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[1]Gulden Tussupova, [1]Aiman Aubakirova[*], [1]Gulizat Nurbekova

[1]L. N. Gumilyov Eurasian National University, Astana, Republic of Kazakhstan

DIGITAL PEDAGOGICAL TECHNOLOGIES IN TEACHING A SECOND FOREIGN LANGUAGE (GERMAN) IN A BILINGUAL ENVIRONMENT: PRACTICE AND PROSPECTS FOR HIGHER EDUCATION

Abstract. The study examines the role of digital educational technologies in teaching German as a second foreign language within the bilingual higher education environment. Using a quantitative, descriptive design, data was collected from 150 university teachers through a self-developed questionnaire. Conclusions indicate that the responsible majority were mid-career teachers with 6–10 years of professional experience, providing reliable insight into class practices. Results suggest that teachers strongly confirmed the effectiveness of digital devices in increasing vocabulary, grammar, and communication skills and increasing inspiration, cooperation, and inclusion. The average score above 4.0 reflects a wide consensus on the positive impact of digital technologies on the results of student learning. Teachers also reported readiness to integrate digital pedagogy, though challenges such as infrastructure limitations and the need for continuous professional training were emphasized. Significant differences in perceptions emerged by age and experience, with younger and mid-career teachers showing greater acceptance of technology. Overall, the study highlights both the promise and conditions necessary for sustainable digital pedagogy in bilingual contexts.

Keywords: digital pedagogy, bilingual education, second foreign language, German, higher education.

Introduction

The rapid digital transformation of higher education has changed the way languages are taught and learned. Digital pedagogical technologies have become the main instruments in the modernization of curricula. The use of digital platforms in foreign language education has brought new avenues for immersion, intercultural exchanges and personal learning experiences, which are difficult to get in traditional face-to-face settings (Azadov, 2025). In bilingual academic settings, learners who shift between their mother tongue and additional language such as English will surprise that the German phenomenon has become a unique challenge as the second foreign language. Despite this, Germany still holds a country with the richest culture and the most promising career opportunities in Europe, and the use of technology will make students busier arriving, practicing with German language, which may not come into language otherwise often (Stikhina & Erofeeva, 2024). In this way, the use of digital educational devices merges not only as a mere technological upgradation, but also as an essential educational remedy to strengthen the learning of the German language at the tertiary level.

Between many others, scholars have argued that successful digital education implementation in foreign language education will rely much more on the planned framework that combines the use of technology with the participation of students through active teaching techniques. Esen (2025) reveals that digital resources can do a variety of things simultaneously, from enabling interaction among users to raising their desire to learn more, while Zhang and Zou (2022) put forward that such technologies can be classified based on their effects on one’s ability to communicate, think rationally, and feel emotionally. They are excellent tools in situations when German is delivered as a second foreign language because as they facilitate the procurement of vocabulary, the practice of grammar, and the interaction between cultures, they do not need to be bound by the walls of the traditional classroom. For example, digital storytelling and gamification have been the focus of much research, which has led to them gaining recognition as powerful tools to improve students' involvement by providing them with authentic, creative, and interactive types of environments (Monti & Raffone, 2019; Perez & Masegosa, 2022). These strategies enable learners to get over one of the obstacles to motivation that they usually meet when they learn another foreign language, thus helping them to accumulate their confidence and fluency.

Simultaneously, however, it is not possible not to take into consideration the significant changes in the teaching and administrative practices, which are required because of the digital transformation of foreign language education. Chilla et al. (2025) argue that for a digitally inclusive setting, the faculty's preparedness for teaching it is of crucial importance, as they will have to do the integration of the tools while catering to the linguistic diversity of the students.

Comparisons between different situations reveal that the level of success of institutions following international models of digital pedagogy is in their capability to adapt to the changing needs of learners (Onishchuk et al., 2020; Guimarães & Hildeblando, 2021). It is worth noting that with regard to bilingual environments, the multilingual and plurilingual views stress the potential of digital pedagogies to facilitate student empowerment through acknowledgment of their current linguistic resources as well as via the provision of well-structured routes leading to languages such as German (Oliinyk et al., 2024; Galante et al., 2023). These views locate digital technologies in the range of non-supporting but really necessary components of language learning ecosystems in higher education.

