

From Everyday Digital Engagement to Professional Readiness: Preservice Primary Teachers in Kazakhstan

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Abstract

The rapid digitalization of education has increased expectations for preservice teachers to develop not only operational digital skills but also pedagogically oriented digital competence. This study examined digital culture and professional readiness among preservice primary teachers in Kazakhstan, with particular attention to the relationship between everyday digital engagement and readiness for technology-integrated teaching. A quantitative descriptive survey design was employed using a researcher-developed questionnaire administered to 99 preservice primary teachers at a university in Kazakhstan. Data were analyzed using descriptive statistics and Spearman's rank-order correlation analysis. The findings indicate that although participants demonstrated extensive digital engagement and highly positive attitudes toward the professional importance of digital competence, relatively few perceived themselves as possessing advanced digital culture. Students relied primarily on communication- and productivity-oriented technologies, whereas the use of digital tools supporting instructional design, visualization, and content creation was comparatively limited. The correlation analysis further revealed that educationally oriented digital engagement was more strongly associated with professional readiness than recreational technology use, suggesting that the educational purpose of technology use is more important than its frequency. The study contributes to research on teacher digital competence by demonstrating that everyday digital familiarity should not be interpreted as evidence of readiness for technology-integrated teaching. The findings highlight the need for teacher education programs to provide systematic opportunities for preservice teachers to develop pedagogically meaningful digital competence through authentic educational applications of digital technologies.

Keywords: *Digital culture, professional digital readiness, preservice teachers, teacher education, digital competence, educational digitalization, primary teacher education, Kazakhstan.*

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Introduction

The rapid digitalization of education has fundamentally transformed teaching, learning, communication, and professional practice across educational systems worldwide (UNESCO, 2023). Digital technologies are no longer supplementary instructional tools but integral to curriculum delivery, assessment, collaboration, resource development, and student engagement. Consequently, digital competence has become a core component of teacher professionalism, and teacher education institutions are increasingly expected to prepare future teachers to integrate digital technologies into teaching in pedagogically meaningful, ethically responsible, and critically informed ways (Demir et al., 2026; Orakova et al., 2024; Redecker, 2017; Tenorio-Sepúlveda et al., 2025; UNESCO, 2018).

Accordingly, teacher education has shifted its focus from developing basic digital skills to cultivating broader forms of professional digital competence that enable future teachers to integrate technology effectively into teaching and learning. International frameworks have broadened the conceptualization of teacher digital competence beyond operational technology skills. The UNESCO ICT Competency Framework for Teachers (UNESCO, 2018) and the European DigCompEdu Framework (Redecker, 2017) conceptualize digital competence as a multidimensional construct encompassing technological, pedagogical, informational, communicative, collaborative, and ethical dimensions of professional practice. Similarly, the Technological Pedagogical Content Knowledge (TPACK) framework emphasizes that effective technology integration depends not merely on technological proficiency but on teachers' ability to combine technological, pedagogical, and content knowledge to support meaningful learning (Imankulova et al., 2025; Mishra & Koehler, 2006; Magocha et al., 2025; Morudu, 2025). Contemporary research consistently shows that digital competence develops through pedagogically grounded experiences rather than through frequent technology use alone (Falloon, 2020; Gündoğdu, 2023; Instefjord & Munthe, 2017).

These issues have become increasingly significant in Kazakhstan, where educational digitalization has been identified as a strategic priority within national educational reforms. National initiatives and policy reforms aimed at the digital transformation of education have promoted the expansion of digital educational infrastructure, online learning environments, ICT-supported instruction, and the integration of digital technologies across all levels of education (UNESCO, 2024). The development of teachers' digital competence is increasingly recognized as essential to achieving

these national objectives, as future teachers are expected to design technology-enhanced learning environments, promote digital literacy among schoolchildren, and adapt instruction to rapidly evolving educational contexts. However, the effectiveness of these reforms depends not only on technological infrastructure but also on teachers' preparedness to integrate digital technologies into their professional practice.

