction, acknowledging that digital technologies are the way forward (1 response);
Rn: I continuously learn to effectively use the latest digital technologies and plan to integrate them even more extensively (1 response).

Among the prospects for digital teaching development, most respondents indicated the effective integration of AI technologies, recognizing their potential to enhance learning experiences, provide personalized support for students, design and adapt instructional material.

Rn: My primary objectives are (1) to teach students how to use AI for learning – acknowledging it as a modern reality – rather than relying on it to complete tasks for them; and (2) to guide them in creating an online environment for independent learning and continuous engagement with the language (1 response);
Rn: An up-to-date foreign language class design is impossible without integrating online technologies that help create modern content and choose the methods that motivate students to be active, responsible, and goal-oriented. AI will become an indispensable assistant for the teacher! (1 response);
Rn: Digital technologies improve the class design with relevant content and increase students' interest in instructional material, which leads to new pedagogical practices and allows for developing a new educational model (1 response).

The respondents mentioned the need for further professional development regarding their DC, e.g.:

Rn: I will try to get familiar with new digital resources (1 response);
Rn: Prospects are huge; it is necessary to learn much (1 response);
Rn: It is important to self-improve and increase the use of digital technologies in a language classroom (1 response).

Discussion

Given Ukraine's ongoing reliance on online and blended learning, strengthening university language teachers' digital skills is seen not just as an enhancement but a necessity for fostering an effective digital language education ecosystem. Using the DigCompEdu assessment instrument allows for their structured DC evaluation, identifying strengths and areas for improvement.

The overall assessment findings across all the DC areas in the utilized framework fall within the mean range from 3.0 to 3.6. Clustering analysis further underscores the systematic nature of DC development, revealing four key dimensions: basic digital literacy, institutional support, digital competencies, and critical digital usage, with the mean range from 3.7 to 3.2. The highest mean value in the DC area assessing the *Level of digital technology use in the workplace* asserts language teachers' overall confidence in utilizing digital tools in their professional activity, ease of working with computers, as well as the competent and systematic use of the Internet. However, it does not reflect teachers' ability to empower learners to actively engage with digital tools, particularly during lessons. This is evident in the lower mean value (3.0) observed in the area evaluating the DC indicators of *Empowering learners*. This discrepancy can be explained by teachers' responses to open-ended questions, where they emphasize the importance of *live communication* with students, which they believe is best achieved during in-class meetings. Another response highlights the problem of additional time requirements, and the difficulties encountered when instructing students on how to use a digital resource offered for an in-class activity. This assumption is reinforced by a slightly higher mean value (3.2) in the DC framework area of *Facilitating learners' digital competence,* particularly in terms of encouraging students to use digital tools for solving specific problems that arise in the learning process (4.6) and engaging them in using digital tools for communication and collaboration (3.3). This suggests that using digital technologies can be characterized as more task-oriented rather than fully embedded in interactive classroom practices. Instead, the focus is on out-of-class use of digital tools, including completing assignments, accessing resources, or other creative supplementary activities.

Within the framework area embedding teachers' professional engagement, which has the second-highest mean value (3.4), it is significant that the indicator for the systematic and active development of personal digital teaching skills scores the highest. It highlights a strong self-directed approach to professional DC development. This is further supported by teachers' responses, in which they express a desire to continuously develop and promote the extensive use of existing digital tools. It emphasizes the need to enhance the efficiency of instruction delivery and the quality of digital teaching.

A high score for the indicator of university support for DC development (4.1) reflects the institution's role in fostering an environment that encourages ongoing professional development and the adoption of innovative digital tools for teaching and learning. This aligns with the findings of Karimi and Khawaja (2025), who distinguish two key strategies for enhancing DC: implementing effective training programs tailored to educators' needs and

fostering self-efficacy and motivation in adopting digital technologies (p. 308). Such efforts are crucial for building a robust digital language education system, where technological advancements, institutional support, and continuous teacher development work together to create a sustainable and effective learning environment.

