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TEACHERS' READINESS AND PRACTICES REGARDING TECHNOLOGY-SUPPORTED URDU LANGUAGE INSTRUCTION IN PAKISTANI SCHOOLS

***Dr. Muhammad Amjad Abid**
Associate Professor, Department of Urdu, University of Education, Lahore
University of Education, Lahore
****Dr. Muhammad Javed Aftab**
Assistant Professor (Special Education), Department of Special Education,
Division of Education, University of Education, Lahore
*****Dr. Atif Manzoor**
Assistant Professor Urdu (Visiting), Division of Islamic & Oriental Learning
University of Education, Lahore
******Mahnoor Hameed**
Lecturer (English Linguistics) Department of English, University of Okara

Abstract

In this study, the level of preparedness and practices of teachers in relation to technology based Urdu language teaching in Pakistani schools were studied. The quantitative research with cross sectional survey design method was used and the data were collected from 483 Urdu language teachers using a structured questionnaire that comprises the following factors: digital competence, technological self-efficacy, attitudes toward technology, pedagogical preparedness, institutional support, pedagogical practice, and barriers perceived by teachers. Descriptive statistics, independent-samples t tests, one-way ANOVA, Pearson correlation, multiple regression and structural equation modeling were used. The results showed that the overall readiness of the teachers was of moderate level, technology supported Urdu teaching practices were also moderate, however, attitudes towards technology was comparatively high. Preparation and classroom use of technology increased readiness and practices. Pedagogical preparedness was the most important factor in predicting technology integration, while perceived barriers negatively predicted technology implementation. The structural model showed a high correlation between teacher readiness and use of technology in teaching Urdu. The findings point towards the necessity of training, strengthening digital infrastructure, and providing Urdu-based educational materials.

Keywords: *Urdu language instruction, teacher readiness, educational technology, digital competence, technology-supported learning, mobile-assisted language learning, pedagogical preparedness, Pakistan*

Introduction

Thanks to the wide-ranging changes in digital technology, language education is facing a new era that goes beyond classroom learning and textbooks to integrate digital media into the teaching process. Digital technology has brought about new changes in language education, extending language teaching beyond traditional textbooks and teacher-led language teaching models. The use of the smartphone, tablet and various multimedia materials, educational applications, learning management systems, digital games, online assessment systems and AI increasingly allows for personalized, interactive, multimodal and flexible language learning. Recent studies in technology-enhanced language learning have provided a growing body of literature highlighting the current interest in the fields of mobile-assisted language learning, flipped learning, digital game-based learning, multimodal resources, and informal digital learning, and the evidence of their effectiveness to support the receptive and productive language skills (Hasumi & Chiu, 2024). The mobile-based language learning field has also been supported by meta-analytic evidence that shows meaningful improvements in language learning when compared to traditional language learning approaches, which is dependent on the instructional design, learners' characteristics, and how the technology is integrated into the language learning process (Chen et al., 2020; Mihaylova et al., 2022). Teachers still play a key role in transformation, not only in terms of having access to devices, but in terms of teachers'

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competence, confidence, pedagogical understanding and ability to choose and use digital tools. The developments make it important to explore teachers' readiness and practices in Urdu language teaching through technology in Pakistani schools.

Technology-supported language instruction refers to the purposeful integration of digital technologies into teaching processes to facilitate language acquisition, communication, practice, assessment, feedback, collaboration, and independent learning. Mobile-assisted language learning has become particularly significant because portable devices enable learners to access instructional material inside and outside the classroom. Recent systematic evidence indicates that smartphones and mobile applications can support pronunciation, vocabulary, reading, writing, collaboration, engagement, and other aspects of language learning, while collaborative mobile-assisted language learning has shown substantial growth since 2019 (Guo et al., 2024; Metruk, 2024). However, the presence of technology does not automatically result in effective teaching. Teachers need digital competence to identify appropriate resources, create or adapt digital content, manage technology-enhanced activities, assess student learning, provide digital feedback, and use technology in pedagogically meaningful ways. The OECD (2023) emphasizes that teachers are key agents of educational digitalization and require both general digital skills and teaching-specific digital competencies encompassing digital resources, instruction, assessment, communication, collaboration, and learner empowerment. Thus, investigating Urdu teachers' readiness alongside their actual classroom practices is essential for understanding whether technology is being transformed from a technical resource into an effective pedagogical tool for language education.

While there has been considerable growth in the international literature on the use of technology and mobile devices in language learning, the literature is still overwhelmingly dominated by English and other well-studied second or foreign languages. A study by Hasumi and Chiu (2024) showed that the majority of the literature concerning technology and language learning was written in English with the field of pronunciation learning, vocabulary learning, and collaborative language learning all being the most recent areas to see systematic reviews. Previous studies in Pakistan have explored various aspects pertaining to pre-service teachers' mobile-learning readiness, teacher's digital competency, online-teaching self-efficacy, technology-supported instruction in general subjects and digital-learning initiatives. For instance, Asghar et al. (2021) assessed mobile-learning readiness of 429 pre-service teachers from Pakistan, while Sehar and Alwi (2023) found teachers' digital competence was positively related to their self-efficacy on online teaching. However, none of these studies focussed on the instruction of Urdu language. The recent literature in Pakistan thus leaves an important void which would throw light on the preparedness of Urdu teachers for technology use, what technology they are using, for which skills in Urdu they are using it, what are the challenges facing them and whether their preparedness translates into classroom practice or not. The proposed study proposes to plug this gap by focusing on the role of Urdu instead of English or general classroom instruction in the research of technology integration.

Across the globe, digital competence has emerged as an increasingly vital aspect of teachers' quality and professional growth. Education systems are establishing digital-competence standards for teachers, professional-development systems, certification programs, and school-level digital-support systems. OECD evidence suggests that digital resources, digital teaching and learning, assessment, learner empowerment, communication, and professional engagement are key competencies required to effectively integrate technology into teaching and learning, which are not solely dependent on infrastructure (OECD, 2023). Empirical studies in the last years also show a heterogeneity of digital competence among teachers resulting from contextual and professional factors. In a different study, Suzer and Koc (2024) identified that teachers' competence in digital skills varies based on their subject area,

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their educational background and the presence of digital devices. Recently, Bueno-Baquero et al. (2026) argued the ongoing impact of targeted teacher professional development, in a study on 3,828 primary and secondary school teachers, where they highlighted that teacher digital competence is affected by teaching level and teachers' characteristics. In language education the learner-centred and collaborative nature of mobile-supported environments have grown more evident, and smartphones and social-media platforms are prominent after 2019, as found by Guo et al. (2024). These international trends illustrate a move from questions of "should technology be used?" to "how can technology be used effectively in a particular pedagogical and language-learning context?".