This research is motivated by the increasing need for the incorporation of German as a second foreign language subject in the bilingual higher education program while simultaneously considering the issues of limited exposure, learner motivation, and teacher readiness. Even though English tends to be the dominating language in bilingual curricula, the addition of German will widen the students' linguistic palette and develop their intercultural skills, especially in the context of European academia and the labor market (Rubio-Alcalá & Coyle, 2021; Stikhina & Erofeeva, 2024).

However, the successful feeling of the plan depends not only on the availability of digital devices, but also on the evidence-based understanding of their effectiveness, ideas and obstacles in the behavior of students and teachers. This study to evaluate the experience of second stakeholders, first to determine its role in increasing the acquisition of German language by raising the issue of digital educational technologies, and the third to investigate the future possibilities of their integration in terms of higher education. And thus, it not only becomes a witness for teaching discourse related to digital changes of language education, but also for practical and viable design of bilingual programs.

The primary objective of this study is to investigate the effectiveness of digital pedagogical technologies in enhancing the teaching and learning of German as a second foreign language within bilingual higher education settings. Specifically, the research seeks to examine how the integration of digital tools can improve students' language acquisition, engagement, and overall learning outcomes.

Furthermore, this study aims to analyze the perceptions and attitudes of teachers regarding the incorporation of digital technologies into their teaching practices in a bilingual educational environment. Understanding educators' perspectives will provide valuable insights into the factors that influence their willingness to adopt and effectively use digital tools.

Finally, the research intends to explore the key challenges associated with implementing digital pedagogical technologies in higher education foreign language curricula. By identifying these obstacles, the study seeks to propose strategies for achieving sustainable improvements in the quality and effectiveness of foreign language instruction.

Literature review

The shift of higher education to the use of digital technologies has changed the entire foreign language teaching landscape and has provided novel possibilities for personal learning and mutual engagement. The scholars consider that in addition to expanding access, digital platforms bring radical changes to the educational methods used in the language instructions (Azadov, 2025). In terms of bilingual teaching, this digital change is even more important, as learners have to deal with different languages in this digital world, while at the same time they gain their proficiency in a new language like German. The growth of technical resources not only makes the teaching and learning process more adaptive and student-centered but also allows language learners to use authentic communication and develop their international skills in the changing environment.

Research has shown that mixed education is a more efficient way to achieve the language learning objectives if it is properly designed to balance face-to-face activities and online parts. It states that mixed instructions given in digital environment open the door to become the owner of their learning through the

use of such materials for students who are interactive and provide continuous practice.

In the same vein, Gacs et al. (2020) bring the difference between planned digital integration and emergency-based online teaching to say that the presence of technology alone does not guarantee the success of the academic process, but rather makes thoughtful plans. Mixed model for German language learning in bilingual environment makes it possible to combine the knowledge of culture with the practice of language, thus facilitates the development of educational and social skills at the same time.

Investigations related to digital tools for second language learning depict the tools' use cases and their pedagogical functions. Esen (2025) concludes that the digital resources may be such platforms as those for collaboration or gaming, with each resource meeting one specific need in language learning. Zhang and Zou (2022) characterize primary functions of these tools as communicative, cognitive, and affective, and they focus on the ability of tools to motivate and engage the learners. In the case of less commonly spoken languages such as German, where there is little exposure outside of the classroom, these types of technology become an important way through which the learners may practice and immerse themselves.

One of the most effective teaching methods that has been developed in second language acquisition for higher education is digital storytelling. According to Monti and Raffone (2019), storytelling becomes a platform offering real-life experiences to the learners as they creatively use the language in practice. The use of combined text, audio, and visuals makes the students' multimodal expression possible, which resembles the actual communication in the real world. This method is mainly helpful in a bilingual environment since learners may use their first language as a support while they gradually improve their German skills.

The digitization of the field of foreign language learning is a major change that also greatly affects the preparation of teachers. It is necessary for the digitally inclusive methods that teachers individually have the skills to include various devices for individually individual teaching and intercultural communication. Teacher's readiness is most important in bilingual situations, as teachers are those who have to deal with the complications of different languages as well as digital literacy among students. Studies conclude that professional development in these areas has a direct impact on the efficiency of digital education and its stability in higher education.

Domestic researchers have made a lot of comparative analysis of foreign language education in various countries, and their conclusion is that adopting international practices can lead to a local innovation facility. According to Onishchuk et al. (2020), Ukrainian universities have taken foreign models and used them for modernization of training of language teachers and development of digital skills.

