



Digital Technology Competencies and Teaching-Learning Engagement among University Faculty: A Thematic Analysis of Academics' Perspectives

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ABSTRACT

The present study aimed to investigate digital technology competencies of university faculty and factors affecting teaching-learning process in the context of digital technology integration in higher education Institutions of the Punjab, Pakistan. A qualitative approach was adopted, semi-structured interviews conducted to gain detailed insights into faculty member's experiences, practices and views regarding the use of digital technologies in teaching. Participants were selected through purposive sampling based on their relevant knowledge and experience. A total of 18 faculty members from three public sector universities participated in the study. The collected data were analyzed thematically to identify major themes concerning digital technology competencies and the use of technology in teaching and learning practices. The results indicated that most of the faculty members had different levels of digital technology competencies in digital communication, digital content creation, online teaching, information management and technology supported assessment practices. Several challenges were also identified in the integration of digital technologies, such as lack of professional training opportunities, lack of institutional support, lack of access to digital resources, constraints of technological infrastructure, internet connectivity issues, and lack of technical assistance. Universities need to strengthen digital technology infrastructure, expand professional learning opportunities, and ensure the availability of essential digital tools and services.

Introduction

Digital technologies have revolutionized higher education, creating a new, complex and complicated connection between pedagogy and technology. Digital competencies of teachers have to be constantly updated because of the rapid growth of information and communication technologies (ICT). Although research in this field is growing, there is still a huge gap in knowledge regarding the accurate assessment of these competencies in Higher education contexts and their application, as described in the literature (Moreira-Choez, 2024). In the rapidly evolving landscape of higher education's digital transformation the role of the University teachers has evolved from that of a traditional lecturer into that of a facilitator who influences various digital technologies to enhance the overall learning experience. Hence, now more than ever, it is important for educational institutions around the globe to know how teachers think, feel and act in relation to the use of these digital technologies in their pedagogy.

Digital competencies of university faculty include a range of knowledge, skills and attitudes that are necessary for effective learning and teaching in today's digital environment. The skills are not limited to just using technology but encompass finding, assessing, managing, sharing, communicating and collaborating via digital platforms, developing digital content and solving problems using technological tools (Varenyk, 2024; Alonso-García et al., 2023). In higher education, the role of faculty is to influence digital technologies to improve student engagement, learning outcomes, and learning interactions. Faculty digital competence has gained more significance in the context of the digital transformation of educational environments in order to assure teaching efficiency and educational quality. Studies show that teachers who have a good understanding of digital skills can better meet evolving teaching realities, create innovative learning opportunities and help students acquire digital skills for academic and professional success.

Digital competence is not limited to the ability to use digital tools and resources; it also implies selecting, evaluating, adapting and pedagogically using digital resources in relation to the educational purpose and the learners' needs. Given the above, recent studies show that the professional, technological, institutional, and personal dimensions play a role in the university teachers' digital competencies, thereby suggesting that competence development is not a one-dimensional process that can be acquired by learning to use digital devices or software (Saltos-Rivas et al., 2023). The current shift to blended and online learning, as well as learning through technology, has heightened the need for faculty to build skills and knowledge that will support their ability to create interactive learning experiences, engage effectively via digital platforms, deliver timely feedback, and engage in technology-supported assessment practices. Within this context, digital competence is closely related to quality of teaching and learning experiences provided for students.

Based on evidence from higher education, it can be determined that the different aspects of digital competence as lecturers' professional engagement, digital resources, digital teaching and learning, assessment, empowering learners, and developing students' digital competence are positively correlated with the perceived learning value of lecturers in higher education. This association underscores not only the need for digital tools for education but also the need for their confident and appropriate use by teachers in the educational process. The COVID-19 crisis has also highlighted disparities amongst teachers in terms of confidence, preparedness and adaptability to teaching online and blended, making ongoing professional development a key aspect of a university's sustainable digital transformation.