Technology-supported school education has significant opportunities and challenges for Pakistan. Mobile technology has gained significant importance in the context of education delivery, and the study carried out with pre-service teachers revealed that when the factors like perceived usefulness, service quality, innovativeness and technological support are favourable, mobile learning is very accessible and is welcomed with enthusiasm (Asghar et al., 2021). It is most important that the experimental evidence shows that technology has better educational outcomes in middle schools in Pakistan when there is active involvement of teachers in the teaching-learning process. Beg et al. (2022) identified that integrating curriculum content into educational videos via teachers yielded about a 0.3 SD increase in mathematics and science achievement, but the use of the same technological content with individual tablets resulted in lower scores. Structured digital-learning programmes have also been undertaken by Pakistan. UNICEF's Learning Passport pilot, which was rolled out in 2022, engaged over 4,000 students from 28 schools and featured tablets, instructional videos, interactive activities and digital assessments, but primarily focused on teaching mathematics, science and social studies skills as opposed to Urdu language teaching. UNICEF also noted significant disparities in household internet access and the need for ongoing support and teacher training. The developments discussed here suggest that Pakistan is making a shift towards digital education, but at the same time throw light on the need for evidence on the understanding and application of technology by Urdu language teachers in particular.

With the rapid advancement of technology, it has become an integral part of the teaching and learning process, but the effective integration of technology in education relies mainly on teachers' readiness and capacity to share this digital competence in the classroom. Studies conducted in Pakistan, as well as digital-learning programmes emerging, illustrate the promise of technology-mediated learning in improving learning outcomes when mediated by teachers, and the studies show that issues of professional preparation, technological competency, access, training, and institutional support remain a concern. Despite Urdu's central place in Pakistan's educational and linguistic context, limited recent empirical attention has been given specifically to the readiness of Urdu-language teachers to integrate digital technologies and to the ways in which these technologies are actually used for Urdu reading, writing, vocabulary, grammar, comprehension, communication, assessment, and learner engagement. Consequently, it remains unclear whether Urdu teachers possess the technological and pedagogical competencies necessary for technology-supported instruction, what digital practices are currently being employed, what factors facilitate or restrict their use, and whether higher levels of teacher readiness correspond with more meaningful technology-integrated Urdu teaching. Without such evidence, professional-development programmes and educational technology initiatives may remain generic rather than responsive to the linguistic and pedagogical requirements of Urdu instruction. Therefore, the present study seeks to systematically investigate teachers' readiness and practices regarding technology-supported Urdu language instruction in Pakistani schools.

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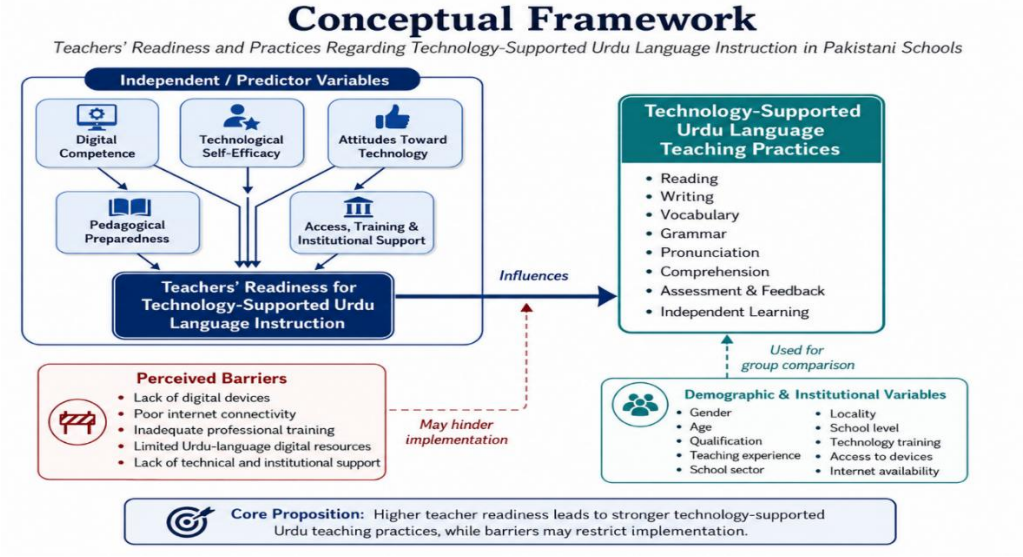
The study aimed to assess teachers' readiness for technology-supported Urdu language instruction in terms of digital competence, self-efficacy, attitudes, pedagogical preparedness, access, training, and institutional support; examine the extent and nature of digital technology integration in Urdu teaching; identify major barriers affecting its implementation; determine the relationship between teacher readiness and technology-supported practices; compare readiness and practices across selected demographic and school-related variables; and identify the strongest predictors of effective technology-supported Urdu language instruction.

The proposed study is meaningful because it links three domains which are somewhat unconnected in the context of Pakistani research: teacher digital competence, integration of educational technology, and pedagogy of Urdu language. The evidence from abroad suggests the effective use of mobile and digital technologies in language learning is not merely a matter of the availability of the technologies, but equally relies strongly on pedagogical design and teacher involvement (Mihaylova et al., 2022; Metruk, 2024). The principle is supported by evidence from Pakistan where teacher mediated educational technology has been shown to lead to significantly improved performance compared to technology that does not involve teachers (Beg et al., 2022). The study can provide empirical evidence about teachers' preparedness, current practices, challenges, and predictors of technology integration in the Urdu language classrooms and can benefit teacher-education institutions, school leaders, curriculum developers, provincial school education departments, educational technology developers, and policy makers. The results can inform the creation of targeted professional development programs, digital technology resources in Urdu, technology-integrated Urdu school curricula, mobile integrated learning activities, and equitable digital-learning approaches for rural and urban schools. The study can also help the international academic literature as the study's scope is not limited to the dominant language of technology enhanced language learning, which is English, but also Urdu, an important language that is underrepresented in the field of educational-technology research.

