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Effectiveness of Language Education in Kazakhstan: Integration of the Kazakh Language with Technology, Pedagogy, and Content (KFL-TPACK)

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Abstract

This study aimed to examine the technology integration skills of undergraduate and graduate students, as well as teachers and specialists, in the field of Kazakh language teaching. The research, conducted using a quantitative survey model, included 267 participants. The "Teaching on Kazakh Language as a Foreign Language, Technology, Pedagogy and Content Knowledge (KFL-TPACK)" scale was used to measure participants' technology integration skills. The study's findings indicate that participants possess a high level of technology integration skills for teaching the Kazakh language. However, these skills varied based on gender, professional status, and grade level. Female participants demonstrated a higher level of skills in Kazakh language teaching, pedagogical abilities, and technology integration compared to their male counterparts. Teachers and specialists showed higher technology integration skills than both undergraduate and graduate students. This suggests that practical experience plays a crucial role in developing these abilities. Final-year and graduate students were found to have higher technology integration skills for teaching Kazakh compared to students in earlier grades, which indicates that these skills likely improve with greater academic and professional experience over time.

Key Words: *Technology Integration, Gender Differences, Educational Level*

Introduction

Global Perspectives on EdTech in Language Education

The introduction of educational technologies into all levels of instruction has paved the way for the integration of technology into language education. However, integrating technology into language education does not simply mean adding technology to the education process. It also means integrating technology into all language education processes in accordance with language learning objectives (Iqbal et al., 2021; Şimşek, 2023). Effective technology integration requires not only knowledge of content, technology, and pedagogy, but also an understanding of the

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relationships between these elements (Adedokun et al., 2024; Ismagulova et al., 2024; Koehler et al., 2021; Natarajan et al., 2022). Effective educational and instructional technology integration occurs when the use of computer- and internet-based educational-instructional technological tools is associated with a constructivist learning model. Educational technology integration yields highly productive results, particularly when materials are integrated into the curriculum and ongoing structured support is provided. EdTech applications and the related technological literacy of educators occupy a significant place in the literature on this topic (Hamakali & Josua, 2023; Kim et al., 2021; Maphoto & Suliman, 2024; Uddin & Bailey, 2024).

Internationally, EdTech has transformed language education by enabling personalized learning, interactive environments, and access to diverse digital resources. Studies have shown that digital tools, such as language learning apps, virtual classrooms, and gamified platforms, enhance student engagement and improve linguistic proficiency (Chapelle, 2016). For instance, research on computer-assisted language learning (CALL) demonstrates that technology facilitates vocabulary acquisition and grammar mastery through interactive exercises and immediate feedback (Golonka et al., 2014). These findings are relevant to Kazakhstan, where digital tools could address the shortage of Kazakh-language instructional materials by providing scalable, interactive content.

However, the effectiveness of EdTech depends on various contextual factors, including teacher training and infrastructure. A meta-analysis by Grgurović et al. (2013) found that teacher readiness and technological literacy have a significant influence on the success of CALL interventions. In multilingual settings, the integration of EdTech must also take into account cultural and linguistic diversity. For example, studies in bilingual education contexts, such as Canada and Spain, highlight the importance of aligning digital content with local languages and cultural norms to ensure relevance and usability (Cummins, 2014; Merino & Lasagabaster, 2015). These insights underscore the need for Kazakhstan to develop EdTech tools that are linguistically and culturally tailored to its bilingual population.

The importance of this research lies in its potential to bridge the gap between policy initiatives and practical implementation. By focusing on Kazakh-language instruction, the study addresses a critical need for equitable access to digital resources in a bilingual context, ensuring that EdTech supports both linguistic diversity and educational quality. Furthermore, the findings will contribute to global discussions on EdTech in multilingual settings, offering insights that can inform best practices in similar contexts worldwide.

Theoretical Framework

EdTech in Kazakhstan's Education System

Kazakhstan's efforts to digitalize education, as outlined in the "Digital Kazakhstan" program (Nazarbayev, 2017), align with global trends but face unique challenges due to the country's bilingual context. Research by Sapargaliyev and Shulenbayeva (2013) notes that the "E-Learning System" project, initiated in 2011, aimed to modernize higher education through digital platforms. However, the lack of a unified ICT environment and insufficient Kazakh-language digital resources remain significant barriers (Assylzhanova et al., 2024; Fauziya et al., 2022). Sapargaliyev and Shulenbayeva (2013) emphasize that while Kazakhstan has invested in virtual laboratories and e-learning systems, the focus has primarily been on infrastructure rather than evaluating subject-specific outcomes, particularly in language education.