Although digital technology has become an increasing part of the higher education landscape, little research has examined how university faculty builds and applies digital technology competencies in their teaching. While existing research has underscored the relevance of digital skills to promote effective pedagogy and student learning, there has been a lack of intensive studies examining teacher experiences and perceptions in this regard (Basilotta-Gómez-Pablos et al., 2022; Tiwari & Magre, 2025). Filling this gap is vital to gaining a deeper understanding of barriers and opportunities to digital technology adoption in higher education. Thematic analysis is used in the present study to give an in-depth analysis of the perception of university faculty about digital technology competencies and their impact on teaching-learning engagement, which will help to contribute to the body of knowledge related to digital transformation in higher education.

Literature Review

In the last decade, the concept of digital technology competency in Higher Education has evolved from a basic computer literacy to a broad range of skills, knowledge and attitudes. Digital competence, defined as a set of digital skills, pedagogical and instructional awareness and a understanding of the influence of different learning strategies on student learning outcomes, is regarded as an integral part of academic work that enables academics to handle various technological, curricular and pedagogical facets of their work (Bond et al. 2020; Holmes et al. 2021). This construct is very broad as evidenced by the wide range of frameworks that have been developed to define and operationalize the concept. University faculty members are not only expected to have content expertise, but should also exhibit digital technology skills that will make it possible for them to effectively use technological resources in their instruction. Digital competencies are the use of digital tools, the management of online learning environments, the production of digital learning resources, facilitating learners' participation in learning through technology and adapting teaching to new technological developments. Recent research highlighted the importance of digital competencies as a key element of teachers' professional development, directly impacting the effectiveness of their teaching and the learning experience of their students. It has encouraged higher education institutions to increasingly attempt to strengthen the technological skills of their faculty staffs, so as to meet the changing needs of digital education.

Two well-known frameworks for comprehending faculty members' adoption and integration of digital technologies in higher education the Unified Theory of Acceptance and Use of Technology (UTAUT) and the Technological Pedagogical Content

Knowledge (TPACK) framework form the theoretical basis of this study. According to Mishra and Koehler (2006), TPACK paradigm is the framework that requires the interaction of three sets of knowledge: technological, pedagogical, and content. To support this perspective and the other is UTAUT model that explains technological adoption based on the important components such as performance expectancy, effort expectancy, social impact, and facilitating conditions. These frameworks provide a comprehensive framework for understanding the proficiencies in digital technology and AI skills among university faculty in educational contexts (Mishra & Koehler, 2006; Venkatesh et al., 2003). The framework proposes that pedagogically effective use of technology in the classroom requires teachers to develop complex, integrated professional knowledge, which draws on pedagogical, technological, and content expertise and applies these in flexible ways when teaching in specific contexts.

The UTAUT paradigm can be used to complement TPACK and to incorporate institutional and motivational influences on faculty adoption and sustainability of digital technologies in the classroom. Venkatesh et al., (2003) developed the UTAUT model, which is one of the most widely accepted technology acceptance models to understand technology adoption in higher education settings, by combining eight of the previous models (Xue et al., 2024). Four fundamental concepts performance expectancy, effort expectancy, social influence, and facilitating conditions are used by the UTAUT paradigm to explain technology adoption. Although performance expectancy, effort expectancy, and social influence have been found to be variables that are important for faculty members' intention to adopt and integrate digital technologies in higher education, facilitating conditions have been repeatedly found to be critical in influencing faculty members' actual use of digital technology (Venkatesh et al., 2003; Dwivedi et al., 2019). This indicates that faculty has to be adequately supported to be able to implement meaningful technology integration (Noureddine et al., 2025).

The relationship between faculty member digital competence and students learning engagement has received growing attention in higher education research. Recent research has emphasized that the use of digital learning platforms can have a positive influence on student engagement, interaction, and educational experiences (Uzorka & Odebiyi, 2025). Digital technologies including video conferencing, instant messaging and discussion boards can open up opportunities for ongoing communication and collaborative learning between teachers and students (Suen & Hung, 2025, Zamiri & Esmaeili, 2024). The value of these technologies in the educational arena has not only to do with being available, however, it additionally depends on how well faculty members are able to integrate them into their lessons. Digital competent academics can utilize technology to create flexible learning activities, give feedback in real-time, enable individual learning needs, and foster a more active participation of students. Digital platforms can also support individual learning, as teachers can track students' learning process and address their learning needs more flexibly (Draissi et al., 2025). In this regard, faculty's digital competence may be considered as one of the key factors in technology-supported teaching and learning experience and using in the classroom. Therefore, understanding the view of academics about these practices can give insights into meaningful academic teaching-learning engagement in higher education related to digital competency.