Conceptual Framework of Study



Literature Review

Technology-Supported Language Instruction

The rapid expansion of digital technologies has substantially changed the nature of language teaching and learning. Technology-supported language instruction now includes mobile applications, smartphones, multimedia presentations, educational videos, digital games, online learning platforms, interactive exercises, automated feedback, artificial intelligence, and other technology-based resources that supplement or transform conventional classroom

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practices. Rather than functioning only as supplementary teaching aids, digital technologies increasingly create opportunities for personalized, interactive, collaborative, multimodal, and learner-centred language instruction. A large-scale bibliometric analysis conducted by Hasumi and Chiu (2024), covering 1,816 publications in technology-enhanced language learning, demonstrated substantial growth in research on mobile-assisted language learning, flipped learning, digital game-based learning, and other technology-supported pedagogies.

Meta-analytic evidence similarly indicates that mobile technologies can enhance language-learning outcomes when their use is supported by appropriate instructional design. In their meta-analysis of 84 effect sizes for 80 experimental or quasi-experimental studies, Chen et al. (2020) found a medium-to-high effect of mobile-device use on language-learning achievement. The developments indicate that technology-assisted teaching and learning are increasingly becoming an imperative part of modern language education. But the effectiveness of its learning outcomes is not solely determined by the availability of digital resources, but that teachers choose, arrange, and use them in the teacher-student learning process (Chen et al., 2020; Hasumi & Chiu, 2024; Mihaylova et al., 2022).

Mobile-Assisted Language Learning (MALL) is among the fastest growing aspects of technology-based language teaching and learning, due to the mobile devices that enable students to access language learning outside of traditional classroom settings and times. The use of smart phones and tablets can help to practice language over and over, to access authentic texts, audio and video resources, vocabulary and pronunciation exercises, quizzes, peer interaction, and feedback. In the 2022 meta-analysis, Mihaylova et al. found that mL2L apps might have a positive impact on L2 achievement but noted that results were inconsistent. Guo et al. (2024) conducted a systematic review and found that collaborative MALL research has significantly expanded, especially since 2019, wherein the use of smartphones and social platforms has been growing in facilitating learners' interaction and collaboration.

However, Metruk (2024) conducted a review of previous research on mobile-assisted pronunciation study and also reported overall positive results with respect to pronunciation performance and attitudes of the learners. This view has since been bolstered by more recent meta-analytic evidence: Zhou and Zhou (2026) synthesized 65 experimental and quasi-experimental studies and concluded that the overall impact of mobile apps on vocabulary learning was large, suggesting that benefits may be maintained for longer term vocabulary retention. The findings are also significant for the teaching of Urdu language as reading, vocabulary and pronunciation, writing, comprehension and language practice can be supported using inexpensive and increasingly available mobile technology (Guo et al., 2024; Metruk, 2024; Mihaylova et al., 2022; Zhou & Zhou, 2026).

Teachers' Readiness for Technology Integration

Although technical improvements have been made, teachers are still the main actors in the classroom in which educational technologies are made functional. Therefore, teacher preparedness should not be understood as having access to computers, smart phones or the internet. Recent studies have defined readiness as a multidimensional phenomenon that includes digital competence, confidence in technology, technological self-efficacy, attitudes toward technology, pedagogical knowledge, being open to innovation, selecting appropriate resources and institutional and infrastructural support. Peng et al. (2024) analysed 680 educators and found that teachers' attitudes, self-efficacy, and digital competence had a significant impact on their use of ICT to support integration. The findings are significant because they show that the usage behaviour of technology occurs when a combination of personal competence and motivational factors is applied, not solely due to the presence of technology. Likewise, in the DigCompEdu framework Suzer and Koc (2024) showed variation in digital competence based on teacher and professional characteristics for 368 teachers.

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Further, more recent large-scale research conducted on 3,828 primary and secondary teachers revealed that teacher digital competence varies from one level to another and by demographic characteristics, which further reinforces the importance of context-specific professional development and not assuming equal readiness among teachers (Bueno-Baquero et al., 2026; Peng et al., 2024; Suzer & Koc, 2024).

This is especially true for digital self-efficacy as knowing how technology works is not enough for teachers to be confident in using it in class. Teachers need to value and trust their ability to plan digital activities, deal with technical issues, engage with students, evaluate learning, and use technology to accomplish instructional goals. This is supported by evidence from Pakistan. Sehar & Alwi (2023) carried out a study of 155 nursery and lower primary teachers in Karachi to determine the teachers' digital competency and self-efficacy regarding online instruction management. They found that there was a positive correlation between teachers' digital competencies and their self-efficacy in managing online instruction. Teachers' instruction methods and their engagement ability were also positively correlated with digital competence. The authors therefore stressed the significance of professional training as one of the significant mechanisms for enhancing the technical knowledge of the teachers and their confidence. The same is true in international evidence. Peng et al. (2024) discovered that in addition to influencing technology integration, self-efficacy was found to interact with attitudes and digital competence in determining ICT adoption. Hence, the preparedness of Urdu teachers should be analysed in terms of psychological and competence aspects. When confidence and pedagogical competence is poor, a teacher might have a smartphone or a computer, but be hesitant to develop Urdu digital content, utilize multimedia resources, administer online assessments, develop Urdu language applications, or involve students in digital activities (Peng et al., 2024; Sehar & Alwi, 2023).

Teacher Professional Development and Technology-Supported Practices

The literature further suggests that sustainable technology integration requires continuing professional development rather than isolated technical workshops. Effective professional development should connect technology with curriculum, pedagogy, subject knowledge, classroom assessment, learner diversity, and authentic teaching problems. Hennessy et al. (2022), through a systematic review of technology-supported teacher professional development in low- and middle-income countries, concluded that technology offers meaningful opportunities for formal teacher development and informal peer learning, but programmes need to be contextually relevant, adequately supported, and connected with teaching practice. This issue is particularly important for language teachers because technology use involves more than operating devices. Teachers need to identify appropriate digital texts, audio materials, vocabulary resources, interactive tasks, writing tools, assessment applications, and culturally relevant materials that support specified language-learning outcomes. Teachers also require competencies to evaluate the reliability, linguistic quality, age appropriateness, accessibility, and curricular alignment of digital materials. Consequently, readiness for technology-supported Urdu instruction should include teachers' professional training, technological-pedagogical knowledge, frequency of technology use, ability to develop or adapt Urdu resources, and access to technical and administrative support. Professional development that concentrates only on general computer literacy may therefore be insufficient for producing meaningful technology-supported Urdu language pedagogy (Hennessy et al., 2022; Suzer & Koc, 2024).