The bilingual nature of Kazakhstan's education system, where Kazakh and Russian coexist as instructional languages, complicates EdTech implementation. Karyukin et al. (2022) highlight the disparity in digital content availability, noting that Kazakh-language resources are underrepresented compared to Russian-language materials, particularly in social media and educational platforms. This imbalance affects the accessibility of digital tools for Kazakh-speaking students and teachers, limiting their ability to engage with modern learning environments. International studies, such as those by Budach and De Saint-Georges (2017) suggest that in multilingual contexts, EdTech must prioritize equitable access to resources in all relevant languages to avoid marginalizing minority language speakers. Given that language teaching within the Kazakhstani education system is a professional endeavor requiring specialized knowledge, academic study, professional training, and technological skills, young emerging teachers must be more dedicated in this area. It is evident that educators, teachers, and prospective teachers in this field possess digital competencies and effectively utilize technological tools in their classrooms.

Teacher Readiness and Digital Competence

Teacher readiness is a critical factor in the successful integration of EdTech. In Kazakhstan, Fauziya et al. (2022) argue that digital competence encompasses not only technical skills but also creative thinking and effective communication in digital environments. International research supports this view, with studies indicating that professional development programs significantly enhance teachers' ability to integrate technology into language instruction (Hubbard, 2013). For example, a study in South Korea found that targeted training in EdTech tools improved teachers'

confidence and effectiveness in delivering language lessons (Kim, 2018). In Kazakhstan, however, the shortage of training programs tailored to EdTech use in bilingual settings limits teachers' ability to leverage these tools effectively (Heim et al., 2023; Yeleussiz, 2024).

TPACK, which emerges as a result of the addition of technological knowledge to the pedagogical knowledge that educators must possess and the effective transfer of this knowledge to learners, in line with today's needs, is defined, according to Pierson (1999), as "the ability of educators to use technology and technological tools effectively and efficiently in line with the objectives of the course." Voogt and McKenney (2016) investigated what faculty members at five teacher training institutes did to develop TPACK in pre-service teachers. The study concluded that the teacher training faculty members did not actually have sufficient technological knowledge. However, some new technological tools were available in the schools where the pre-service teachers would work. There were sufficient experts in the field of technology in the institutes where the study took place; there was no strong integration between the faculty members and these experts. In their study investigating the TPACK competencies of language teachers, Liang et al. (2017) found that teachers had low TPACK competencies in technology-related sub-dimensions and high TPACK competencies in theoretical sub-dimensions. Additionally, they discovered a positive correlation between teachers' TPACK competencies and their teaching self-efficacy. In this context, to cultivate innovative and qualified language educators, prospective teachers in this field must possess sufficient knowledge and skills regarding the appropriate use of technology in teaching activities. However, in this process, prospective teachers must grapple with the challenge of reconsidering not only the language field and its teaching and learning, but also the impact of technology on the development of the subject area in question (Niess, 2005; Setiawati et al., 2025).

Cultural and Linguistic Suitability of Digital Resources

The cultural and linguistic suitability of EdTech tools is particularly relevant in Kazakhstan's multilingual classrooms. International research emphasizes that digital resources must reflect the cultural and linguistic identities of learners to be effective (Warschauer & Meskill, 2000). In Kazakhstan, the lack of Kazakh-language digital content poses a significant challenge. Fehlings et al. (2025) note that while the "Digital Kazakhstan" program has improved internet access, the development of culturally relevant digital resources lags behind. Comparative studies in other multilingual contexts, such as India, suggest that localized content creation and community

involvement in resource development can enhance the effectiveness of EdTech in language education (Mohanty, 2019).

Knowledge Gaps and Rationale for the Study

Despite global and regional advancements in EdTech, there is a paucity of empirical research evaluating its effectiveness in Kazakh-language instruction. Existing studies in Kazakhstan focus on descriptive analyses of infrastructure and adoption rates rather than subject-specific outcomes or sociolinguistic impacts (Sapargaliyev & Shulenbayeva, 2013; Shiri & Baigutov, 2024). Internationally, while CALL research provides valuable insights, it rarely addresses the unique challenges of post-Soviet, bilingual contexts like Kazakhstan.