The effect of digital technologies in higher education has been quite different across faculty members, in both perceptions and applications of technology within their practice. Recent research indicates that faculty digital literacy is reflected in their attitudes toward digital tools, how they are used as pedagogical resources, and how they feel about technology for online instruction (2025). Digital competence is not just about knowing how to use digital tools; it also entails knowing how to make use of and critically assess digital tools, develop digital content, follow ethical standards in the digital world and engage in lifelong learning. These dimensions affect how academics use technology in instructional activities and their reactions to the expectations that are shifting in digitally changing learning environments. Qualitative research has also revealed how day-to-day use of technology and context, as well as the requirements of online and blended education, affect faculty's experiences with digital teaching (Baskici et al., 2024).

Professional development has increasingly been recognized as an important means of developing and sustaining faculty digital competencies. Training via online professional learning, collaborative learning, mentoring, and real-life practice can be used to enhance teachers' digital competencies and to promote a culture of ongoing learning. There is evidence that contextually relevant programs with long-term repeated implementation can improve rates of implementation and engagement (Moran et al., 2023; Seaton et al., 2024; Dilling et al., 2024). Secondly, institutional leadership is a key factor. Leading practices, such as innovation through achievement-oriented practices, collaboration through a collaborative environment, and shared decision making with technology leaders and educators, have shown to significantly increase faculty motivation, competency, and successful technology integration in education (Mertens et al, 2024; Schmitz et al, 2023). Even with these understandings, it is found that there are aspects of professional development that primarily focus on technical skills and have limited attention to the impact of training on faculty attitudes, long-term motivation and the continued use of digital resources in their pedagogy.

Qualitative research has explored the complex, experiential dimensions that quantitative measures are often unable to capture, and has led to substantial progress in the field's understanding of faculty use of digital technology. The four domains identified in the phenomenological study by using thematic analysis from the in-depth interviews with university teachers were educational, personal, cultural-social and institutional domains that affect digital learning. The study revealed that while the digital learning approach enhances pedagogical innovations and accessibility, it also brings forth substantial challenges in technological adaptation and cultural integration. Thematic analysis of interviews with academic participants also demonstrated that, although sometimes lacking in methodological integration to support effective formal teaching and learning, digital platforms are used in much more complex ways than just communication and serve as means to strengthen professional identity, knowledge sharing, and social practices. These qualitative research validate the use of the thematic analysis approach in this study to explore academics' lived experiences of digital technology competencies and teaching-learning engagement, as they show that institutional culture, disciplinary norms and academics' personal professional identities have a powerful impact on their perceptions of digital technology.

Theoretical Framework of the Study

A recent study revealed that the essential digital skills that university faculty must possess to use AI in higher education extend beyond technical skills to encompass aspects of pedagogy, cognition, and ethics. Current theoretical perspectives support a complete understanding of these competencies, aimed at supporting effective technology-enhanced instruction. The TPACK framework outlines the interaction between content knowledge, pedagogy, and technology, enabling teachers to seamlessly integrate AI and digital tools into their classrooms. Furthermore, the Unified Theory of Acceptance and Use of Technology (UTAUT) explains that the purposes of educators and their actual use of digital and AI-enabled tools in education are shaped by various factors such as perceived ease of use, social influence, expected performance benefits, and facilitating conditions. This method allows for a more comprehensive assessment of faculty capability and willingness to use digital technologies, and takes into consideration the contextual and behavioral factors that will affect their use of the technologies.

Research Methodology

The present study is using qualitative research design and explore the digital technology competencies of faculty and how it affects the teaching-learning processes in higher education. A pilot study was conducted before the data collection process to refine the interview guide and research protocol. Faculty members with experience in digital technologies and AI-supported teaching practices were identified. Participants were grouped into different categories based on their teaching experience. Faculty members were selected from these categories to ensure representation of varying levels of teaching experience. Interviews continued until data saturation was achieved after 18 participants, at which point data collection was concluded. The final sample consisted of faculty members with sufficient digital technology competencies and AI knowledge relevant to the study. The study used in-depth qualitative analysis to produce participants' perceptions, practices, challenges and opportunities regarding technology integration in teaching. This method yielded rich and detailed answers about the nature of digital technologies and their impact on faculty practices and student engagement in higher education.