The difference between teachers' technological readiness and their use of technology in the classroom is another important distinction that has emerged from the literature in recent years. Teachers can describe positive attitudes to the use of educational technology but use the digital resources mainly for basic tasks like creating presentations, searching for information,

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presenting videos and communicating with students. For more advanced pedagogical integration, teachers need to use digital tools to collaborate, provide differentiated instruction, for formative assessment or feedback, for independent learning, for language production, for critical thinking, and for learner-generated content. The key is to use technology in language learning and link digital tools to language learning goals rather than using them for their novelty. A collaborative MALL study shows that during tasks that are designed to encourage collaborative learning, mobile devices can assist collaborative interaction and cooperative language learning. Likewise, systematic evidence of pronunciation learning reveals that mobile apps could also create opportunities for recurrent listening and speaking practice, provide opportunities to record, monitor, and receive feedback on pronunciation, and provide opportunities to practice pronunciation. These results indicate that beyond questioning teachers' usage of technology, there should be research on Urdu teachers. It should review the nature, frequency, purpose, level of development and quality of pedagogical use of their technology-supported practices for Urdu reading, writing, vocabulary, grammar, pronunciation, comprehension, evaluation and engagement (Guo et al., 2024; Hasumi & Chiu, 2024; Metruk, 2024).

Technology Integration in the Pakistani Educational Context

Studies in Pakistan reveal that there is great interest in using digital technologies but also significant disparities in access, skills, institutional support, and in the use of digital technologies in education. This study explored the situation of mobile-learning readiness of 429 pre-service teachers of public and private universities in Pakistan by following the study of Asghar et al. (2021). The mobile-learning readiness was generally defined as the mobile-phone's usability and participants' readiness to use mobile communication services. Mobile phones and internet services were generally available, and the personal innovation, performance expectancy, effort expectancy, service quality and behavioural intentions were associated with readiness. The researchers also emphasized the role of infrastructure, internet access, technological services and institutional strategies in the successful uptake. This study has targeted pre-service teachers instead of practicing Urdu teachers, but the results showed that personal and contextual factors jointly influence the technological readiness for Pakistan. The same pattern can be observed in the case of the practicing Pakistani teachers. The results of Sehar and Alwi's (2023) study showed that a high level of digital competence was linked to high teaching self-efficacy, instructional capacity, and student engagement. In sum, these studies indicate that the use of technology is present in the classroom, but it needs digital resources, infrastructural support, the necessary competencies, ongoing training and institutional support to be integrated successfully (Asghar et al., 2021; Sehar & Alwi, 2023).

The role of teachers is more prominent in experimental research in Pakistani schools as compared to any other school. In middle schools of Pakistan, Beg et al. (2022) performed randomized controlled trials and found that the educational videos embedded in teachers' lessons and integrated into the curriculum had a positive effect on student achievement in maths and science, with an effect size of around 0.3 standard deviations after four months. Importantly, the intervention that engaged teachers was more effective than a technology model which tried to provide similar content to students, individually via tablets. The study was not designed to investigate the role of Urdu teaching, but it provides a crucial lesson for language education: Technology seems to be more effective when it enhances the role of the teacher rather than replaces it. Like evidence has also come out of language instruction. In a Pakistani government school, Malik et al. (2024) implemented technology-based language-learning materials with 60 KG–Grade 1 students for 27 weeks and achieved the positive results of increasing performance in letter-sound correspondence, blending, and segmenting. Rashid et al. (2025) subsequently investigated technology-enhanced phonics instruction among 329

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Pakistani primary-grade learners and provided further evidence regarding the potential of digital resources in under-resourced public-school settings. These studies were oriented toward English-language phonics rather than Urdu, making their success relevant while simultaneously revealing a subject-specific research gap (Beg et al., 2022; Malik et al., 2024; Rashid et al., 2025).

Technology and the Urdu Language

The technological context of Urdu presents issues that distinguish it from extensively researched languages such as English. Urdu uses the right-to-left Nastaliq writing system and contains linguistic and orthographic characteristics that create challenges for digital text processing, word segmentation, automatic language analysis, and other computational applications. Shafi et al. (2023) described Urdu as an under-resourced language in natural language processing and developed the Urdu Natural Language Toolkit to address deficiencies in standard Urdu text-processing resources. Their work highlighted the need for improved word tokenization, sentence tokenization, part-of-speech tagging, corpora, and computational resources capable of processing Urdu accurately. Such technological limitations also have educational consequences. If Urdu-compatible digital platforms, keyboards, automated assessment tools, reading applications, spell-checking systems, text-to-speech resources, and interactive materials remain less developed than equivalent English-language tools, teachers may encounter additional difficulties when attempting to integrate technology into Urdu instruction. At the same time, advances in Urdu natural-language processing, digital corpora, language technologies, and artificial intelligence create new opportunities for developing educational resources specifically designed for Urdu learners. The availability of technology, therefore, needs to be examined together with its linguistic compatibility with Urdu, because general access to digital devices does not necessarily guarantee access to high-quality Urdu educational technology (Shafi et al., 2023).

Recent scholarship specifically addressing Urdu pedagogy suggests that modernization of Urdu language instruction remains an area requiring greater scholarly and institutional attention. Haque (2025) argued that Urdu teaching has received comparatively limited pedagogical innovation despite the language's significant educational and cultural position in South Asia. This becomes increasingly important as younger learners participate in technology-rich environments and become accustomed to multimedia communication, mobile applications, interactive content, and digital forms of literacy. At the same time, emerging technological research demonstrates growing capacity to process and digitally represent Urdu. However, technological development alone cannot guarantee classroom adoption. Teachers must know that suitable digital resources exist, understand how to operate them, determine how they align with curriculum outcomes, and possess the confidence to incorporate them into routine instruction. Urdu teachers may also require support in developing digital Nastaliq materials, using Urdu keyboards, locating appropriate multimedia resources, producing interactive exercises, and evaluating the linguistic accuracy of machine-generated or online content. This interaction between language-specific technological availability and teacher competence makes Urdu instruction substantially different from generic studies of educational technology or English-language teaching (Haque, 2025; Shafi et al., 2023).