Such cross-winter borrowings of various designs reflect the importance of international cooperation for the creation of borrowing courses that use the latest technology and at the same time suit local bilingual realities. The inclusion of world best practices with local adaptation in German language teaching can greatly affect the promotion of the results of learners.

The emphasis on multilingual and plurilingual education as a new teaching method shows increased awareness that learning another language is not a separate process. It claims that knowledge of many languages trains students to become a more optimal speaker because they can move fluidly from one language to another.

In addition, Galante et al. (2023) argues that Digital Plurilingual Pedagogies offer the learners an opportunity to actively use the target languages, while drawing at the same time in the list of their entire linguistic performances. In bilingual environment, this approach allows students to maintain their linguistic knowledge, and at the same time, it creates a favorable bridge for German learning as the second foreign language.

The difficulties faced by those who teach a second foreign language at non-linguistic universities still exist even when there is digital support. Stikhina and Erofeeva (2024) point out the fact that the learners often find second foreign languages such as German more difficult than others because of the limited exposure and lower motivation compared to English. On the other hand, if digital technologies are properly integrated, they can make the learning process more interesting and accessible, and thus the barriers mentioned above will be lowered. By using authentic communicative tasks and digital interactions to contextualize German, higher education can become a location of the transformation of perceived difficulty into opportunity.

Cross-border higher education has gone global, and digital resources play a significant part in the

communication and learning process of a foreign language. Guimarães and Hildeblando (2021) consider the digital technologies as one of the most important factors in the facilitation of the intercultural exchange, which in return gives the students the possibility of being more connected, and they get prepared for the global mobility.

German, being one of the most important languages to learn academically and professionally in Europe, is definitely very helpful when combined with digital tools, as they can provide the learners with the most authentic and latest cultural content, international peers, and even professional networks, which can be just perfect to not only strengthen the language skills but also the intercultural awareness.

One more point of the up-and-coming MALL is the promising field of development. According to Puebla et al. (2022), the use of mobile technologies creates versatile and learner-friendly scenarios where learners, even those who are vulnerable to barriers in the conventional learning context, can study. Vocabulary development and micro-learning tasks are the areas in which the portability and immediacy of mobile applications make them especially effective. However, there are issues such as digital distractions and different competence levels of digital literacy that need to be managed in order to guarantee that the benefits can be fairly distributed.

Although digitization is one of the most important changes in foreign language teaching, creating a favorable environment for learning is the foundation of success. Shulgina et al. (2023) has an opinion that language digital ecosystems can not only reduce the problem of limited communication requirements, but can also expand the boundaries of mutual and professional skills. This is the same as Petrenko et al. (2020) mentioned that digital resource courses provide more flexibility in design, which is more responsible.

Thus, the environment of the culture-teaching school for bilingual learners of German provides an opportunity where academics can be real in the classroom and students are concurrently immersed in intercultural contact as well as communication capacity.

The structure is the backbone of any institution, and it is also true for the Foreign Language Department. The role of Foreign Language Centers (FLCs) in adopting digital education is really very important. In its research, Tseliga (2019) suggests that FLC is challenged when it comes to lining its resources with changing academic needs, but they are still necessary to promote innovation. Activity method proposed by Biletska et al. (2021) also goes with this claim, as it allows for the development of student-centered, interactive and active functions that can be facilitated using digital platforms. These institutional and functioning support are especially relevant to the inclusion of German as a second foreign language (L2) in bilingual courses, thus it is a viable and attractive option.

Asia's research clearly reveals how digital learning is changing the second language acquisition worldwide. Kawaguchi (2021) says that digital platforms offer language risk in places where it is very difficult to communicate directly with the native speakers of the language. While their focus is Asia, the situation in bilingual European contexts is very high, where students may have very little contact with the German language outside the school environment. Digital resources are being used to fill this void by giving students the possibility of being fully attached to the language and thus makes the experience closer to real communication as much as possible.

Gamification is another factor that has powerful energy and can attract more students in a multilingual he atmosphere. Perez and Mashegosa (2022) claim that gamified technology motivates learners to actively engage and also reduce the anxiety related to learning language.