The results of self-assessment indicate a varied distribution of DC levels among teachers, with the majority identifying as Integrators (B1) or Experts (B2), suggesting moderate to advanced proficiency in digital skills. Age and teaching experience significantly influence DC, as younger teachers are more actively engaged in digital skills development, while those with 10–19 years of experience demonstrate the highest integration of digital technologies into their pedagogical practices. These findings are also consistent with Karimi and Khawaja (2025), who claim that younger educators and those with more teaching experience tend to demonstrate higher DC levels (p. 308). Correlation analysis highlights strong interconnections between digital engagement and institutional support, with university investment in digital infrastructure positively influencing instructors' use of technology. Klimova et al. (2023) and Moradi (2025) assert that when digital tools – ranging from basic presentation software to advanced applications – are used effectively, emerging technologies in foreign language education can greatly enhance students' motivation and lead to improved learning outcomes.

Additionally, professional practices in digital technology use are closely linked with a notable relationship between internet competency and social networking. It highlights the role of professional unions and organizations (e.g., British Council, TESOL, Goethe Institut, Assoziation der Ukrainischen Germanisten, etc.) as platforms for collaboration and tools for enhancing digital literacy, fostering engagement in such activities as networking, resource sharing, or exchange of best teaching practices. Language teacher associations serve as essential pillars in the personal and professional growth of language teachers worldwide (Thumvichit et al., 2024). By disseminating innovative practices and guiding "the focus … towards critical areas" (Thumvichit et al., 2024, p. 356), they enhance teachers' effectiveness by hosting conferences, workshops, seminars, or short training courses focused on optimizing classroom tools.

Pedagogical strategies also play a crucial role, as teachers who encourage student engagement through technology tend to integrate digital tools more effectively in communicative tasks. However, critical digital skills, with a mean value of 3.2 (Table 7), need further improvement, particularly regarding media competence, which points to the need to "develop transversal actions for instructing both university professors and students in media competencies to face an ecosystem dominated by fake news and disinformation" (Romero-Rodríguez et al., 2019, p. 326). Overall, the findings suggest that while DC is well-developed among many educators, targeted support – particularly for older teachers and in using emerging technologies like AI – remains essential for further advancement.

Given the correlations between DC, pedagogical practices, and institutional factors, a systematic, multi-level approach can be recommended to enhance

DC across all teaching demographics. Strategies should include targeted training programs for older and less experienced teachers, increased institutional investment in digital infrastructure and professional development, and the encouragement of creative and communicative digital practices to maximize engagement and learning outcomes.

Conclusion

This study concludes the critical role of DC in Ukraine's higher education system, focusing on those teaching Ukrainian for Specific Purposes and English or German as Foreign Languages. By utilizing the DigCompEdu framework and a self-reflection questionnaire, the research gathered insights from 71 language teachers across different age groups, academic ranks, and levels of technological proficiency. The mixed-methods approach, coupled with statistical analysis, enabled a comprehensive evaluation of the factors influencing DC. The findings reveal that while educators demonstrate moderate to advanced proficiency in digital skills, their ability to actively engage students with digital tools in class remains an area for improvement. The preference for *live communication* and concerns over the additional time required for digital instruction highlights key challenges in integrating technology into interactive classroom practices. However, this limitation seems to be compensated for through out-of-class activities, where students engage with technology for collaboration, independent learning, and skills development.

Age and teaching experience significantly impact DC levels, with younger educators showing greater enthusiasm for emerging technologies, while mid-career teachers (10–19 years of experience) demonstrating the highest integration of digital tools into pedagogy. Institutional support is acknowledged as another crucial factor, with university investment in digital infrastructure positively correlating with instructors' digital engagement, particularly in professional networking. Teachers also display a strong self-directed approach to digital skills development, emphasizing continuous learning and the integration of AI to enhance teaching efficiency and student support.