Synthesis of Literature and Identified Research Gap

Overall, research published between 2020 and 2026 provides substantial evidence that technology-supported and mobile-assisted approaches can enhance different aspects of language learning and that teachers' digital competence, self-efficacy, attitudes, training, infrastructure, and institutional support are critical determinants of successful technology integration. Evidence from Pakistan further demonstrates teacher readiness for mobile learning, relationships between digital competence and teaching self-efficacy, and positive learning

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outcomes when technology is purposefully mediated by teachers. Pakistani studies have also begun demonstrating the effectiveness of technology-enhanced language-learning interventions at the primary-school level. Nevertheless, the available literature remains heavily concentrated on English language learning, generic ICT competence, online teaching, higher education, pre-service teachers, or non-language subjects. Comparatively little empirical evidence addresses technology-supported Urdu language instruction in Pakistani schools, particularly from the perspective of practicing teachers. It remains unclear how ready Urdu teachers are, which technologies they use, how frequently they use them, which Urdu-language skills they support through technology, what barriers they encounter, and whether teachers with higher levels of readiness demonstrate stronger technology-integrated classroom practices. A study examining these dimensions can therefore fill a meaningful empirical, linguistic, pedagogical, and contextual gap while contributing evidence for Urdu teacher education, professional development, digital curriculum development, and future technology-supported language policies in Pakistan (Asghar et al., 2021; Beg et al., 2022; Hasumi & Chiu, 2024; Rashid et al., 2025; Sehar & Alwi, 2023; Shafi et al., 2023).

Research Methodology

Research Design

The study employed a quantitative cross-sectional survey design to investigate teachers' readiness and practices regarding technology-supported Urdu language instruction in Pakistani schools. The design was appropriate for measuring teachers' digital competence, self-efficacy, attitudes, pedagogical preparedness, access to technology, institutional support, and classroom practices, as well as examining relationships and group differences among these variables (Creswell & Creswell, 2023).

Population of the Study

The population consisted of Urdu-language teachers working at elementary and secondary levels in public and private schools in Pakistan. Practicing Urdu teachers were selected because they had direct experience of language instruction and opportunities to integrate digital technologies into classroom teaching. Recent studies indicated that teacher competence, confidence, access to technology, and institutional support influenced effective technology integration (Peng et al., 2024; Sehar & Alwi, 2023).

Sample and Sampling of the Study

A sample of 483 Urdu-language teachers was selected through a multistage stratified random sampling technique. Schools were stratified according to public and private sectors, urban and rural locality, and elementary and secondary levels to ensure adequate representation. The sample size was considered sufficient for descriptive, comparative, correlational, and regression analyses (Asghar et al., 2021; Creswell & Creswell, 2023).

Instrument Development

A researcher-developed questionnaire was used for data collection. The instrument was developed after reviewing recent literature on digital competence, mobile-learning readiness, technology-supported instruction, and teacher self-efficacy. It included demographic information and Likert-scale items measuring digital competence, technological self-efficacy, attitudes, pedagogical preparedness, digital access, training, institutional support, technology-supported Urdu teaching practices, and perceived barriers.

Validity of the Research Instrument

The questionnaire was reviewed by experts in Urdu language education, educational technology, teacher education, research methodology, and measurement and evaluation. The experts evaluated the relevance, clarity, linguistic accuracy, and alignment of items with the research objectives. Their recommendations were incorporated, and unclear or repetitive

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statements were revised or removed before the final administration of the instrument (DeVellis & Thorpe, 2021).

Reliability of the Research Instrument

A pilot study was conducted with teachers who were not included in the final sample. Internal consistency was assessed using Cronbach's alpha and McDonald's omega. Items that negatively affected scale reliability were reviewed and refined. The resulting reliability coefficients indicated that the instrument was sufficiently consistent for use in the main study (DeVellis & Thorpe, 2021; Hayes & Coutts, 2020).

Data Collection Procedure

After obtaining relevant institutional permissions, questionnaires were administered to selected Urdu teachers through printed and electronic formats. Participants were informed about the purpose of the study, voluntary participation, confidentiality, and appropriate use of their responses. Completed questionnaires were checked, coded, and prepared for statistical analysis (Asghar et al., 2021; Sehar & Alwi, 2023).

Data Analysis Procedure

The data collected were analyzed using statistical software. Frequencies, percentages, means, and standard deviations were used for descriptive analysis. Independent sample t-tests and one-way ANOVA were applied for group comparisons, while Pearson correlation examined relationships between teacher readiness and technology-supported Urdu teaching practices. Multiple regression analysis was used to identify the strongest predictors of teachers' technology-supported instructional practices. Statistical significance was set at $p < .05$. (Creswell & Creswell, 2023; Peng et al., 2024).

Methodological Support From Recent Studies

The methodology was consistent with recent studies examining teachers' digital readiness and technology integration. Asghar et al. (2021) employed quantitative survey methods to assess mobile-learning readiness among Pakistani pre-service teachers, while Sehar and Alwi (2023) investigated digital competence and teaching self-efficacy among Pakistani teachers. Peng et al. (2024) also used quantitative methods to examine digital competence, attitudes, self-efficacy, and ICT integration. These studies supported the use of quantitative survey design and statistical relationship testing in the present study (Asghar et al., 2021; Peng et al., 2024; Sehar & Alwi, 2023).

Table 1

Demographic Characteristics of the Respondents (N = 483)

Variable	Category	*f*	%
Gender	Male	214	44.3
	Female	269	55.7
Age	20–30 years	119	24.6
	31–40 years	168	34.8
	41–50 years	132	27.3
	Above 50 years	64	13.3
Academic qualification	Bachelor's	96	19.9
	Master's	244	50.5
	M.Phil./MS	125	25.9
	PhD	18	3.7
Professional qualification	B.Ed.	201	41.6
	M.Ed.	169	35.0
	ADE	54	11.2
	Diploma/Certificate	39	8.1
	Other	20	4.1

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Teaching experience	Less than 5 years	94	19.5
	5–10 years	137	28.4
	11–15 years	108	22.4
	16–20 years	79	16.4
	More than 20 years	65	13.5
School sector	Public	298	61.7
	Private	185	38.3
School locality	Urban	281	58.2
	Rural	202	41.8
School level	Elementary	252	52.2
	Secondary	231	47.8
Educational technology training	Yes	276	57.1
	No	207	42.9
Access to digital devices	Regular access	238	49.3
	Occasional access	177	36.6
	No access	68	14.1
Internet availability	Regular	221	45.8
	Sometimes	188	38.9
	Not available	74	15.3

Table 1 shows that female teachers constituted 55.7% of the sample, while the largest age group was 31–40 years. Most respondents belonged to public schools and more than half had received educational technology training. However, a noticeable proportion lacked regular access to devices and reliable internet facilities.