For German learners, integration of gamification in bilingual programs is extremely beneficial, as it provides them an opportunity to work on their hard grammar and vocabulary through sports and other fun activities, which are usually low-minded, and thus learning is reinforced without loss of student interest.

The teacher's knowledge in the field of digital and ICT literacy is very important for keeping up with these changes. Konovalenko et al. (2022) state that future foreign language teachers should have various digital skills, and they must be able to efficiently use technology in their teaching. Konovalenko and Nadolska (2020) agree with that and stress the importance of information technology literacy for the preparation of the educators for the contemporary challenges. Still, without these skills, even the most advanced digital resources run the risk of being underutilized. Therefore, the training of digitally literate teachers should be considered the top priority in the progression of German language education in bilingual higher education.

New developments such as artificial intelligence and aggregative communication give us an idea of where language instruction may be headed in the future. Godwin-Jones (2025) points to AI as a tool to facilitate less commonly taught languages through adaptive learning systems, whereas Solmaz (2025) refers to apps like Duolingo for reshaping multilingual learners' experiences.

Collectively, these studies predict that digital language learning will be increasingly personalized and interactive and is a planet-sized as well as globally interconnected. As far as German as a second foreign language in bilingual higher education is concerned, these technological breakthroughs are the cause to expand the practice periodically and to move more extensively towards linguistic and cultural competence through the gradual disappearance of inclusion barriers.

Materials and methods

In order to study digital pedagogical technology integration for teaching German as a second foreign language in the bilingual higher education context, the research was carried out through a quantitative descriptive research design.

It was deemed suitable to use the quantitative approach, as it facilitated the collection of standardized data from a relatively large group of respondents and empowered the researcher to measure trends, attitudes, and practices in a systematic way. By identifying emerging challenges and future prospects alongside documenting the present state of pedagogical practices, the research accomplished its objectives.

The research sample was made of university lecturers who teach foreign languages and are especially dedicated to those schools where bilingual education programs are set up and German is taught as the second language.

Teachers have been identified as the group most central to the deployment of digital pedagogy strategy, transforming classroom practices, and positively impacting the learner's outcome; thus, they were chosen as the object of this study. Their opinions and experiences were an important source of truth regarding both the advantages and limitations of the incorporation of digital tools in higher education language curricula.

150 teachers were picked as the simple random sample from the population. The method guaranteed that every member of the target population had an equal chance of being included in the study, which minimized bias and maximized the representativeness of the results.

The size of the sample was considered enough to provide a substantial quantitative analysis of the data, as well as to detect similar behaviors among differing institutional contexts.

A self-made questionnaire was used as a data collection tool in this research, which was designed with reference to the literature and precedents in the field of digital pedagogical technology in foreign language education.

The survey instrument was intended to identify technologies' adoption, practices, and experiential aspects across different areas of technology integration. Five-point Likert scale ranging from Strongly Agree to Strongly Disagree was used to construct items, which allowed for detailed responses, and, at the same time, these responses could be quantified and statistically analyzed.

The instrument was made with quality in mind, and for this reason, validity and reliability testing was carried out. The questionnaire was given to language education and educational technology experts for them to check if the contents were valid. A pilot study was also conducted with the help of a small group of teachers, who were given the questionnaire, and their feedback was taken into consideration when necessary adjustments were made. Cronbach's alpha, which showed a high level of internal consistency, was used as a measure of reliability, and this, in turn, enabled the identification of the instrument's suitability for the main study.

Data were collected both through physical distribution and online collection. The questionnaire was in a printed version, which was handed out to selected universities, and an online version was made available as a Google Form link, which ensured that more people could have access to it and would participate. Response rates benefited from this hybrid approach, as teachers from various institutions could easily contribute to the study despite geography or scheduling constraints.

The study's data were subjected to both descriptive and inferential statistical techniques using a Statistical Package for the Social Sciences (SPSS) software program. Descriptive statistics such as

frequency, percentage, mean, standard deviation, etc., were used to summarize the data and to show the general trends of digital pedagogical practices.

While testing the connections and differences between the variables, the researcher went deeper into the field of the perceptions of the effectiveness and challenges of digital technology integration in teaching German within bilingual higher education contexts by applying inferential methods.

Results

Table 1 shows the demographic characteristics of the respondents. Out of 150 participants, females (63.3%) outnumbered males (36.7%).