Research instrument

After a comprehensive literature review on the competencies required of digital technology and technology integration, as well as student engagement in learning, a semi-structured interview guide was developed as the primary instrument for data collection. It included open-ended questions to analyze rich answers about the experiences, perceptions, and practices of faculty in regards to the use of digital technologies. The semi-structured design enabled participants to give in-detail explanation and in depth to express their views. The instrument was subjected to face and content validity procedures by the experts in Education, Educational Technology and Research Methods for clarity, relevance and consistency with the study objectives to ensure the quality and credibility of the instrument. Their feedback was taken into consideration to make improvements to the questions, making the instrument more comprehensive and effective prior to data collection.

Results and Discussion

The information obtained from the participants was audio-recorded with their permission and later transcribed word for word for analysis. For confidentiality and privacy purposes, all participants were given a unique identification code rather than their names (e.g., R1, R2, and R3). The data were carefully transcribed and examined by means of thematic analysis after transcribing. The relevant themes and sub-themes in the transcripts were identified by repetitive reading and coding with respect to research

goals. The identified themes were based on the views of the participants on digital technology skills and their implications for the present-day learning and teaching process. Findings are presented in detail following the themes and sub-themes that have emerged from the analysis.

Digital Technology Competencies

This theme describes how faculty members in universities interpret the digital technology competencies and how they use the competencies in teaching and academic practices. The results indicate that digital competencies are viewed as a necessity of handling contemporary academic tasks, especially in teaching, research, communication, and assessment. Members of the faculty pointed out a change in the conventional teaching to the application of technology. The digital technology competencies are the most widely understood as the skills that university faculty should have to be capable of effectively utilizing the digital tools in teaching, research and academic management. The views of respondents 01, 02, 03, and 04 were similar and centered on the use of Learning Management Systems (LMS), online teaching systems, online assessments, and communication tools (Zoom and Microsoft Teams). Their answers reveal that teaching is no longer in the traditional form, but in digital form, particularly following COVID-19, and thus is requiring these competencies to handle academic tasks. Similarly, Respondents 03 and 04 further elaborated how these tools are practically applied in lesson planning, student interaction, and assessment, whereas Respondents 09 and 11 also shared this view by concentrating on application of digital tools in research processes like academic databases and statistical software. All these respondents share the common position regarding the significance and practical application of the digital technologies in teaching, research, and communication.

The differences in responses accentuate the fact that, despite the prevailing awareness of digital technology competencies as a significant factor, their application is not consistent across the faculty members. A single respondent (R07) highlighted the lack of knowledge and exposure, which means that the knowledge of digital tools do not always translate into the effective use of them. This implies that there are still faculty members in an introductory or basic level of competency where they have been made aware of the significance of digital tools, but they cannot fully incorporate them in their teaching because of either lack of training or experience.

Factors Influencing Digital Technology Competencies

The competencies of digital technology in higher education have various factors that affect the effectiveness of the adoption and integration of digital tools by the faculty members in teaching and learning activities. The answers indicate that individual traits and institutional factors contribute to the development of these competencies greatly. The members of the faculty noted that their use of digital technologies not only centers on their personal preparedness but on their institutional support and setting as well.

Internal Factors Influencing Digital Technology Competencies

This theme encompasses personal, psychological, and experience aspects that impact digital competencies of faculty members. These are the attitudes toward technology, the beliefs regarding the educational value of technology, confidence or self-efficacy to use digital tools, personal motivation to change the teaching practices, and the prior experience with digital tools. In cases where these internal factors work in favor like a strong belief that technology improves learning, high digital confidence, intrinsic motivation and related past experience faculty members have higher chances of adopting, exploring, and successfully integrating digital tools in their academic activities. On the other hand, internal barriers may be in the form of limited confidence, negative attitudes, or absence of previous exposure.