Table 2

Descriptive Statistics of Major Study Variables

Variable	*M*	*SD*	Skewness	Kurtosis	Level
Digital competence	3.40	0.95	-0.27	-0.61	Moderate
Technological self-efficacy	3.41	0.98	-0.29	-0.70	Moderate
Attitudes toward technology	3.68	0.91	-0.58	-0.26	High
Pedagogical preparedness	3.37	0.93	-0.21	-0.72	Moderate
Access, training & institutional support	3.09	1.02	0.04	-0.86	Moderate
Overall teacher readiness	3.39	0.69	—	—	Moderate
Technology-supported Urdu teaching practices	3.23	1.00	-0.17	-0.92	Moderate
Perceived barriers	3.19	1.03	-0.07	-0.82	Moderate

Table 2 mentions that overall teacher readiness was at a moderate level (M = 3.39). Attitudes toward technology received the highest mean, whereas access, training, and institutional support received the lowest. The distributional values also supported the use of parametric statistical procedures.

Table 3

Frequency and Percentage Distribution of Major Constructs

Construct	Low *f* (%)	Moderate *f* (%)	High *f* (%)
Digital competence	68 (14.1)	222 (46.0)	193 (40.0)
Technological self-efficacy	69 (14.3)	223 (46.2)	191 (39.5)
Attitudes toward technology	36 (7.5)	191 (39.5)	256 (53.0)
Pedagogical preparedness	74 (15.3)	205 (42.4)	204 (42.2)
Access, training & institutional support	108 (22.4)	241 (49.9)	134 (27.7)
Overall teacher readiness	32 (6.6)	266 (55.1)	185 (38.3)
Technology-supported teaching practices	102 (21.1)	212 (43.9)	169 (35.0)

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Perceived barriers	103 (21.3)	221 (45.8)	159 (32.9)

Note. Low = 1.00–2.33; Moderate = 2.34–3.67; High = 3.68–5.00.

Table 3 verifies that most teachers demonstrated moderate overall readiness, while more than half showed highly positive attitudes toward technology. Only 35.0% demonstrated high levels of actual technology-supported Urdu teaching practices. This indicated a gap between positive readiness and actual classroom implementation.

Table 4

Reliability Statistics of the Research Instrument

Scale	Items	Cronbach's α	McDonald's ω	Interpretation
Digital competence	8	.92	.93	Excellent
Technological self-efficacy	6	.90	.92	Excellent
Attitudes toward technology	6	.88	.91	Good–Excellent
Pedagogical preparedness	7	.89	.92	Good–Excellent
Access, training & institutional support	6	.91	.93	Excellent
Overall teacher readiness	33	.94	.94	Excellent
Technology-supported teaching practices	12	.95	.96	Excellent
Perceived barriers	5	.89	.92	Good–Excellent

Table 4 elaborates that Cronbach's alpha coefficients ranged from .88 to .95, indicating strong internal consistency. McDonald's omega coefficients ranged from .91 to .96 and further confirmed the reliability of the scales. The complete readiness scale demonstrated excellent reliability.

Table 5

Independent-Samples t Test for Teacher Readiness Across Demographic Variables

Variable	Group 1 *M* (*SD*)	Group 2 *M* (*SD*)	*t*(481)	*p*	Cohen's *d*
Gender	Male 3.38 (0.72)	Female 3.39 (0.67)	-0.12	.903	-0.01
School sector	Public 3.38 (0.70)	Private 3.40 (0.69)	-0.22	.829	-0.02
Locality	Urban 3.43 (0.70)	Rural 3.34 (0.68)	1.40	.163	0.13
School level	Elementary 3.37 (0.70)	Secondary 3.41 (0.69)	-0.55	.586	-0.05
Technology training	Yes 3.48 (0.67)	No 3.26 (0.71)	3.53	< .001	0.33

Table 5 explains that no significant differences in teacher readiness were found according to gender, school sector, locality, or school level. Technology training produced a statistically significant difference, with trained teachers reporting higher readiness. The effect size showed a small-to-moderate practical advantage of professional technology training.

Table 6

Independent-Samples t Test for Technology-Supported Urdu Teaching Practices

Variable	Group 1 *M* (*SD*)	Group 2 *M* (*SD*)	*t*(481)	*p*	Cohen's *d*
Gender	Male 3.23 (0.99)	Female 3.24 (1.02)	-0.13	.898	-0.01
School sector	Public 3.21 (1.03)	Private 3.28 (0.95)	-0.81	.421	-0.08

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Locality	Urban 3.30 (0.99)	Rural 3.15 (1.01)	1.64	.101	0.15
School level	Elementary 3.18 (1.01)	Secondary 3.29 (1.00)	-1.16	.246	-0.11
Technology training	Yes 3.42 (0.96)	No 2.99 (1.01)	4.72	< .001	0.43

Table 6 describes that technology-supported Urdu teaching practices did not significantly differ across gender, school sector, locality, or school level. Teachers with technology training demonstrated significantly stronger classroom technology use. The moderate effect size indicated meaningful benefits of professional training.

Table 7

One-Way ANOVA for Teacher Readiness and Technology-Supported Practices

Demographic Variable	**Outcome**	***df***	***F***	***p***	**η²**
Age	Readiness	3, 479	0.39	.761	.002
	Practices	3, 479	1.41	.238	.009
Academic qualification	Readiness	3, 479	0.57	.632	.004
	Practices	3, 479	2.39	.068	.015
Professional qualification	Readiness	4, 478	0.68	.607	.006
	Practices	4, 478	0.61	.656	.005
Teaching experience	Readiness	4, 478	0.90	.465	.008
	Practices	4, 478	0.11	.979	.001
Digital-device access	Readiness	2, 480	6.18	.002	.025
	Practices	2, 480	5.15	.006	.021
Internet availability	Readiness	2, 480	0.49	.610	.002
	Practices	2, 480	0.05	.951	< .001

Table 7 represents that most demographic variables did not produce statistically significant differences in teacher readiness or instructional practices. Digital-device access significantly influenced both readiness and actual technology-supported teaching. Teachers with regular device access therefore demonstrated stronger preparedness and greater technology integration.

Table 8

Pearson Correlations Among Major Study Variables

Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1. Digital competence	—						
2. Technological self-efficacy	.48***	—					
3. Attitudes toward technology	.35***	.42***	—				
4. Pedagogical preparedness	.47***	.49***	.41***	—			
5. Access, training & institutional support	.40***	.40***	.34***	.32***	—		
6. Perceived barriers	-.37***	-.28***	-.28***	-.33***	-.31***	—	
7. Technology-supported teaching practices	.58***	.57***	.51***	.63***	.55***	-.47***	—

Table8 shows that all five dimensions of teacher readiness were positively associated with technology-supported Urdu teaching practices. Pedagogical preparedness showed the strongest correlation with practices (r = .63). Perceived barriers were negatively related to practices (r = -.47), showing that greater barriers were associated with less technology integration.