Most respondents fell within the 41–50 age group (56.7%), followed by those aged 31–40 (32.7%), while only a small number were between 21–30 (1.3%). In terms of teaching experience, a majority had 6–10 years of service (56.7%), with fewer teachers in the ranges of 1–5 years (16%), 11–15 years (24%), and above 15 years (3.3%).

These demographics indicate that the data primarily represents mid-career and experienced teachers, providing reliable insights into the integration of digital pedagogical technologies.

Table 1.

Frequency distribution at the basis of demographic analysis

Title	Description	Frequency	Percentage (%)
Gender	Male	55	36.7%
	Female	95	63.3%
	Total	150	100%
Age of respondents	21-30 Y	2	1.3%
	31-40 Y	49	32.7%
	41-50 Y	85	56.7%
	51-60 Y	14	9.3%
	Total	150	100%
Experience	1-5 Y	24	16.0%
	6-10 Y	85	56.7%
	11-15 Y	36	24.0%
	>15 Y	5	3.3%
	Total	150	100%

Table 2 highlights teachers' perceptions regarding the effectiveness of digital technologies in teaching German. The majority strongly agreed or agreed that digital tools make learning interactive, support grammar understanding, and improve vocabulary practice, with mean scores ranging from 4.04 to 4.41.

The respondents also recognized the role of digital platforms in listening and increasing the skills of speaking and stated that such equipment increased inspiration and supported personal learning.

The overall tendency suggests a strong agreement that digital technologies positively affect students' performance and engagement in German learning.

Table 2.

Perceived effectiveness of digital technologies

N	Statements of questions	SA	A	UD	DA	SDA	M	SD
1	Digital tools make learning German more interactive and engaging	72	70	6	2	0	4.41	0.64
		48%	47%	4%	1%	0%	-	-
2	The use of digital technologies helps me understand German grammar more effectively.	66	79	5	0	0	4.41	0.56
		44%	53%	3%	0%	0%	-	-
3	Online resources improve my ability to practice German vocabulary regularly.	58	86	4	0	2	4.32	0.66
		39%	57%	3%	0%	1%	-	-
4	Digital platforms provide useful opportunities to practice German	63	75	5	6	1	4.29	0.77

	listening and speaking skills.	42%	50%	3%	4%	1%	-	-
5	Learning German through digital technologies is more effective than traditional methods.	40	84	18	8	0	4.04	0.78
		27%	56%	12%	5%	0%	-	-
6	Digital tools enhance my motivation to learn German as a second foreign language.	52	73	20	5	0	4.15	0.77
		35%	49%	13%	3%	0%	-	-
7	Using digital technologies has improved my overall performance in learning German.	50	81	17	1	1	4.19	0.71
		33%	54%	11%	1%	1%	-	-
8	Digital pedagogical technologies help me learn German at my own pace and according to my needs.	54	84	9	2	1	4.25	0.69
		36%	56%	6%	1%	1%	-	-

The data of Table 3 reflects the attitude of the respondents towards integrating the digital tool in German language teaching.

Table 3.

Perceptions and attitudes toward digital technologies

N	Statements of questions	SA	A	UD	DA	SDA	M	SD
9	I enjoy learning German when digital technologies are integrated into teaching.	44	92	11	0	3	4.16	0.72
		29%	61%	7%	0%	2%	-	-
10	Digital resources make the learning environment more student-centered.	59	75	10	4	2	4.23	0.80
		39%	50%	7%	3%	1%	-	-
11	Teachers are well prepared to use digital technologies in teaching German.	49	84	13	1	3	4.17	0.77
		33%	56%	9%	1%	2%	-	-
12	The use of digital tools increases my confidence in learning German.	43	78	21	6	2	4.03	0.84
		29%	52%	14%	4%	1%	-	-
13	I feel that digital tools make German learning more accessible and inclusive.	45	84	16	3	2	4.11	0.77
		30%	56%	11%	2%	1%	-	-
14	I believe that digital technologies encourage active participation in class.	50	86	10	4	0	4.21	0.68
		33%	57%	7%	3%	0%	-	-
15	Digital learning platforms foster collaboration among students in learning German.	59	77	12	2	0	4.29	0.67
		39%	51%	8%	1%	0%	-	-
16	I am satisfied with the integration of digital technologies in my German language courses.	42	97	7	4	0	4.18	0.64
		28%	65%	5%	3%	0%	-	-

With average score from 4.03 to 4.29, a high level of agreement was recorded in the item. Most of the teachers believed that digital resources promote student-centric learning, cooperation, and encourage active participation. Satisfaction with integration of digital technologies was also notable, many people admit that teachers are usually well prepared to use such devices. These findings show that digital academic technologies are not only effective, but also well received by both teachers and learners in bilingual contexts

Table 4 presents insights into future opportunities and challenges in using digital pedagogical technologies.