R 10 and R11 indicated that confidence and self-efficacy is enhanced through constant use and experience with digital tool, "I was not very sure of using digital technologies in particular at first, but through experience and practice, I have gained some confidence in my ability to use them more effectively in teaching and research". According to respondent 03, 07, 08, 15, and 18, motivation, personal interest, and previous experience are important factors that influence the development of digital competencies. According to them, readiness to learn new tools and technological openness contribute to enhanced teaching practices. Nevertheless, Respondent 07 and 17 indicated that insufficient knowledge and exposure to refined tools, especially AI technologies, create a lack of confidence and limit the effectiveness of application. Respondent 08 indicated that they have a positive attitude and interest in digital tools, but in most cases they still choose conventional teaching methods. In a similar note, Respondent 09 and 12 indicated that overuse of digital technologies is harmful to the learning habits of students because students are more focused on AI tools rather than their own ability to gain an in-depth understanding.

External Factors Influencing Digital Technology Competencies

External factors are critical in determining the digital technology capabilities of faculty members in higher education. These are mostly institutional and environmental such as organizational support, access to training programs, access to digital resources, infrastructure and policy frameworks. Although the number of faculty members who are ready to use digital technologies is quite high, the successful use of digital technologies is determined by the support and opportunities offered by their institutions. Responses shows that faculty members feel more comfortable using digital tools in their teaching and research in the case of appropriate infrastructure, ongoing training, and enabling policies in universities. Nonetheless, the constraints of these external conditions are usually a hindrance and limit the successful application of digital and AI-based technologies.

R1, R11, R15 indicated that the institutional support, training opportunities, and leadership encouragement has a substantial impact on developing digital competencies, “Institutional policies, leadership encouragement, and training opportunities are important external factors, which allow universities to organize workshops and training sessions and enable faculty to acquire technological competencies.”

Certain respondents presented opinions that did not follow to the majority, specifically; they raised barriers and limitations rather than support. These respondents (03, 07, 08, 09, and 17) highlighted that unlike them, who were interested in the institutional facilitation, they felt constrained in the provision of infrastructure, lack of training and policy constraints, which impede their successful usage of digital and AI technologies.

Integration of Digital Skills in Research and Knowledge Creation

The digital technology competencies also play a pivotal role in determining the capacity of university faculty members to carry out research activities and make contributions towards the production of knowledge other than that of classroom teaching. Respondent 01, 02, 04, 05, 06, 10, 13, 14, and 16 report that digital competencies improve the productivity of research by providing access to online databases, data analysis tools, collaboration tools. These interviewees focused the role of digital tools in enhancing literature review, data management, and academic writing and worldwide scholarly interaction. Respondent 07, 09, 17, and 18 are somewhat different or in contrast to this though, as they emphasize restrictions, including the absence of experience, unwillingness to use more advanced tools, or the fact that they tend to teach more than to use research. These differences demonstrate that although the majority of the faculty acknowledges the relevance of digital competencies in research, some of them continue to struggle with their full utilization.

One of the respondents indicated that, “A small number of faculty members are active users of digital tools, and some are unwilling to use them. Faculty of younger age is more motivated to using modern tools, but not all of them use them equally”. Two respondents cited that they lack the knowledge and abilities to exploit digital tools to their full potential to improve the productivity of research. Moreover, another respondent was more centered on the application of digital technologies in teaching and student interaction as opposed to research activities, which is another way of applying digital competencies. In general, these results imply that even though the role of digital competencies in research has been acknowledged, they differ in their practical implementation because of the differences in skills, confidence, and priorities.

The results show that the digital technology competencies are crucial in increasing research productivity and knowledge production among university faculty. The majority of respondents emphasized that academic work is made more efficient and globalized as digital tools help to access literature, analyze data and collaborate and disseminate research. Nonetheless, there are disparities in the degree of utilization since not all faculty members can work with high-level skills because some have low training, expertise, and access to advanced tools. These differences imply that digital competencies are commonly considered a key component of research but their successful implementation requires individual abilities, institutional resources, and access to resources.