The digital transformation of educational environments in Kazakhstan requires teachers to develop competencies not only in content but also in pedagogical and technological knowledge. In this context, the TPACK framework can offer a powerful structural model that aims to effectively integrate these three domains (content, pedagogical, and technological knowledge) (Mishra & Koehler, 2006; Shambare et al., 2024). Research in Kazakhstan indicates that teachers have strong content knowledge but struggle to integrate technology and pedagogy; in addition, a lack of administrative support and time has been identified as a significant obstacle (Abdigapbarova & Yessimova, 2022; Mukhamediyeva & Kozhakhmetova, 2023; Ospanova & Kussainova, 2024). In this context, this study, focusing on "technology, pedagogy and content integration skills of Kazakh language educators", aims to present (implementation dimension) and (policy recommendations) by determining the strengths and development areas of Kazakh teachers along the axis of the TPACK model.

Purpose of the Research

The purpose of this study is to examine the technology integration skills of participants in the field of Kazakh language teaching. In relation to this aim, the study sought answers to the following questions:

Research Sub-problems

1- What is the level of technology pedagogy integration skills of participants in Kazakh language teaching?

2- Is there a significant difference in the technology pedagogy integration skills of participants in Kazakh language teaching based on gender?
3- Is there a significant difference in technology pedagogy integration skills among undergraduate, graduate, and teacher/expert participants in Kazakh language teaching?
4- Is there a significant difference in the technology pedagogy integration skills of participants in Kazakh language teaching based on grade level?

Research Model

The research, based on the quantitative paradigm, employed a survey model and, in relation to this, a comparative relational survey model as its design. The main goal of the quantitative research design is to express the findings obtained during and after the research process with numerical values and to concretely demonstrate and state the desired characteristic. In this way, phenomena and events are clearly objectified, becoming observable, measurable, and numerically expressible (Bowling & Ebrahim, 2005). The data collection tools frequently used in survey models are scales and questionnaires. This method was chosen because it allows for reaching a large number of people in a short period, provides a free-thinking environment for participants, and enables the acquisition of more objective and transparent information. In this context, the study comparatively examined the technology integration skills of undergraduate students, graduate/doctoral students, and field teachers/experts in the teaching of Kazakh as a foreign language.

Research Group

In research, the population refers to the entire group of individuals that reflects the problem and from which generalizations can be made. The sample, on the other hand, is a subset of elements taken from the population, selected at a specific size and in an objective manner (Umar & Usman, 2015). The population for this study consists of undergraduate and graduate students enrolled in Kazakh as a Foreign Language programs during the 2024-2025 academic year in Kazakhstan, as well as teachers/experts in this field. The study's sample is composed of 267 volunteer participants selected using a simple random sampling method in Kazakhstan. It was calculated that to achieve a heterogeneous distribution and representation with a 95% confidence interval, a total of 265 people were needed for the study. Although a large number of participants were sent the online research instrument, those who did not agree to participate or did not fully complete the online scales were excluded from the analysis. The final sample of 267 participants consisted of: Gender:

73.78% female (n=197) and 26.21% male (n=70). Education Level: 87.64% undergraduate students (n=234), 5.99% Master's/PhD students (n=16), and 6.36% teachers/experts (n=17). Grade Level: The distribution by grade level was: 8.23% 1st year (n=22), 46.06% 2nd year (n=123), 11.98% 3rd year (n=32), 20.59% 4th year (n=55), and 13.11% graduates (n=35). The average age of the research participants was 19.87 (Sd=4.01).

Data Collection Instrument

The KFL-TPACK (Teaching on Kazakh Language as a foreign Language, Technology, Pedagogy and Content Knowledge) scale was used to measure participants' technology integration skills while teaching Kazakh as a foreign language. This scale was originally developed by Wang (2022) to assess the TPACK (Technology, Pedagogy and Content Knowledge) skills of foreign language teachers. The KFL-TPACK scale consists of 49 items and uses a 5-point Likert format, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The scale has two sub-scales: The TPCK (Technological Pedagogical Content Knowledge) sub-scale, which contains 28 items. The PCK (Pedagogical Content Knowledge) sub-scale, which contains 21 items. Wang (2022) conducted validity, reliability, and factor analysis on the original scale, finding it to be both a valid and reliable tool for foreign language students and teachers. In the present study's sample, the overall Cronbach's Alpha reliability for the KFL-TPACK scale was calculated as 0.94. The reliability for the TPCK sub-scale was 0.93, and for the PCK sub-scale, it was 0.92.

Data Analysis

Before analyzing the scores from the KFL-TPACK scale, the data were tested for normality assumptions. Skewness and kurtosis values were used to determine the distribution. According to Tabachnick and Fidell (2007), values within the range of ±1 indicate that the data is normally distributed. The scores from the KFL-TPACK scale in this study were found to be very close to a normal distribution (Table 1). Based on these results, parametric tests were used to analyze the KFL-TPACK scores. Specifically, the Independent Samples t-test and the One-Way ANOVA test were employed for the analysis.