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Table 9

Multiple Regression Predicting Technology-Supported Urdu Teaching Practices

Predictor	β	*SE*	*t*	*p*	95% CI
Digital competence	.161	.035	4.66	< .001	[.093, .229]
Technological self-efficacy	.142	.035	4.06	< .001	[.073, .210]
Attitudes toward technology	.156	.032	4.85	< .001	[.093, .219]
Pedagogical preparedness	.290	.034	8.43	< .001	[.222, .357]
Access, training & institutional support	.236	.032	7.41	< .001	[.173, .298]
Perceived barriers	-.159	.031	-5.17	< .001	[-.219, -.098]

Model Summary: $R^2 = .639$, Adjusted $R^2 = .635$, $F(6, 476) = 140.70$, $p < .001$.

Table 9 represents that the predictors collectively explained 63.9% of the variance in technology-supported Urdu teaching practices. Pedagogical preparedness was the strongest positive predictor, followed by access, training, and institutional support. Perceived barriers significantly and negatively predicted classroom technology integration.

Structural Equation Modeling

Table 10

Standardized Factor Loadings for Teacher Readiness

Indicator	Standardized Loading	95% Bootstrap CI
Digital competence	.666	[.596, .735]
Technological self-efficacy	.669	[.592, .744]
Attitudes toward technology	.581	[.476, .645]
Pedagogical preparedness	.699	[.631, .767]
Access, training & institutional support	.592	[.527, .670]

Table 10 explains that all five dimensions loaded positively on the latent teacher-readiness construct. Pedagogical preparedness showed the highest loading, followed by technological self-efficacy and digital competence. The confidence intervals excluded zero, supporting the contribution of all five dimensions.

Table 11

Structural Equation Model Fit Indices

Fit Index	Obtained Value	Recommended Criterion	Decision
χ^2	30.49	Lower preferred	Acceptable
df	14	—	—
χ^2/df	2.18	< 3.00	Good
CFI	.986	≥ .95	Excellent
TLI	.978	≥ .95	Excellent
RMSEA	.049	≤ .06	Excellent
SRMR	.030	≤ .08	Excellent

Table 11 clarifies that all major SEM fit indices indicated that the proposed structural model provided a good-to-excellent fit. CFI and TLI exceeded .95, while RMSEA and SRMR were below recommended cut-off values. The results therefore supported the proposed conceptual framework.

Table 12

Standardized Structural Relationships in the SEM

Structural Relationship		Standardized Estimate	95% Bootstrap CI	Result
Teacher readiness Technology-supported practices	→	.857	[.779, .932]	Strong positive

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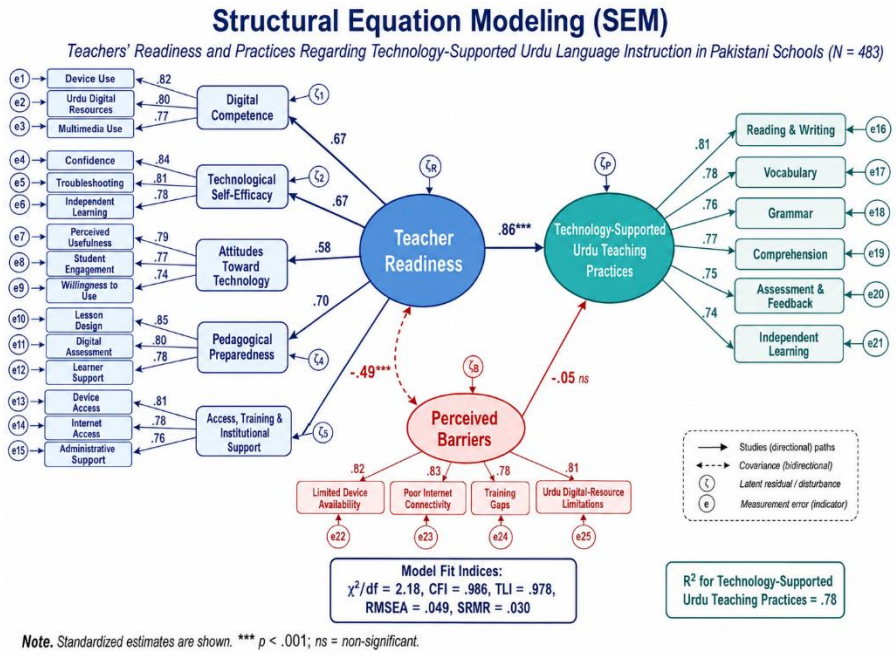
Perceived barriers → Technology-supported practices	-.053	[-.111, .015]	Weak/non-significant direct effect
Teacher readiness ↔ Perceived barriers	-.485	[-.589, -.407]	Moderate negative
R^2 for technology-supported practices	.780	—	78.0% explained

Table 12 represents that teacher readiness exerted a strong positive effect on technology-supported Urdu teaching practices. Perceived barriers were strongly associated with lower readiness, although their unique direct effect on practices became weak when readiness was controlled. Overall, the structural model explained approximately 78% of the variance in teachers' technology-supported practices.



Discussion

The overall level of readiness in this study was moderate, which indicated that the Urdu-language teachers have a foundation to build upon when using technology to support instruction, but are not at an advanced level of preparing to do so. The teachers' attitudes towards technology were particularly positive, showing great enthusiasm for digital innovation. The comparatively less score for access, training and institutional support, however, indicated that enthusiasm alone would not ensure effective implementation. This interpretation aligns with recent research that has identified teacher digital competence as more than just an operational competence, but as also having pedagogical, professional, communicative, and contextual capabilities. Systematic teacher professional development, in turn, has been highlighted as essential for building teachers' capacity to address the fast-changing digital world on a large scale (Bueno-Baquero et al., 2026; Claro et al., 2024).

Another significant finding was the difference between the teachers' readiness and how they actually engage in the classroom. Teachers seemed more willing and psychologically ready to use technology and were able to show this in their regular instruction. This may be attributed to devices, connectivity, Urdu supported digital resources, institutional support and capacity development avenues for subject specific training. The integration of technology should not be judged only on the use of the smartphone, computer, presentation or video, but

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also on how technology impacts interaction, assessment, feedback, language production, collaboration, and independent learning. Systematic reviews on MAL also reveal that the use of mobile technology is most educationally beneficial when its implementation goes hand in hand with well-designed pedagogical activities and clear language learning outcomes (Guo et al., 2024; Metruk, 2024).