Barriers to Digital Technology Integration

The results show that the members of the university faculty experience various issues with implementing digital tools in their instruction and their knowledge of these technologies are assessed at different levels, ranging between the basic and moderate levels. Many of the respondents, including 01, 02, 05, 06, 10, 13, 14, 16, and 17, identified typical issues in the form of insufficiency of training, the rapid technological change, ethical issues, and insufficient institutional support. These interviewees expressed comparable opinions that despite having basic or moderate knowledge of the digital tools and AI applications, they find it challenging to be current with the latest trends because of time limitations and rapid changes in technology. Conversely,

respondents 03, 04, 08 and 18 highlighted the infrastructural challenges like inadequate internet access, limited access to platforms, equipment shortage and financial constraints that are a major impediment to successful integration. Also, respondent 07 and 09 mentioned internal and external difficulties in the form of limited knowledge, subject-specific issues, and lack of confidence. Respondent 15, on the other hand, offered an opposite point of view by saying that there were no major difficulties because he was very familiar with digital tools. Generally speaking, the results indicate that although faculty members acknowledge the significance of AI, numerous institutional, technical, pedagogical, and ethical obstacles affect the successful use and lifelong learning.

R13 and R17 indicated that they are moderately familiar with AI and need to improve the situation. "I have basic to moderate knowledge of digital tools and attempt to learn them on my own, yet still have to make better use of the advanced capabilities, which is why I need continuous learning to improve my knowledge". Conversely R09 indicated that there are contextual constraints to the use of AI irrespective of awareness:

"I have heard about digital tools, but I do not have an opportunity to apply them in practice because of the subject-related requirements and institutional limitation. It means that I can only use AI in relation to simple tasks".

The results indicates that faculty members encounter an extensive variety of issues in the implementation of AI and digital tools in the teaching process, which includes the infrastructural constraints, insufficiency of training, ethical issues, and the rapid technological evolution. Although the majority of the respondents exhibit a basic to moderate level of familiarity with digital tools and new applications of AI, the level of success in incorporating these technologies depends on the institutional support, resource availability, and ongoing learning opportunities. The results also indicate that there are differences in experiences where some faculty members experience a lot of barriers whereas some experience less due to increased familiarity. Notably, the recent developments with regards to AI are rising, yet it is difficult to stay abreast with the development. On the whole, these barriers need to be addressed by means of better infrastructure, systematic training, and codes of conduct, to increase AI knowledge, confidence, and effective implementation among faculty in higher learning institutions.

Adaptive Techniques to Technology- Enhanced Teaching

The results of this theme show that the members of the university faculty have diverse strategies and practical adjustments to overcome the difficulties that can be encountered with the implementation of digital technologies in teaching. Respondent No: 01, 02, 04, 06, 07, 10, 13, 14, 16, and 17 state that the continuous self-learning, the involvement in training programs, the teamwork with the colleagues, and the gradual introduction of digital tools are the main strategies in the management of technological challenges. These respondents focus on the necessity of gaining the digital skills through experience, professional growth, and ethical awareness. They also point out that responsible digital use, as well as academic integrity, is also important in making sure that technology as an aid to rather than a substitute of effective pedagogical and learning practices.

R02, R13 mentioned that constant self-education and personal research are major techniques to address technological issues, "The faculty members are involved in lifelong learning through online research and changing their teaching techniques through gradual adaptation to technology and they concentrate on enhancing their digital skills through practice and online reading and discussions with their colleagues and these efforts enable them to incorporate technology better into teaching". According to the R11, it is necessary to verify the information generated by AI to ensure the accuracy of the research, "The faculty members can verify that the information provided by AI is correct and reliable by using reputable academic databases and other reliable sources, which contributes to the preservation of high quality and authenticity of the research works".

On the whole, the results indicate that the university faculty uses both a mixture of developmental and control-based approaches to overcoming the obstacles associated with digital technologies. The majority of the respondents underline the importance of constant learning, ethical consciousness, teamwork, and gradual incorporation as the methods of competence and confidence development. Meanwhile, the practical strategies identified by some respondents include assessment redesign and checking the AI outputs, which will help preserve academic integrity. These results indicate that successful adaptation is achieved through the development of skills as well as the organization of teaching activities so that digital technologies could facilitate the learning process without reducing its quality.