This challenge is especially important in primary teacher education. Primary school teachers often provide children's first systematic exposure to educational technologies and play a central role in developing learners' digital and information literacy and responsible technology use. Unlike teachers at higher educational levels, primary teachers must select and adapt developmentally appropriate digital resources while fostering collaboration, creativity, critical thinking, and safe participation in digital environments. Consequently, professional digital readiness among preservice primary teachers has important implications not only for their professional competence but also for the quality of children's early digital learning experiences.

Although the importance of digital competence has been widely recognized internationally, existing research has focused predominantly on general teacher digital competence, technology acceptance, or ICT integration in teacher education. Fewer studies have examined the relationship between preservice teachers' everyday digital practices and their readiness to use digital technologies for pedagogical purposes, particularly in Kazakhstan. Existing studies in Kazakhstan have largely concentrated on educational digitalization policies, technological infrastructure, or general ICT implementation, while relatively little attention has been devoted to understanding how future teachers perceive their digital culture, evaluate their professional digital readiness, and engage with digital technologies in ways that support future classroom practice. Consequently, empirical evidence regarding the alignment between everyday digital engagement and pedagogically oriented digital competence among preservice primary teachers in Kazakhstan remains limited.

To address this gap, the present study investigates digital culture and professional readiness among preservice primary teachers in Kazakhstan. Rather than assuming that extensive digital engagement automatically translates into professional competence, the study examines how future teachers assess their digital culture, how they use digital technologies in educational contexts, and the extent to which their everyday digital practices align with pedagogically oriented professional readiness.

The following research questions guided the study:

RQ1. How do preservice primary teachers in Kazakhstan perceive their digital culture and their professional readiness for technology-integrated teaching?

RQ2. To what extent do preservice primary teachers' everyday digital practices align with pedagogical digital competence?

Literature Review

Digital Competence and Digital Culture in Teacher Education

The rapid digital transformation of education has fundamentally reshaped expectations for teachers' professional knowledge and classroom practice. Digital technologies are no longer viewed merely as instructional tools but as integral to teaching, learning, assessment, communication, collaboration, and professional development. Consequently, teacher digital competence has become a central component of educational quality and an essential outcome of teacher education programs worldwide (Mapisa & Makena, 2024; Kalymova et al., 2026; Redecker, 2017; UNESCO, 2018).

Earlier conceptualizations of technology integration focused primarily on digital literacy, typically defined as the ability to access, operate, and communicate with digital technologies. Although these operational skills remain important, contemporary scholarship increasingly argues that they constitute only one dimension of teachers' professional competence. Rather than emphasizing technical proficiency alone, recent frameworks conceptualize digital competence as a multidimensional construct that encompasses technological knowledge, pedagogical decision-making, information literacy, digital communication, collaboration, ethical responsibility, creativity, and reflective professional practice (Falloon, 2020; Strielkowski & Chigisheva, 2019; Strielkowski & Chigisheva, 2018; Chigisheva, 2017; Redecker, 2017).

One of the most influential conceptualizations of teacher digital competence is the European Framework for the Digital Competence of Educators (DigCompEdu), which identifies six interconnected areas of professional competence: professional engagement, digital resources, teaching and learning, assessment, learner empowerment, and facilitating learners' digital competence (Redecker, 2017). Similarly, the UNESCO ICT Competency Framework for Teachers situates digital competence within broader educational transformation, emphasizing teachers' ability not only to use technology effectively but also to foster inclusive, collaborative, and

innovative learning environments through pedagogically meaningful technology integration (UNESCO, 2018). Together, these frameworks illustrate that effective technology integration depends on teachers' capacity to make informed pedagogical decisions rather than merely operating digital tools.

Recent scholarship has further expanded this perspective through the concept of digital culture. While digital competence generally refers to the knowledge, skills, and dispositions needed for effective technology use, digital culture reflects broader patterns of participation in digitally mediated environments. It encompasses individuals' attitudes toward technology, the critical evaluation of digital information, ethical online behavior, collaborative engagement, adaptability to technological change, and responsible participation in digital communities (Falloon, 2020). From this perspective, teachers are viewed not merely as technology users but as professionals who critically select, evaluate, and integrate digital resources to support meaningful learning experiences.