Considering the clustering analysis values that range between 3.7 and 3.2 and are about the average on a 5-point scale, targeted interventions – such as professional training for older teachers, structured institutional support, and strategies to enhance student engagement with digital tools – are necessary for further advancement. A systematic, multi-level approach that integrates professional development, technological infrastructure, and innovative pedagogical strategies will be essential to fostering a sustainable and effective digital language education ecosystem.

Limitations and implications

Despite the authors' endeavors to achieve the highest levels of accuracy and comprehensiveness, the study's limitations include: heavy reliance on participants' self-assessment and subjective responses implying either overestimation

or underestimation of their actual DC proficiency; limited sample representativeness, as the survey is confined to four universities; and challenges in measuring the DC formation in a constantly evolving field, where continuous advancements in digital tools cause ongoing changes to pedagogical practices.

Despite these limitations, the findings offer valuable insights into framing targeted interventions in language teachers' professional development, curriculum design, and institutional policies.

Competing interests

The authors declare that there are no competing interests.

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References

Althubyani, A. R. (2024). Digital competence of teachers and the factors affecting their competence level: A nationwide mixed-methods study. *Sustainability, 16,* 2796. https://doi.org/10.3390/su16072796

Aydin, M. K., Yildirim, T., & Kus, M. (2024). Teachers' digital competences: A scale construction and validation study. *Frontiers in Psychology, 15,* 1356573. https://doi.org/10.3389/fpsyg.2024.1356573

Basilotta-Gómez-Pablos, V., Matarranz, M., Casado-Aranda, L.-A., & Otto, A. (2022). Teachers' digital competencies in higher education: A systematic literature review. *International Journal of Educational Technology in Higher Education, 19*(1), 1–16. https://doi.org/10.1186/s41239-021-00312-8

Batac, K. I. T., Baquiran, L. A., & Agaton, C. B. (2021). Qualitative content analysis of teachers' perceptions and experiences in using blended learning during the COVID-19 pandemic. *International Journal of Learning, Teaching and Educational Research, 20*(6), 225–243. https://doi.org/10.26803/ijlter.20.6.12

Bengtsson, M. (2016). How to plan and perform a qualitative study using content analysis. *NursingPlus Open, 2,* 8–14. http://dx.doi.org/10.1016/j.npls.2016.01.001

Biletska, I. O., Paladieva, A. F., Avchinnikova, H. D., & Kazak, Y. Y. (2021). The use of modern technologies by foreign language teachers: Developing digital skills. *Linguistics and Culture Review, 5*(S2), 16–27. https://lingcure.org/index.php/journal/article/view/1327

Bitegeko, R. M., Lawrent, G., & Cosmas, J. (2024). Applying the UNESCO ICT competency framework to evaluate digital competencies among undergraduate students in teacher education in Tanzania. *Educational Technology Quarterly, 3,* 298–318. https://doi.org/10.55056/etq.769

Bojórquez-Roque, M. S., Garcia-Cabot, A., García-López, E., & Oliva-Córdova, L. M. (2024). Digital Competence Learning ecosystem in higher education: A mapping and systematic review of the literature. *IEEE Access, 12,* 87596–87614. https://doi.org/10.1109/ACCESS.2024.3416906

Broadbent, J., Ajjawi, R., Bearman, M., Boud, D., & Dawson, P. (2023). Beyond emergency remote teaching: Did the pandemic lead to lasting change in university courses? *International Journal of Educational Technology in Higher Education, 20*(1), 1–20. https://doi.org/10.1186/s41239-023-00428-z

Cabero-Almenara, J., Guillén-Gámez, F. D., Ruiz-Palmero, J., & Palacios-Rodríguez, A. (2021). Digital competence of higher education professors according to DigCompEdu. Statistical research methods with ANOVA between fields of knowledge in different age ranges. *Education and Information Technolies, 26,* 4691–4708. https://doi.org/10.1007/s10639-021-10476-5