Findings

Table 1

Descriptive Statistics of Scores from the KFL-TPACK Scale and Its Sub-scales

Statistics		PCK	TPCK	KFL-TPACK (Total)
Mean		3,66	3,62	3,64
95% Confidence Interval for Mean	Lower Bound	3,55	3,51	3,53
	Upper Bound	3,78	3,73	3,75
5% Trimmed Mean		3,72	3,68	3,70
Median		4,00	3,96	3,98
Variance		0,86	0,84	0,84
Std. Deviation		0,93	0,92	0,91
Minimum		1,00	1,00	1,00
Maximum		5,00	5,00	5,00
Range		4,00	4,00	4,00
Interquartile Range		1,14	1,07	1,14
Skewness		-0,94	-0,91	-0,94
Kurtosis		0,60	0,70	0,67

After examining Table 1, the PCK sub-scale scores were found to range from 1.00 to 5.00, with a mean score of 3.66 (SD=0.93). The TPCK sub-scale scores also ranged from 1.00 to 5.00, with a mean score of 3.62 (SD=0.92). Finally, the overall average for the KFL-TPACK scale was calculated as 3.64 (SD=0.91). Based on these average values, the participants' technology, pedagogy, and content knowledge integration skills for teaching Kazakh as a foreign language were observed to be at a high level.

Table 2

Comparison of KFL-TPACK Scale and Sub-scale Scores by Gender

Gender	Gender	N	Mean	Std. Deviation	-t-	p
PCK	Female	197	3,79	0,80	3,096	0,003
	Male	70	3,32	1,16		
TPCK	Female	197	3,74	0,82	3,450	0,001
	Male	70	3,30	1,09		
KFL-TPACK (Total)	Female	197	3,76	0,80	3,021	0,003
	Male	70	3,31	1,12		

Based on Table 2, the distribution of scores from the KFL-TPACK scale and its sub-scales is shown according to the participants' gender. On the PCK sub-scale, the average for women was calculated as 3.79, while the average for men was 3.32. A significant difference was observed in PCK scores based on the gender variable ($t=3.096;p<0.01$). Women included in the study were found to have significantly higher PCK (Pedagogical Content Knowledge) scores compared to men.

On the TPCK sub-scale, the average for women was calculated as 3.74, while the average for men was 3.30. According to the calculated t-value ($t=3.45;p<0.01$) between the two groups, women also obtained significantly higher average scores on this sub-scale than men. Finally, for the overall KFL-TPACK scale, the average for women was 3.76, and for men it was 3.31. Based on the t-test analysis ($t=3.01;p<0.01$), a significant difference was found in KFL-TPACK scores favoring women. This indicates that in the context of teaching Kazakh as a foreign language, female participants demonstrate higher technology integration skills compared to their male counterparts.

Table 3

Comparison of KFL-TPACK Scores for Undergraduate Students, Master's/PhD Students, and Teachers/Specialists

		Mean	Std. Deviation	F	p
PCK	Students	3,63	0,96	2,816	0,041
	Master's/PhD students	3,68	0,58		
	Teachers/specialists	4,14	0,50		
TPCK	Students	3,59	0,95	2,189	0,114
	Master's/PhD students	3,59	0,56		
	Teachers/specialists	4,07	0,56		
KFL-TPACK	Students	3,61	0,95	2,735	0,049
	Master's/PhD students	3,64	0,55		
	Teachers/specialists	4,10	0,51		

Table 3 shows the results of the F-test analysis comparing the technology integration skills (KFL-TPACK) for teaching Kazakh as a foreign language among undergraduate students, Master's/PhD students, and teachers/specialists. The analysis revealed a significant difference in the PCK scores ($F=2.816;p<0.05$) and the total KFL-TPACK scores ($F=2.73;p<0.05$) across these three groups. According to the Tukey post-hoc test, the average scores for the teachers/specialists group on both

the PCK and KFL-TPACK scales were significantly higher than the average scores of both undergraduate and Master's/PhD students This finding indicates that teachers/specialists demonstrate higher pedagogical competence and technology integration skills for teaching Kazakh as a foreign language compared to the students in the field.