The distinction between digital competence and digital culture has grown increasingly important in teacher education research. Contemporary educational environments require teachers to navigate rapidly evolving digital ecosystems, including artificial intelligence, learning management systems, collaborative online platforms, multimedia resources, and data-driven instructional practices. Consequently, preparing future teachers requires more than technical proficiency; it also entails cultivating a professional digital culture that enables educators to critically evaluate emerging technologies, adapt them to diverse educational contexts, and integrate them ethically and pedagogically into classroom practice (Caena & Redecker, 2019; Falloon, 2020; Moyo et al., 2022).

This broader understanding is reflected in recent systematic reviews of teacher digital competence. For example, a comprehensive scoping review by Tzafilkou et al. (2023) found substantial international consensus that professional digital competence extends beyond operational ICT skills to include pedagogical integration, critical thinking, ethical awareness, digital content creation, collaboration, and continuous professional learning. Similarly, recent systematic reviews emphasize that developing teacher digital competence requires pedagogically grounded, reflective approaches that go beyond technological proficiency (Claro et al., 2024).

Taken together, contemporary scholarship demonstrates a clear conceptual shift from viewing digital technologies primarily as technical tools to understanding digital competence and digital

culture as multidimensional professional capabilities. This shift has important implications for teacher education, suggesting that preparing future teachers successfully depends not only on increasing exposure to digital technologies but also on creating opportunities for pedagogically grounded, reflective, and professionally meaningful engagement with digital environments.

Professional Digital Competence and Teacher Readiness

Although contemporary university students are often described as digitally connected and technologically proficient, growing evidence suggests that extensive digital engagement alone does not ensure professional readiness for technology-integrated teaching. Numerous studies have shown that preservice teachers often have high confidence in using digital technologies for communication, entertainment, and information retrieval, yet they struggle to apply these technologies to instructional planning, classroom management, assessment, collaborative learning, and knowledge construction (Instefjord & Munthe, 2017; Tondeur et al., 2017). Consequently, researchers increasingly distinguish between everyday digital competence and professional digital competence, arguing that the latter requires pedagogically grounded knowledge developed through systematic teacher education rather than through routine technology use.

Professional digital competence has therefore become a central concept in contemporary teacher education research. Unlike general digital literacy, professional digital competence refers to teachers' ability to select, evaluate, adapt, and integrate digital technologies to enhance student learning and support curriculum objectives. It encompasses pedagogical decision-making, instructional design, digital assessment, ethical technology use, collaborative learning, and reflective professional practice (Falloon, 2020; Gudmundsdottir & Hatlevik, 2018). From this perspective, effective technology integration depends not only on knowing how digital tools function but also on understanding when, why, and under which pedagogical conditions they should be used.

Empirical evidence consistently supports this distinction. Instefjord and Munthe (2017), in their study of Norwegian teacher education programs, found that preservice teachers' professional digital competence depended primarily on the extent to which digital technologies were systematically integrated into pedagogical coursework, rather than on students' prior experience with technology. Similarly, Gudmundsdottir and Hatlevik (2018) reported that newly qualified teachers who had engaged in authentic, technology-supported teaching activities during their teacher education programs demonstrated significantly greater confidence in integrating digital

technologies into classroom practice than those whose preparation focused primarily on technical skills.

More recent studies have reached similar conclusions across diverse educational contexts. A systematic review by Reisoğlu and Çebi (2020) found that although preservice teachers generally report positive attitudes toward educational technologies, their professional digital competence varies considerably across pedagogical, technological, and ethical dimensions. The review further showed that teacher education programs that emphasize authentic instructional applications of technology consistently yield higher levels of professional readiness than those that focus primarily on technical ICT training. Likewise, recent international evidence suggests that preservice teachers remain more confident with communication-oriented technologies than with digital tools that support collaborative learning, content creation, visualization, digital assessment, or inquiry-based instruction (Tzafilkou et al., 2023).

These findings challenge earlier assumptions about the notion of "digital natives." Early discussions often suggested that individuals who grew up with digital technologies would naturally possess advanced digital competence and therefore require little formal preparation for technology-rich educational environments. However, this assumption has been widely criticized. Kirschner and De Bruyckere (2017) argue that frequent exposure to technology should not be confused with the ability to use digital tools critically, pedagogically, or professionally. Contemporary research likewise shows substantial variation in digital competence among preservice teachers, indicating that technological familiarity alone is an unreliable predictor of instructional readiness (Falloon, 2020; Reisoğlu & Çebi, 2020).