Table 4.

Prospects and challenges of digital pedagogy

N	Statements of questions	SA	A	UD	DA	SDA	M	SD
17	Digital technologies can significantly improve future teaching of German in higher education.	48	87	11	4	0	4.19	0.68
		32%	58%	7%	3%	0%	-	-
18	The integration of digital pedagogical tools ensures long-term benefits for bilingual language education.	61	75	12	2	0	4.30	0.67
		41%	50%	8%	1%	0%	-	-
19	Lack of technical infrastructure is a major challenge for implementing digital language teaching.	47	82	13	8	0	4.12	0.78
		31%	55%	9%	5%	0%	-	-
20	Teachers need more professional development to use digital tools effectively in teaching German.	50	82	11	6	1	4.16	0.78
		33%	55%	7%	4%	1%	-	-
21	The use of artificial intelligence and new technologies will shape the future of German language education.	54	78	15	3	0	4.22	0.70
		36%	52%	10%	2%	0%	-	-
22	Digital pedagogy can help overcome the difficulties of learning German as a second foreign language.	49	77	19	5	0	4.13	0.76
		33%	51%	13%	3%	0%	-	-
23	I believe investment in digital resources is essential for improving	53	83	12	2	0	4.25	0.65

	German language teaching.	35%	55%	8%	1%	0%	-	-
24	Future prospects of digital pedagogical technologies are promising for bilingual higher education.	62	65	16	4	3	4.19	0.88
		41%	43%	11%	3%	2%	-	-

Respondents largely agreed that digital tools ensure long-term benefits, improve teaching prospects, and can overcome learning difficulties, with mean values above 4.10. They also emphasized the need for teacher training and investment in infrastructure, while acknowledging the potential role of artificial intelligence in shaping future practices.

Although some concerns about infrastructure gaps remain, the overall perception is optimistic about the sustainable role of digital pedagogy in bilingual higher education.

Table 5 presents the analysis of variance at the basis of gender.

Table 5.

Analysis of variance at the basis of gender

Gender	N	Mean	Std. Deviation	df	t	Sig. (2-tailed)
Male	55	147.84	9.95	148	0.06	0.955
Female	95	147.75	8.97	-	-	-

The t-test results show no significant difference between male and female respondents in their perceptions of digital pedagogical technologies ($p = 0.955$). Both genders reported nearly identical mean scores, indicating that attitudes toward the use of digital tools in teaching German are consistent across gender lines.

Table 6 presents the analysis of variance at the basis of age. The ANOVA results reveal a significant difference in perceptions across age groups ($p = 0.001$).

Table 6.

Analysis of variance at the basis of age

Age	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1690.89	3	563.63	7.34	0.001
Within Groups	11218.85	146	76.84	-	-
Total	12909.74	149	-	-	-

This indicates that teachers' attitudes toward digital pedagogical technologies vary by age, with younger and mid-career teachers likely to show greater acceptance and confidence compared to their older counterparts.

Similar to age, teaching experience also shows significant differences in perceptions of digital pedagogical technologies ($p = 0.001$) (Table 7). The results suggest that mid-career teachers with 6–10 years of experience expressed stronger agreement on the effectiveness and prospects of digital tools compared to those with very limited or very extensive teaching experience.

The research results indicate that the majority of respondents belonged to the female teaching staff, which makes up 63.3% of the sample, while males were 36.7%. Most of the participants were aged between 41 and 50 years (56.7%), followed by those aged 31–40 with 32.7%.

Table 7.

Analysis of variance at the basis of experience

Experience	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1708.49	3	569.50	7.42	0.00
Within Groups	11201.25	146	76.72	-	-
Total	12909.74	149	-	-	-

The groups of under 30-year-olds and over 50s were quite small. More than half of teachers (56.7%) had a 6–10-year professional experience, while small groups were distributed less than 5 years and more than 15 years of experience in teaching. These demographic features indicate the fact that the reactions came mainly from the career level between teachers, which are exposed to digital academic practices for a long

time; Thus, their insight is quite reliable.