Cahyono, B. Y., Fauziah, H., Santoso, D. R., & Wulandari, I. (2024). Revisiting technological tools used in EFL speaking classes during the COVID-19 pandemic: What are the implications for the post-pandemic? *The JALT CALL Journal, 20*(2), 1–21. https://doi.org/10.29140/jaltcall.v20n2.1054

Canal, M. N., de las Mercedes de Obesso, M. & Rivera, C. A. P. (2024). Does educators' digital competence improve entrepreneurial students' learning outcomes? *International Entrepreneurship and Management Journal, 20,* 1707–1730. https://doi.org/10.1007/s11365-023-00921-x

Caviglia, F., Boie, M. A. K., Dalsgaard, C., & Pedersen, A. Y. (2024). Bringing digital competence to the disciplines. *Education Inquiry,* 1–29. https://doi.org/10.1080/20004508.2024.2318842

Chahuán-Jiménez, K., Lara-Yergues, E., Garrido-Araya, D., Salum-Alvarado, E., Hurtado-Arenas, P., & Rubilar-Torrealba, R. (2025). Cluster analysis of digital competencies among professors in higher education. *Frontiers in Education, 10,* 1499856. https://doi.org/10.3389/feduc.2025.1499856

Council recommendations of May 22, 2018, on key competences for lifelong learning. *Official Journal of the European Union, C 189*/1. 4. 6., from https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0604(01) (accessed on 15.12.2024)

Crompton, H. (2023). Evidence of the ISTE standards for educators leading to learning gains. *Journal of Digital Learning in Teacher Education, 39*(4), 201–219. https://doi.org/10.1080/21532974.2023.2244089

Dawadi, S., Shrestha, S., & Giri, R. A. (2021). Mixed-methods research: A discussion on its types, challenges, and criticisms. *Journal of Practical Studies in Education, 2*(2), 25–36. https://doi.org/10.46809/jpse.v2i2.20

Decision 2022/2481. Decision (EU) 2022/2481 of the European Parliament and of the Council of 14 December 2022 establishing the Digital Decade Policy Programme 2030 (Text with EEA relevance). *Official Journal of the European Union, L* 323/4, 19.12.2022. Available online: http://data.europa.eu/eli/dec/2022/2481/oj (accessed on 08.01.25)

Edelsbrunner, P. A., Simonsmeier, B. A., & Schneider, M. (2025). The Cronbach's alpha of domain-specific knowledge tests before and after learning: A meta-analysis of published studies. *Educational Psychology Review 37*, 4. https://doi.org/10.1007/s10648-024-09982-y

European Commission. (2019). Directorate-General for Education, Youth, Sport and Culture. *Key competences for lifelong learning*. Luxembourg: Publications Office of the European Union. Available online: https://data.europa.eu/doi/10.2766/569540. (accessed on 21.12.2024)

Imran, R., Fatima, A., Elbayoumi Salem, I., & Allil, K. (2023). Teaching and learning delivery modes in higher education: Looking back to move forward post-COVID-19 era. *The International Journal of Management Education, 21*(2), 100805. https://doi.org/10.1016/j.ijme.2023.100805

Ito, Y. (2024). Uncovering how in-service teachers are learning about technology in language teaching and learning. *The JALT CALL Journal, 20*(1), 1–22. https://doi.org/10.29140/jaltcall.v20n1.1111

Handayani, S., Hussin, M., & Norman, M. (2023). Technological Pedagogical Content Knowledge (TPACK) model in teaching: A review and bibliometric analysis. *Pegem Journal of Education and Instruction, 13*(3), 176–190. https://doi.org/10.47750/pegegog.13.03.19

Kallunki, V., Katajavuori, N., Kinnunen, P., Anttila, H., Tuononen, T., Haarala-Muhonen, A., Pyörälä, E., & Myyry, L. (2023). Comparison of voluntary and forced digital leaps in higher education – Teachers' experiences of the added value of using digital tools in teaching and learning. *Education and Information Technologies, 28*, 10005–10030. https://doi.org/10.1007/s10639-022-11559-7