One theoretical perspective that helps explain this distinction is the Technological Pedagogical Content Knowledge (TPACK) framework proposed by Mishra and Koehler (2006). The framework suggests that effective technology integration results from the interaction among technological, pedagogical, and content knowledge rather than from technological knowledge in isolation. Accordingly, teachers need to understand how digital technologies can support specific instructional goals, learner characteristics, and disciplinary content. Although the present study does not operationalize the individual TPACK domains, the framework provides a valuable conceptual lens for interpreting why extensive everyday digital engagement may not necessarily translate into pedagogically meaningful professional readiness. Rather than serving as the study's

measured construct, TPACK informs the interpretation of the relationship between preservice teachers' digital practices and their perceived readiness to integrate technology into teaching.

The distinction between everyday digital engagement and professional digital competence is especially relevant for preservice primary teachers. Primary school teachers introduce children to formal educational uses of technology and are responsible for creating learning environments that promote digital literacy, creativity, collaboration, and responsible technology use from the earliest stages of schooling. Unlike teachers of older learners, primary teachers must carefully adapt digital resources to children's developmental, cognitive, and socio-emotional characteristics while ensuring that technology enhances rather than distracts from learning. Consequently, professional digital readiness among future primary teachers requires considerably more than operational technology skills; it demands the pedagogical capacity to integrate digital technologies into developmentally appropriate, meaningful, and inclusive educational practice.

Taken together, existing research indicates that although preservice teachers are generally active users of digital technologies, extensive everyday digital engagement should not be taken as evidence of professional readiness for technology-integrated teaching. Instead, professional digital competence develops through structured pedagogical experiences that enable future teachers to transform routine technology use into purposeful instructional practice. This distinction provides the conceptual foundation for this study's examination of the relationship between preservice teachers' everyday digital practices and their professional digital readiness.

Methodology

Research Design

This study used a quantitative descriptive survey design to examine digital culture and professional readiness among preservice primary teachers in Kazakhstan. A descriptive survey was appropriate because the study sought to investigate participants' perceptions, self-assessments, and patterns of digital technology use rather than examine causal relationships or evaluate the effectiveness of an intervention (Creswell & Creswell, 2018). This approach enabled the systematic collection of quantitative data on preservice teachers' digital culture, educational uses of digital technologies, and perceptions of professional readiness for technology-integrated teaching amid Kazakhstan's ongoing educational digitalization. By capturing participants' self-reported experiences and

attitudes, the study provides empirical evidence of their preparedness to integrate digital technologies into future professional practice.

Participants

The study was conducted at K. Zhubanov Aktobe Regional University in Kazakhstan. The participants comprised 99 preservice primary teachers enrolled in the undergraduate program in *Pedagogy and Methods of Primary Education*. Students in the second, third, and fourth years of study were included because they had completed foundational pedagogical coursework and had gained experience using digital technologies in university learning and teaching.

A convenience sampling strategy was used. Participants were recruited from courses offered during the data collection period and consented to participate in the study. Convenience sampling is widely used in educational research when the objective is to examine perceptions and practices within a defined population rather than to generate nationally representative estimates (Creswell & Creswell, 2018).

The study focused specifically on preservice primary teachers because they play a foundational role in introducing children to digital technologies and fostering digital literacy from the earliest stages of formal education. Their professional readiness to integrate technology into teaching is therefore critical to the successful implementation of digital transformation initiatives in schools.

Research Instrument

Data were collected using a researcher-developed structured questionnaire to assess preservice teachers' digital culture and professional readiness for technology-integrated teaching.

The questionnaire was developed following a comprehensive review of international frameworks and empirical research on teacher digital competence, including the UNESCO ICT Competency Framework for Teachers (UNESCO, 2018), the European Framework for the Digital Competence of Educators (DigCompEdu) (Redecker, 2017), and prior studies on professional digital competence in teacher education (Falloon, 2020; Instefjord & Munthe, 2017). These frameworks informed the instrument's conceptual development by identifying key dimensions of teachers' professional engagement with digital technologies; however, they served as conceptual guides rather than as measurement instruments.