The implementation of digital technologies in the school and the German home learning were given high status by teachers. He also admitted that it becomes easy to come with languages with digital tools, as they provide inputs of hearing and reading, as well as they facilitate grammar and vocabulary.

With the average rating overtook 4.0, the respondents stated that digital equipment not only stimulates inspiration and provides personal learning support, but also contributes to the improvement of student's performance. Thus, this study reveals that there is a common agreement among respondents that resorting to digital academic technologies plays an important role in achieving language learning goals.

In terms of perceptions and approaches, the users of digital solutions in German language teaching were quite materials. He emphasized that the use of digital materials provokes working-based learning and promotes interaction and hence not only in class but also beyond it.

In addition, they agreed that such equipment makes good access and inclusion, while at the same time develop the confidence of learners. Most of the respondents considered their training enough, which enabled them to include these techniques, which makes us believe that along with institutional readiness, the teacher ability also plays a major role.

The purpose of research is to discover opportunities and challenges generated by technical teaching methods. They were complete sure that digital technology, in the long run, can bring a lot of benefits in the environment of bilingual education, improve the horizon of language teaching, and even make it easier to learn.

Nevertheless, the infrastructure upgrade and continuous teacher training were two main issues raised by them to achieve maximum receipt of efforts in training benefits. The AI and New Tech portion was also seen as an essential factor that would determine the future of the German language instructions. While infrastructural deficiency is still seen as a difficulty, there is an optimistic tone of general stability and innovation in the field of digital education.

The discovery of the impact of demographic factors on the study variables achieved deep insight. The penis was not considered a major factor, as the views shared by male and female teachers about digital academic technologies were more or less similar.

However, the difference in age and teaching experience occurred due to the emergence of statistically important results. When it came to use digital devices compared to older people, small and mid-career teachers looked more inclined and confident. Similarly, teachers who have experience 6–10 years, felt more positive about the efficiency and possibilities of digital technologies, which are starting or ending their teaching career. The study found that the readiness for digital education may be more generated and related to career-phase factors than the gender.

Discussion

The main results of this research work show, firstly, that digital pedagogical technologies have a crucial role in teaching a second foreign language, especially in a bilingual environment. For example, technologies work well in German language classes in universities. The survey shows that the implementation of the ICT tools leads to the involvement of the students and to the consolidation of the vocabulary and grammar. Moreover, digitalized material facilitates the listening and speaking processes of the learners since it offers a wider range of interactive activities.

These findings are consistent with Ihnatova et al. (2021), where the authors also point out that the application of digital technologies in hybrid and bilingual milieus propels the learners' autonomy, cultivates the engagement of all students, and finally, raises the quality of the course. The same is true for Azadov (2025), who, besides the emphasis on the role of technology for better learning results, talks about the modernization of pedagogical practices when digital tools are involved in higher education.

The teachers' positive experience with and openness to using digital tools are indicative of their confidence in integrating technology in their pedagogical work. Inclusion, collaboration, and autonomy, together with accessibility for diverse groups of students, are some of the pedagogical values that the participating teachers saw as being enhanced by using ICT as instructional resources.

Thus, we may refer to the conclusions of Esen's (2025) systematic review of the literature, which suggests that digital tools for second language acquisition increase student engagement by offering

personalized learning experiences and that we can see this especially in higher education contexts. Furthermore, practitioners holding such views about their preparedness to use technology for teaching make us think of Chilla et al. (2025), who, in the same vein, indicate that digital language education will be successful if teachers are trained well enough.

According to the results of this survey, notable factors are gender, age, and experience, with the latter two having a significant impact on perception. Young and middle-aged teachers are more open to saying that they can incorporate the technology successfully in their own classes. On the contrary, older teachers seemed a little skeptical about using ICT in their classrooms.

This difference between generations is a classic example of the general trend of technology adoption in the educational field. Puebla et al. (2022) also concluded that older educators and learners would struggle more to transition to mobile and digital learning environments, which underscores the significance of continuous professional development. Thus, it might be the case that training programs dedicated to senior faculty are the best way to solve the problem of the digital divide in HEIs.