Karimi, H., & Khawaja, S. (2025). Exploring digital competence among higher education teachers: A systematic review. *International Journal of Learning, Teaching and Educational Research, 24*(1), 298–314. https://doi.org/10.26803/ijlter.24.1.15

Kiryakova, G., & Kozhuharova, D. (2024). The digital competences necessary for the successful pedagogical practice of teachers in the digital age. *Education Sciences, 14*, 507. https://doi.org/10.3390/educsci14050507

Klimova, B., Pikhart, M., Polakova, P., Cerna, M., Yayilgan, S. Y., & Shaikh, S. (2023). A systematic review on the use of emerging technologies in teaching English as an applied language at the university level. *Systems, 11*(1), 42. https://doi.org/10.3390/systems11010042

Koehler, M. J., Mishra, P., Akcaoglu, M., & Rosenberg, J. M. (2013). The technological pedagogical content knowledge framework for teachers and teacher educators. *ICT Integrated Teacher Education: A Resource Book*, 2–7. Available online: https://www.matt-koehler.com/publications/Koehler_et_al_2013.pdf (accessed on 28.02.2025)

Kupchyk, L., & Litvinchuk, A. (2021). Constructing personal learning environments through ICT-mediated foreign language instruction. *Journal of Physics: Conference Series* 1840 012045. https://doi.org/10.1088/1742-6596/1840/1/012045

Liesa-Orus, M., Lozano Blasco, R., & Arce-Romeral, L. (2023). Digital competence in university lecturers: A meta-analysis of teaching challenges. *Education Sciences, 13,* 508. https://doi.org/10.3390/educsci13050508

Litvinchuk, A., & Kupchyk, L. (2024). English Teaching and Learning Strategies and Tactics for Tertiary Education. In *Proceedings of the 4th International Conference on History, Theory and Methodology of Learning – ICHTML;* SciTePress, pp. 85–97. https://doi.org/10.5220/0012646800003737

López-Nuñez, J.-A., Alonso-García, S., Berral-Ortiz, B., & Victoria-Maldonado, J.-J. (2024). A systematic review of digital competence evaluation in higher education. *Education Sciences,14*(11), 1181. https://doi.org/10.3390/educsci14111181

Maiier, N., & Koval, T. (2021). How to develop digital competence in pre-service FL teachers at university level. *Advanced Education, 8*(18), 11–18. https://doi.org/10.20535/2410-8286.227639

Marisa, R., Rachmajanti, S., & Anugerahwati, M. (2024). Investigating the digital proficiency of English as a Foreign Language (EFL) educators in association with their professional identity. *The JALT CALL Journal, 20*(2), 1–31. https://doi.org/10.29140/jaltcall.v20n2.1315

Meniado, J. C. (2023). Digital language teaching 5.0: Technologies, trends and competencies. *RELC Journal, 54*(2). https://doi.org/10.1177/00336882231160610

Moradi, H. (2025). The role of language teachers' perceptions and attitudes in ICT integration in higher education EFL classes in China. *Humanities and Social Sciences Communications, 12*(1), 1–12. https://doi.org/10.1057/s41599-025-04524-5

Moreira, J. A., Nunes, C. S., & Casanova, D. (2023). Digital competence of higher education teachers at a distance learning university in Portugal. *Computers, 12*(9), 169. https://doi.org/10.3390/computers12090169

Mouselli, S., & Massoud, H. (2018). Common biases in business research. In Gomez, J. M., & Mouselli, S. (Eds.). *Modernizing the Academic Teaching and Research Environment. Progress in IS.* Springer, Cham, pp. 97–109. http://dx.doi.org/10.1007/978-3-319-74173-4_6

Myyry, L., Kallunki, V., Katajavuori, N., Repo, S., Tuononen, T., Anttila, H., Kinnunen, P., Haarala-Muhonen, A., & Pyörälä, E. (2022). COVID-19 accelerating academic teachers' digital competence in distance teaching. *Frontiers in Education 7,* 770094. http://dx.doi.org/10.3389/feduc.2022.770094