Table 4

Comparison of KFL-TPACK Scores by Participant Grade Level

	Grade	N	Mean	Std. Deviation	F	p
PCK	1st Grade	22	2,87	1,29	6,808	0,000
	2nd Grade	123	3,59	0,94		
	3rd Grade	32	3,76	0,86		
	4th Grade	55	3,95	0,61		
	Graduate	35	3,91	0,78		
	Total	267	3,66	0,93		
TPCK	1st Grade	22	2,88	1,22	6,101	0,000
	2nd Grade	123	3,55	0,92		
	3rd Grade	32	3,67	0,86		
	4th Grade	55	3,93	0,67		
	Graduate	35	3,81	0,80		
	Total	267	3,62	0,92		
KFL-TPACK (Total)	1st Grade	22	2,88	1,25	6,550	0,000
	2nd Grade	123	3,57	0,92		
	3rd Grade	32	3,72	0,85		
	4th Grade	55	3,94	0,63		
	Graduate	35	3,86	0,78		
	Total	267	3,64	0,91		

Table 4 shows the comparison of technology integration skills (KFL-TPACK) for teaching Kazakh as a foreign language based on the participants' grade level. The analysis revealed a significant difference in the mean scores for PCK ($F=6.808;p<0.01$), TPCK ($F=6.101;p<0.01$), and total KFL-TPACK ($F=6.55;p<0.01$) across different grade levels. According to the results of the Tukey post-hoc test, participants who are graduates and those in their fourth year of study obtained higher KFL-TPACK scores compared to students in the lower grades (first and second year). This finding

suggests that as the grade level increases in the teaching of Kazakh as a foreign language, the participants' technology integration skills also improve.

Discussion and Conclusion

The study's findings indicate that participants possess a high level of technology integration skills for teaching the Kazakh language. As a matter of fact, the results of the studies conducted by Demircan, et. al (2025), Demir (2024), Gurramkonda (2023) and Omojemite (2025) are similar to the findings of this study. However, these skills varied based on gender, professional status, and grade level. Female participants demonstrated a higher level of skills in Kazakh language teaching, pedagogical abilities, and technology integration compared to their male counterparts. Teachers and specialists showed higher technology integration skills than both undergraduate and graduate students. This suggests that practical experience plays a crucial role in developing these abilities. Final-year and graduate students were found to have higher technology integration skills for teaching Kazakh compared to students in earlier grades, which indicates that these skills likely improve with greater academic and professional experience over time. The findings of the studies conducted by Be (2025), Kara (2021), Orakova et al. (2024), Özkan (2024) are similar to the findings of this study.

The study found that female participants possess a significantly higher level of technology integration skills for teaching Kazakh compared to their male counterparts. Specifically, women scored higher on both the pedagogical content knowledge (PCK) and technological pedagogical content knowledge (TPCK) sub-scales, as well as on the overall KFL-TPACK scale. This finding aligns with similar research (Campos & Scherer, 2023) that has explored gender differences in technology readiness and digital competencies among educators. These studies also highlight factors beyond technical skills, such as self-efficacy and confidence, may play a role in these observed differences. The analysis showed that female participants had significantly higher average scores on the PCK (3.79 vs. 3.32) and TPCK (3.74 vs. 3.30) sub-scales, as well as on the total KFL-TPACK scale (3.76 vs. 3.31). This suggests a gender-based disparity in the development of these skills, which merits further investigation into factors such as training, access, or personal interest.

Furthermore, the research reveals a significant difference in skills based on professional status. Teachers and specialists demonstrated higher technology integration skills than both undergraduate and graduate students. The average scores for teachers/specialists on the KFL-TPACK scale (4.10) were significantly higher than those of undergraduate students (3.61) and Master's/PhD students (3.64). This suggests that practical, real-world experience is a crucial factor in developing these abilities. This aligns with other studies (Fernandez-Batanero et al., 2020; Kahraman & Bicen, 2022) that emphasize how practical experience and professional development can enhance a teacher's ability to effectively use technology in their lessons.

The study also shows that technology integration skills improve with greater academic and professional experience over time. Specifically, fourth-year and graduate students demonstrated higher KFL-TPACK scores than students in earlier grades. The analysis revealed a significant difference in scores across grade levels, with fourth-year students (3.94) and graduates (3.86) scoring notably higher than first-year students (2.88). This finding suggests that the longer a student is immersed in their academic program, the more they develop the necessary skills to integrate technology into their teaching. This finding suggests that the longer a student is immersed in their academic program, the more they develop the necessary skills to integrate technology into their teaching. This is supported by international research (Kara, 2021; Orakova et al. (2024) that shows a positive correlation between years of study and teachers' preparedness for technology-enhanced instruction.

In conclusion, while the overall level of technology integration skills is high among the participants, this study provides new findings that highlight the importance of individual-level factors. The results underscore the need for targeted interventions, training, and curriculum development that address the specific needs of different groups—whether based on gender, professional status, or academic level—to ensure equitable and effective EdTech integration in Kazakh language education.

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