Although the study draws on broader scholarship on technology integration in education, the questionnaire was not designed to operationalize the individual domains of the Technological Pedagogical Content Knowledge (TPACK) framework (Mishra & Koehler, 2006). Instead, TPACK serves as a conceptual lens for interpreting the relationship between preservice teachers' everyday digital engagement and their perceived readiness to integrate digital technologies into teaching.

The instrument comprised 26 items, including multiple-choice questions and five-point Likert-scale statements, organized into four dimensions: (1) self-assessed digital competence and digital culture, (2) educational uses of digital technologies, (3) perceptions of professional digital readiness, and (4) attitudes toward educational digitalization. The questionnaire was designed to capture participants' perceptions, experiences, and self-reported educational practices rather than objective measures of digital performance.

Validity and Reliability

Content validity was established through expert review. The preliminary version of the questionnaire was independently evaluated by two experts in teacher education and educational technology. They assessed each item for relevance to the research objectives, conceptual clarity, representativeness of the intended constructs, and appropriate wording. Based on their recommendations, minor revisions were made to improve item clarity, eliminate ambiguity, and strengthen alignment with the study objectives.

Internal consistency of the instrument was assessed using Cronbach's alpha, a widely recommended measure for evaluating the reliability of educational questionnaires (Taber, 2018). The questionnaire demonstrated satisfactory overall reliability (Cronbach's $\alpha = .84$). Reliability coefficients for the four dimensions ranged from .76 to .83, exceeding the recommended threshold of .70 and indicating acceptable internal consistency.

Data Collection

Data were collected during the academic year at K. Zhubanov Aktobe Regional University. Participation was voluntary, and all participants were informed of the study's purpose, the voluntary nature of participation, the anonymity of their responses, and their right to withdraw at

any time without consequence. Completing the questionnaire was considered to constitute informed consent.

The questionnaire was administered during scheduled university classes under standardized conditions to ensure consistency across participants. Respondents completed the questionnaire independently, with an average completion time of 15 to 20 minutes.

Data Analysis

Data were analyzed using IBM SPSS Statistics. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were computed to summarize participants' digital culture, educational uses of digital technologies, perceptions of professional readiness, and attitudes toward educational digitalization.

For the correlation analysis, composite scores for digital culture, educational digital use, recreational digital use, and professional readiness were computed by averaging the questionnaire items for each construct. These composite scores were then used in the inferential analysis.

To examine the relationship between preservice teachers' everyday digital engagement and their perceived professional readiness for technology-integrated teaching (RQ2), Spearman's rank-order correlation analysis was conducted. Spearman's correlation was selected because the study used Likert-scale data and aimed to assess the strength and direction of associations between participants' self-reported digital practices and professional readiness without assuming a normal distribution of the variables (Field, 2018). Correlation coefficients were interpreted using Cohen's (1988) guidelines, with values of approximately .10, .30, and .50 indicating small, moderate, and large associations, respectively. Statistical significance was set at $p < .05$.

Results

Before the main analysis, the internal consistency of the questionnaire was assessed using Cronbach's alpha. The overall instrument demonstrated satisfactory reliability ($\alpha = .84$), indicating acceptable internal consistency across the questionnaire items. Reliability coefficients for the individual dimensions ranged from .76 to .83, exceeding the commonly accepted threshold of .70 for exploratory educational research (Taber, 2018). These results support the instrument's suitability for examining preservice teachers' perceptions of digital culture and professional readiness.

Table 1*Internal Consistency Reliability of Questionnaire Dimensions*

Dimension	Number of Items	Cronbach's alpha
Self-assessed digital competence and digital culture	6	.81
Educational uses of digital technologies	8	.78
Perceptions of professional digital readiness	7	.83
Attitudes toward educational digitalization	5	.76
Overall instrument	26	.84

Note. Cronbach's alpha of .70 indicates acceptable internal consistency reliability (Taber, 2018).