Teachers' acknowledgment of the opportunities and challenges offered by digital pedagogy is another important result of the research. The respondents agreed that artificial intelligence and other futuristic gadgets will become the pillars of the bilingual method of the future, as digital tools can be a great stimulus for that.

At the same time, they also brought up problems such as infrastructure gaps and the need for continuous professional development. The issues raised here by practitioners who embrace technology are echoed in Monti and Raffone's (2019) report pointing out that a major concern regarding the sustainability of innovations is the level of institutional support provided in this direction. The above clearly suggests that we can only achieve the benefits of digital education if institutional obstacles are addressed for its full use, such as people belonging to infrastructure.

Complete discussion suggests that digital technologies not only serve as a useful support for teaching and learning, but on the other hand, are characterized by teachers as a valuable tool in a bilingual context of higher education.

However, his richness depends a lot on the organization's commitment, training, and proper allocation by various groups iconic through age and experience by various groups. Keeping the results in interaction with current educational research, this research study suggests that the implementation of digital educational technologies in second foreign language teaching is not only an essential and attainable pathway for university teaching in future, but also moves forward in the higher education sector.

Conclusion

Research has concluded that digital academic technologies are very effective in teaching Germans as a second foreign language in a bilingual higher education environment. The teachers stated that this equipment improves the learning process by enhancing student engagement and inspiration, as well as strengthening grammar, vocabulary, and communication skills.

These positive attitudes mark the use of digital resources as a means of supporting student-centered learning, inclusion, and cooperation principles. The results also suggest that most teachers are in a position to execute digital technologies competently, a suggestion of great greetings between teacher skills and institutional readiness. These results support the first two objectives of the study, showing the effectiveness of digital technologies and their use by teachers at the same time.

At the same time, the study reveals the fact that the ability of digital education is quite attainable, but there are still some difficulties in overcoming some difficulties. Among other things, the participants indicated the long-term possibilities of digital innovations, which may be the future of bilingual language education, such as Artificial Intelligence.

Nevertheless, they were still drawing attention to the needs of infrastructure and continuous teacher training, which one of the most important factors is contributing to success. In addition, differences in age and experience are also indicated in adopting technology along the lines of generational intervals. These reflections, when pieced together, align with the third research purpose, which controls our disposal ability and faces obstacles because we take steps towards digital academic practices. In the final analysis, research does not leave much space for doubt that digital equipment is already making significant changes in the way

they teach foreign languages; nevertheless, how far they will succeed in the future will be contingent on the important investment of strategically teaching workforce resources, training, and equitable access to the world.

Based on the findings of the study, the authors recommend strengthening the digital transformation of higher education institutions by investing in modern digital infrastructure and ensuring equitable access to technological resources for all faculty members. Particular attention should be given to the continuous professional development of academic staff through targeted training programs aimed at enhancing digital competencies, especially among senior educators and those with limited experience in using digital technologies. In addition, universities are encouraged to integrate emerging technologies, including artificial intelligence, into educational programs and teaching practices to foster personalized, innovative, and more effective language learning experiences while supporting the development of digital skills required in contemporary education.

Conflict of Interest Statement

The authors declare no potential conflicts of interests regarding the research, authorship, or publication of this article.

Author Contributions

Gulden Tussupova: Conceptualization, Methodology, Supervision, Writing – Review and Editing, Proofreading.

Aiman Aubakirova: Literature Review, Data Analysis, Resources, Data Analysis, Final Editing.

Gulizat Nurbekova: Data Collection and Curation, Validation, Visualization, Writing – Original Draft.

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Information about authors

Gulden Tussupova – Associate Professor, Candidate of Pedagogical Sciences, L. N. Gumilyov Eurasian National University, Astana, Republic of Kazakhstan, tusgul@mail.ru, ORCID ID: 0000-0001-5011-4063 ***(corresponding author)***.

Aiman Aubakirova – Associate Professor, Candidate of Pedagogical Sciences, L. N. Gumilyov Eurasian National University, Astana, Republic of Kazakhstan, aubakirova-aiman@mail.ru, ORCID ID: 0009-0003-9217-666X.

Gulizat Nurbekova – Senior Lecturer, Master of Pedagogical Sciences, L. N. Gumilyov Eurasian National University, Astana, Republic of Kazakhstan, guleken169@bk.ru, ORCID ID: 0000-0002-9601-556X.

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