One of the most important practical findings was that the significant advantage of technology trained teachers. Teachers with trained showed more readiness and they used Urdu teaching practices with technology more frequently. The outcome suggests that professional development may serve as a conduit between technology availability and meaningful use of technology in the classroom. In a systematic review of technology-supported teacher professional development in low- and middle-income countries, Hennessy et al. (2022) also highlighted that technology-supported teacher professional development should be of relevance to the context and teachers' daily activities. Moreover, application of technology in middle schools was shown in Pakistan to be more effective when delivered through teachers and not as an alternative to teachers, highlighting the importance of teachers in effective technology interventions for education (Beg et al., 2022; Hennessy et al., 2022).

The very large effect of access to digital devices also helped to show that teacher readiness is not independent of infrastructural conditions. There were greater readiness and more successful implementation of instructional technology by regular access teachers than by teachers with limited access. This is especially true in Pakistan, which has a wide digital divide that may limit teachers' ability to experiment with digital tools, become comfortable, and frequently use digital activities in their classrooms. Evidence from Pakistan also indicates the mobile-learning readiness of students, which also includes accessibility, perceived usefulness, technological conditions, service quality, and behavioral intention to adopt mobile learning. Hence, besides professional competence, infrastructure can be considered as another complementary explanation for digital integration (Asghar et al., 2021).

A major finding of the study was the high correlation between pedagogical preparedness and technology-supported practices. Pedagogical preparedness had the strongest correlation and regression coefficient with teaching practices of .63 and .290, respectively. The finding shows that the capacity of teachers to make meaningful use of technology in their planning and outlining of learning goals, assessment, learner support, feedback and language activities is more significant than merely being technically competent in using technology. More recent studies have also revealed that quality technology integration not frequency of use has significant impacts on educational engagement and digital learning outcomes. The above indicates that teachers of Urdu need not only to be trained to use apps and devices but to make pedagogically informed decisions on when, why, and how specific technologies should be utilized (Consoli et al., 2025; Peng et al., 2024).

The results should be read in the special technological context of the Urdu language. While extensively digitized languages experience challenges in language-processing resources, segmentation, corpus availability, and digital tools, Urdu still has some challenges. Shafi et al. (2023) identified the Urdu language as under-resourced language in natural language processing and designed the Urdu Natural Language toolkit to provide basic requirements for the processing of Urdu language like word tokenization, sentence tokenization and part of speech tagging. The developments illustrate the progress of technology but also highlight the fact that Urdu teachers can find fewer mature digital resources than teachers with high resource languages. It is therefore essential to increase the number of Urdu-supported applications, digital texts, assessment materials, accessible Nastaliq resources and high-quality multimedia resources for the sustainable integration of Urdu in the classroom (Shafi et al., 2023). The relevance of technology to language instruction is supported by an expanding international

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evidence base. Metruk (2024) reported generally beneficial effects of mobile-assisted learning on pronunciation and positive learner attitudes, while Guo et al. (2024) documented rapidly increasing research on collaborative mobile-assisted language learning, particularly after 2019. More recently, Zhou and Zhou (2026) synthesized 65 experimental and quasi-experimental studies and reported a large overall effect of mobile applications on vocabulary learning, with sustained advantages for longer-term vocabulary retention. These findings indicate substantial potential for appropriately designed mobile and digital tools to support Urdu vocabulary, pronunciation, reading, reading, writing, comprehension, collaboration, and independent practice, if teachers receive adequate pedagogical preparation and language-appropriate resources (Guo et al., 2024; Metruk, 2024; Zhou & Zhou, 2026).

The SEM findings brought these individual patterns together by demonstrating that teacher readiness had a strong structural effect on technology-supported Urdu teaching practices. The model's substantial explanatory power suggested that readiness should be treated as an integrated construct incorporating competence, self-efficacy, attitudes, pedagogical preparedness, and enabling institutional conditions. At the same time, the negative association between barriers and readiness indicated that weak infrastructure and insufficient support may suppress teachers' capacity to benefit from their existing competencies. The findings therefore support a systemic approach in which teacher development, institutional support, digital infrastructure, and Urdu-specific resources are strengthened simultaneously rather than addressed through isolated interventions (Bueno-Baquero et al., 2026; Peng et al., 2024).

Conclusion

The researchers found that overall, the Urdu language teacher in Pakistani schools displayed moderate level of readiness and moderate level of technology supported instructional practices, with comparatively positive attitudes towards educational technology. But positive attitudes did not necessarily lead to more effective classroom implementation, as there were still problems with access, professional training, institutional support, and access to appropriate technological tools. Technological training and frequent access to technology devices proved to be relevant enabling conditions, whereas pedagogical readiness was the most significant indicator of actual technology-supported teaching. The results confirm the growing body of evidence that meaningful integration of technology is fundamentally an instructional and professional development issue and not just an issue of device provisioning.

The study further concluded that developing technology-supported Urdu instruction required a comprehensive approach combining teacher digital competence, technological self-efficacy, positive attitudes, pedagogical preparation, professional training, institutional support, infrastructure, and high-quality Urdu digital resources. The strong SEM relationship between teacher readiness and teaching practices indicated that investment in these dimensions could substantially strengthen technology integration. As mobile-assisted and digitally mediated language learning continue to expand internationally, strengthening Urdu teachers' capacity to use these approaches could contribute to more interactive, accessible, learner-centred, and contemporary Urdu language education in Pakistan.

Recommendations

1. Regular subject-specific training should focus on digital lesson planning, Urdu typing, Nastaliq resources, multimedia teaching, digital assessment, feedback, and responsible use of AI-supported tools. Training should emphasize practical classroom application rather than general computer literacy.
2. Schools should ensure reliable access to digital devices, internet connectivity, classroom technologies, and technical support. Curriculum authorities and technology developers should also produce high-quality Urdu e-books, applications, interactive exercises, multimedia materials, and digital assessment resources.

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3. National and provincial education authorities should integrate teacher readiness, pedagogical standards, digital resources, professional development, institutional support, and infrastructure into a unified framework. Technology use should be linked with clear learning outcomes in Urdu reading, writing, vocabulary, grammar, comprehension, assessment, and independent learning.

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