RQ1. Preservice Teachers' Perceptions of Digital Culture and Professional Readiness

The findings indicate that preservice primary teachers were highly engaged with digital environments in their everyday lives; however, this engagement did not consistently translate into strong perceptions of professional digital readiness. Approximately 90% of respondents reported spending five or more hours online daily, with the average duration of Internet use reaching 7.6 hours per day. At the same time, students indicated that a substantial proportion of this digital engagement was associated primarily with communication and entertainment rather than with educational or professionally oriented practices.

Despite extensive digital exposure, students' self-assessments of digital culture remained relatively moderate. As shown in Table 2, nearly half of respondents (48.5%) rated their digital culture as satisfactory, while 27.3% rated it as unsatisfactory. Only 23.0% rated their digital culture as high or excellent, including 5.2% who selected the highest category. A small proportion of respondents (1.2%) reported a very low level of digital culture.

Table 2*Self-Assessment of Digital Culture among Preservice Teachers (N = 99)*

Self-assessment category	n	%
Excellent	5	5.2
High	18	17.8
Satisfactory	48	48.5
Unsatisfactory	27	27.3
Very low	1	1.2

The distribution of responses reveals a notable discrepancy between students' intensive participation in digital environments and their evaluations of professionally relevant digital

competence. Although respondents were highly active digital users, fewer than one-quarter perceived themselves as possessing advanced digital culture. These findings suggest that frequent engagement with digital technologies does not automatically translate into confidence in pedagogically oriented digital competence or professional digital readiness.

Students nevertheless demonstrated highly positive attitudes toward the professional significance of digital competence. Approximately 94% agreed that digital competence enhances professional competitiveness, and all respondents acknowledged that digital culture is essential to future primary teacher preparation. Similarly, 94% reported feeling prepared to use information and communication technologies in educational settings. These findings indicate that students strongly recognize the professional importance of digital competence, even though their self-assessments of digital culture remain relatively moderate.

The analysis further examined the specific types of digital technologies students used for educational and self-educational purposes. The findings revealed that students' digital practices were primarily centered on communication- and productivity-oriented technologies. As shown in Table 3, the most frequently used technologies included social networks and messaging platforms (79.0%), electronic mail (78.9%), text-processing software (73.7%), and presentation software (73.7%). Educational video channels were used by 61.4% of participants, whereas spreadsheet applications were used by 47.4% of respondents.

In contrast, technologies associated with more advanced pedagogical and content-creation practices were used much less frequently. Thematic webinars were used by 42.1% of participants, graphic editors by 29.8%, and online visualization services by only 14.0% of respondents.

Table 3

Educational Uses of Digital Technologies among Preservice Teachers (N = 99)

Digital technology	<i>n</i>	%
Social networks and messaging platforms	78	79.0
Electronic mail	78	78.9
Text-processing software	73	73.7
Presentation software	73	73.7
Educational video channels	61	61.4
Spreadsheet applications	47	47.4
Thematic webinars	42	42.1
Graphic editors	30	29.8
Online visualization services	14	14.0

To strengthen analytical interpretation, the technologies were grouped into two broader categories: communication/productivity technologies and advanced pedagogical technologies. Communication/productivity technologies included social media, email, word-processing applications, and presentation software, whereas advanced pedagogical technologies included webinars, spreadsheet applications, graphic editors, and visualization tools.

The mean usage rate for communication and productivity technologies was 76.3%, whereas the mean usage rate for advanced pedagogical technologies was substantially lower at 33.3%. This more than 40-percentage-point difference indicates that students' digital practices remain predominantly functional and communication-oriented rather than pedagogically innovative or instructionally sophisticated.

Students also held strongly positive perceptions of educational digitalization and its professional significance. Approximately 82% agreed that digitalization significantly influences contemporary society and educational practice, while 90% reported regularly using Internet resources, search engines, and databases during academic preparation. Furthermore, all participants expressed satisfaction with university instructors' use of digital technologies in teaching. However, only 65% agreed that the university's informational and educational resources sufficiently contributed to the development of digital culture and interest in educational digitalization. These findings suggest that although preservice teachers recognize the professional importance of digital competence, they perceive fewer opportunities within their teacher education program to develop advanced pedagogical digital skills.