Digital Technologies in Future Transformations in Teaching and Learning

This theme emphasize the transition to blended and hybrid learning frameworks, the rise in the use of digital platforms, customization of learning, and the rise of digital literacy as a critical aspect to both educators and students. They note that,

teaching will be more flexible, interactive, and technologically oriented, whereas assessment practices will shift towards analytical, critical, and application-based practices. They also think that this will facilitate research, efficiency of teaching and international academic cooperation, which will make education more accessible and creative. R09, R13 also indicated that excessive dependence on AI can have adverse learning and creativity, “In my opinion, overuse of digital tools can decrease the ability of students to think and learn on their own. I have noticed that students tend to use existing solutions rather than create their own knowledge. To my mind, this overuse can undermine creative and critical thinking skills in the learning process”.

On the whole, the results show that digital technologies will have a great impact on the practice of teaching and learning in the higher education sector by facilitating flexibility, personalization, and innovation. These changes are mostly discussed by the respondents as positive, with the focus on the better teaching techniques, the increased possibilities in research, and the acquisition of the necessary digital skills. Nevertheless, a number of respondents indicate that there is a risk of over-reliance on AI and it may affect critical thinking and creativity.

Table 1 : Major Themes and Sub Themes of the Study

Sr No.	Themes	Sub Themes
1	Digital Technology Competencies	1. Learning Management Systems and Online Platforms. 2. Video Conferencing Tools. 3. Digital Preparation of Lectures and Presentations 4. Digital Support for Research. 5. AI Tools in Teaching and Research. 6. Online Assessment and Feedback.
2	Factors Influencing Digital Technology Competencies	1. Digital Self-Efficacy. 2. Adaptability to New Technologies. 3. Time and Individual Efforts. 4. Training and Professional Development. 5. Organizational Policies. 6. Technological Infrastructure.
3	Integration of Digital Skills in Research and Knowledge Creation	1. Digital Tools in Research. 2. Online Research Resources. 3. Research Innovation. 4. Collaboration and Knowledge Sharing.
4	Barriers to Digital Technology Integration	1. Training and Skill Gaps. 2. Academic Integrity. 3. Technological Changes. 4. AI and Digital Competency. 5. Emerging AI Awareness. 6. Contextual Limitations.
5	Adaptive Techniques to Technology- Enhanced Teaching	1. AI-Resistant Assessment 2. Hybrid Learning 3. Ethical AI Use 4. AI Training 5. AI-Supported Planning 6. Student AI Awareness
6	Digital Technologies in Future Transformations in Teaching and Learning.	1. Evolving Teaching Roles 2. AI in Curriculum Design 3. Digital Knowledge Creation 4. Smart Learning Environments 5. Advanced Digital Literacy

Discussion

The current research aims to discover experiences and perceptions of university educators about digital technology competencies and AI knowledge, and their impact on teaching and instructional design. The research questions were used to guide the study and the data were gathered using in-depth interviews on 18 participants. According to the responses, some important themes and subthemes became apparent, giving a valuable insight into the way faculty members are involved in the digital technologies use in higher education.

The results of the research show that the competencies regarding digital technologies of the university faculty members are moderate, with little knowledge and confidence in using AI tools. Majority of the respondents indicated that they were familiar with the basic digital applications like MS word, PowerPoint, Google Drive, online learning platforms and research tools. Nevertheless, the application of AI programs, such as ChatGPT, Grammarly, or automated data analysis software is still new and unstable. One respondent explained:

The institutional and infrastructural difficulties as the unstable internet connection, the lack of access to such platforms as YouTube, and the availability of high-level AI software and subscriptions were mentioned by many respondents. These challenges negatively impact the successful use of AI technologies and reduce the effectiveness of online teaching. Faculty members found it difficult to incorporate AI tools into learning outcomes and assessment plans, and academic integrity. Some of the respondents even mentioned that sometimes students can overuse AI-generated content which affects critical thinking and self-education. These are even complicated by the question of ethical considerations of plagiarism and unfair use of AI paid tools. Digital divide between students was indicated by some respondents as a pressing issue. Inequality in access to the internet and affordability of AI tools means that it is more difficult to design activities that can be accessed by all students by faculty. Moreover, technical failures in classrooms, e.g., non-functional LED screens or software, interfere with teaching sessions and restrict the effective use of AI in learning. These results are supported by other researchers who emphasize technological, pedagogical, ethical, and institutional barriers as the key impediments to the implementation of AI in higher education (Su et al., 2022). It suggests that to successfully overcome these challenges, an organized training, well-developed infrastructure, ethical standards, and institutional policies are needed to allow meaningful AI integration. Finally, to integrate AI and digital technologies into teaching, university faculty experiences multi-dimensional issues such as technical, pedagogical, infrastructural, ethical, and institutional. Professional development programs, supportive policies, and equal access to AI resources will help to overcome these challenges and increase the capacity of the faculty and the quality of AI-supported teaching and learning.