Nguyen, L. A.T., & Habók, A. (2023). Tools for assessing teacher digital literacy: A review. *Journal of Computers in Education, 11,* 305–346. https://doi.org/10.1007/s40692-022-00257-5

Noskova, M., Semianyk, O., Miziuk, V., Babakina, O., & Lytvyn, V. (2021). Formation of digital competence of teachers in the conditions of distance. *Laplage em Revista (International), 7,* 548–558. http://dx.doi.org/10.24115/S2446-622020217Extra-C1043p.548-558

OECD. (2023). *OECD digital education outlook 2023: Towards an effective digital education ecosystem.* Paris: OECD Publishing. https://doi.org/10.1787/c74f03de-en

Ovcharuk, O., & Ivaniuk, I., (2021). A self-assessment tool of the level of digital competence of Ukrainian teachers in the context of lifelong learning: the results of an online survey 2021. *Educational Dimension, 5,* 75–88. https://doi.org/10.31812/educdim.4719

Rahimi, A.R. (2024). Beyond digital competence and language teaching skills: The bi-level factors associated with EFL teachers' 21st-century digital competence to cultivate 21st-century digital skills. *Education and Information Technologies, 29,* 9061–9089. https://doi.org/10.1007/s10639-023-12171-z

Redecker, C. (2017). *European framework for the digital competence of educators: DigCompEdu.* Punie, Y. (ed). EUR 28775 EN. Publications Office of the European Union, Luxembourg. https://doi.org/10.2760/159770

Romero-Rodríguez, L. M., Contreras-Pulido, P., & Pérez-Rodríguez, M. A. (2019). Media competencies of university professors and students. Comparison of levels in Spain, Portugal, Brazil and Venezuela / Las competencias mediáticas de profesores y estudiantes universitarios. Comparación de niveles en España, Portugal, Brasil y Venezuela. *Culture and Education, 31*(2), 326–368. https://doi.org/10.1080_11356405.2019.1597564.

Rubio-Gragera, M., Cabero-Almenara, J., & Palacios-Rodríguez, A. (2023). Digital innovation in language teaching – Analysis of the digital competence of teachers according to the DigCompEdu framework. *Education Sciences, 13*(4), 336. https://doi.org/10.3390/educsci13040336

Strauss, T., & von Maltitz, M. J. (2017, Jan 13). Generalising Ward's method for use with Manhattan distances. *PLoS One, 12*(1): e0168288. https://doi.org/10.1371/journal.pone.0168288.

Suzer, E., & Koc, M. (2024). Teachers' digital competency level according to various variables: A study based on the European DigCompEdu framework in a large Turkish city. *Education and Information Technologies,* 29, 22057–22083. https://doi.org/10.1007/s10639-024-12711-1

Tang, K. H. D. (2023). Impacts of COVID-19 on primary, secondary and tertiary education: A comprehensive review and recommendations for educational practices. *Educational Research for Policy and Practice, 22,* 23–61. https://doi.org/10.1007/s10671-022-09319-y

Thumvichit, A., Tangkiengsirisin, S., & Vathanalaoha, K. (2024). Making sense of collective leadership in English teacher associations: Insights from Thailand TESOL's committees. *English in Education, 58*(4), 346–362. https://doi.org/10.1080/04250494.2024.2358752

Turan, U. (2020). A correlation coefficients analysis on innovative sustainable development groups. *EUREKA: Social and Humanities, 1*(1), 46–55. https://doi.org/10.21303/2504-5571.2020.001130

UNESCO (2018). *UNESCO ICT Competency Framework for Teachers.* UNESCO. Available online: https://unesdoc.unesco.org/ark:/48223/pf0000265721 (accessed on 08.01.25)

Younas, A., & Durante, A. (2023). The logics of and strategies to enhance generalization of mixed methods research findings. *Methodology, 19*(2), 170–191. https://doi.org/10.5964/meth.10863