RQ2. Relationship Between Everyday Digital Engagement and Professional Readiness

To address the second research question, composite scores for digital culture, educational use of digital technologies, recreational digital use, and professional readiness were computed by averaging the questionnaire items for each construct. Spearman's rank-order correlation analysis was then conducted to assess relationships among these variables. The results are presented in Table 4.

Table 4

Spearman's Rank-Order Correlations between Digital Engagement Variables and Professional Readiness

Variables	Spearman's ρ	p	Interpretation
Digital culture ↔ Professional readiness	.48	< .001	Moderate positive
Educational use of digital technologies ↔ Professional readiness	.55	< .001	Moderate positive
Recreational digital use ↔ Professional readiness	.19	.048	Weak positive

Note. *Spearman's rank-order correlation coefficients (ρ). Statistical significance was established at $p < .05$.*

The results indicate a moderate positive association between digital culture and perceived professional readiness for technology-integrated teaching ($\rho = .48$, $p < .001$). Similarly, educational use of digital technologies was moderately associated with professional readiness ($\rho = .55$, $p < .001$), suggesting that participants who used digital technologies more frequently for educational purposes also reported greater confidence in integrating technology into future teaching practice.

By contrast, recreational digital use showed only a weak positive association with professional readiness ($\rho = .19$, $p = .048$). Although statistically significant, this association suggests that general familiarity with digital technologies gained through everyday personal use contributes less to professional readiness than educationally oriented digital engagement.

Taken together, the correlation analysis extends the descriptive findings presented in response to RQ1. Although preservice teachers reported intensive engagement with digital technologies, professional readiness was more strongly associated with educationally purposeful digital practices than with general digital activity. These findings suggest that frequent technology use alone is insufficient to develop pedagogically meaningful digital competence and underscore the importance of teacher education experiences that explicitly support the instructional use of digital technologies.

Discussion

The present study examined preservice primary teachers' digital culture and professional readiness in the context of Kazakhstan's ongoing educational digitalization. Addressing the first research question, the findings indicate that although participants demonstrated extensive engagement with digital technologies and held highly positive attitudes toward their professional importance,

relatively few perceived themselves as possessing advanced digital culture or pedagogically oriented digital competence. Addressing the second research question, the correlation analysis further demonstrated that professional readiness was more strongly associated with educationally purposeful uses of digital technologies than with everyday recreational digital engagement. Together, these findings suggest that the frequency of technology use alone is insufficient to prepare future teachers to integrate digital technologies effectively into classroom practice.

One of the study's principal contributions is distinguishing between everyday digital engagement and professionally meaningful digital competence. Although participants reported spending substantial time online and expressed confidence in the professional importance of digital competence, fewer than one-quarter rated their digital culture as highly developed. This discrepancy indicates that digital familiarity gained through routine communication and entertainment should not be interpreted as evidence of pedagogical readiness. These findings align with previous research showing that professional digital competence develops through structured educational experiences rather than through technology exposure alone (Instefjord & Munthe, 2017; Falloon, 2020). They also reinforce the conclusions of Tondeur et al. (2017), who argue that effective technology integration requires systematic opportunities to connect digital tools with instructional practice rather than simply increasing access to technology.

The correlation analysis provides additional evidence for this interpretation. Educational uses of digital technologies showed a substantially stronger relationship with professional readiness than recreational digital use. This finding suggests that not all forms of digital engagement contribute equally to teacher preparation. Rather, engagement with technologies used for learning, instructional planning, and academic communication appears to support the development of professional confidence more effectively than general digital activity. Although recreational technology use exhibited a statistically significant relationship with professional readiness, the association was comparatively weak, indicating that everyday digital experiences alone contribute only marginally to pedagogically oriented competence. These findings extend previous research by demonstrating that the educational purpose of technology use is more important than its frequency.

The findings also contribute to ongoing debates about the concept of "digital natives." Earlier perspectives held that individuals who grew up with digital technologies naturally possess advanced digital skills with relatively little formal preparation. However, this assumption has been

widely challenged in teacher education research (Kirschner & De Bruyckere, 2017). The present findings provide additional empirical support for these critiques. Despite extensive digital engagement, participants demonstrated limited use of technologies for visualization, digital content creation, interactive learning, and instructional design. Consequently, technological familiarity should not be equated with professional readiness for technology-integrated teaching. From a theoretical perspective, the findings align with the broader understanding of digital competence proposed by UNESCO (2018) and DigCompEdu (Redecker, 2017), both of which conceptualize digital competence as extending beyond operational ICT skills to include pedagogical, collaborative, ethical, and reflective dimensions of professional practice. Although the present study did not operationalize the individual domains of the TPACK framework, the findings may also be interpreted through this lens. Participants appeared confident in using digital technologies operationally. However, they demonstrated comparatively lower readiness to apply those technologies in instructional contexts, illustrating the distinction between technological familiarity and pedagogically integrated knowledge described by Mishra and Koehler (2006).

An additional important finding concerns participants' perceptions of institutional support. Although respondents overwhelmingly recognized the professional importance of digital competence and expressed positive attitudes toward educational digitalization, evaluations of institutional support for developing digital culture were more moderate. This pattern suggests that preservice teachers perceive a gap between the rising professional expectations associated with educational digitalization and the opportunities available within teacher education programs to develop advanced pedagogical digital competence. Similar conclusions have been reported internationally, where professional digital competence develops most effectively when digital technologies are systematically embedded in pedagogical coursework, teaching practice, and reflective learning activities (Gudmundsdottir & Hatlevik, 2018).

The study also contributes to understanding digitalization in education in Kazakhstan. While national reforms have successfully expanded access to digital technologies and strengthened digital infrastructure, the findings suggest that future teacher preparation should increasingly emphasize pedagogically meaningful uses of technology rather than operational digital skills alone. For primary teacher education in particular, this is especially important because primary teachers introduce children to digital learning environments and establish foundational patterns of responsible, ethical, and educational technology use. Strengthening preservice teachers'

professional digital competence therefore has implications not only for teacher preparation but also for the quality of pupils' early learning experiences.

Several limitations should be acknowledged. First, the study was conducted at a single university, which may limit the generalizability of the findings to other teacher education institutions. Second, the study relied on self-reported perceptions, which may not fully reflect participants' actual pedagogical digital competence. Third, the cross-sectional design does not allow examination of how professional digital competence develops over time. Finally, although inferential correlation analysis identified significant associations among the study variables, the findings should not be interpreted as evidence of causal relationships. Future research employing longitudinal, mixed-methods, or experimental designs could provide a more comprehensive understanding of how pedagogically oriented digital competence develops during teacher education.

Overall, the findings indicate that professional digital readiness depends less on the extent of technology use than on the educational quality of that engagement. Consequently, teacher education programs should move beyond the assumption that digitally connected students are inherently prepared for technology-integrated teaching. Instead, curricula should provide systematic opportunities for preservice teachers to engage with digital technologies through instructional design, digital assessment, collaborative learning, digital content creation, and reflective pedagogical practice. Such approaches are likely to strengthen the transition from everyday digital familiarity to professionally meaningful digital competence and better prepare future teachers for increasingly digital educational environments.

Conclusion

This study examined digital culture and professional readiness among preservice primary teachers in Kazakhstan amid ongoing educational digitalization. The findings indicate that although participants actively engaged with digital technologies and recognized the professional importance of digital competence, extensive everyday technology use did not automatically translate into pedagogically oriented professional readiness. The correlation analysis further showed that educationally oriented digital engagement was more strongly associated with professional readiness than recreational technology use, underscoring that the educational purpose of technology use is more important than its frequency.

The study contributes to the growing literature on teacher digital competence by showing that everyday digital familiarity should not be taken as an indicator of readiness for technology-integrated teaching. Instead, professionally meaningful digital competence develops through structured educational experiences that enable preservice teachers to apply digital technologies in pedagogically purposeful ways.

These findings have significant implications for teacher education in Kazakhstan and in comparable educational contexts undergoing digital transformation. Teacher education programs should provide systematic opportunities for preservice teachers to integrate digital technologies into instructional planning, assessment, collaborative learning, and reflective practice rather than focusing solely on operational digital skills. As educational systems continue to expand digital transformation initiatives, strengthening pedagogically grounded digital competence among future teachers will be essential to ensure that technology contributes meaningfully to teaching and learning.

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