The emphasis on constant and discipline-based training that goes beyond technical expertise to cover pedagogical novelty and ethical consciousness was emphasized by many respondents. The purpose of such programs is to assist educators in meaningfully incorporating AI into the curriculum, assessment, and research practices. More recent works also note that faculty development should be balanced in terms of technological skills and ethical factors to guarantee the responsible application of AI in academia. Moreover, respondents emphasized the importance of institutional support, such as the availability of licensed AI services, regular technical support services, and well-defined policies to inform ethical AI use in education. In the absence of these, faculty might be unwilling to adopt AI in teaching and research. Practical training was proposed to be more efficient than theoretical sessions because hands-on training will allow faculty to use AI tools in practice both in the classroom and research scenarios. It was also suggested that there should be national initiatives and clear institutional policies to ensure that there is continuity in professional development.

Conclusion

The results of this study explain the complex and multifaceted relationship between the competencies of digital technology and teaching-learning engagement of university faculty. Thematic analysis of academics' experiences found that those with higher digital literacy are more likely to be able to create interactive learning spaces that are student-centered, enabling deeper cognitive engagement and student motivation in learning. It was clear that in today's modern higher education context, the use of technology is becoming more and more a part of the teaching process, and that it is an integral part of an individual student's learning. The development of technological skills is becoming, in the era of the Internet, a fundamental pedagogical competency, with technological tools becoming teaching tools as well as a means of communication and interaction between the teacher and the student.

The study also identified some context- and profession-specific challenges that influenced faculty experiences with integration of digital technology. Academic engagement with technology was shaped by a variety of factors, including their limited training

opportunities, technological resources, infrastructure-related challenges, access to advanced digital tools, and differences in confidence. With the start of artificial intelligence, these experiences have taken another turn, with potential for instructional support and concerns about academic honesty, responsible use, privacy, and reliance on AI-generated materials. The findings show that faculty digital competence is an evolving construct that adapts to the changing expectations and technological developments in higher education.

In summary, the thematic findings reveal the digital technology competency as an element of the university teaching that is multidimensional and closely related to the practices of the faculty members, their experiences, and the engagement in teaching and learning. The study does not view the use of technology as a separate technical process, but instead focuses on how academics are using, adapting and integrating digital tools into their everyday work. The results add to the knowledge about the faculty's experiences of digital transformation in higher education and, specifically, how digital competencies can be lived in the teaching and learning arena. In this regard, the research confirms the idea that the relation of technological literacy, pedagogical practice, personal experience and academic environment is involved in the creation of meaningful digital interaction in higher education.

Recommendation

In light of the results of this research, faculty members' digital technology competency needs to be strengthened and thus, improve teaching and learning process and quality of Higher Education. Professional learning opportunities for teachers are added in greater frequency for discipline specific issues that are encountered in the classroom when addressing use of digital technologies to enhance learning. Plan for ongoing development of competency, through continuous professional learning, faculty learning communities, peer collaboration, and frequent digital competency checks. The particular indication of digital competence as a key professional competency, identified in recruitment, performance assessment and promotion procedures, enhances the institutional dedication to digital transformation. The collaboration between the higher education institutions and relevant educational authorities such as Higher Education Commission (HEC) Pakistan, Punjab Higher Education Commission (PHEC), Punjab Information Technology Board (PITB) and National Information Technology Board (NITB) helps to integrate technology with proper internet connectivity, smart digital devices, licensed software, learning management systems and technical support services. Evidence gathered from longitudinal research that looks at how faculty digital competencies evolve over time and how these competencies drive student learning outcomes, is valuable for informing policy and practice. Comparative studies, carried out in various institutional settings, complement the understanding of digital technology competencies in higher education with mixed-methods and quantitative studies that also include students' perspectives. Collective institutional efforts create new spaces for innovative, participatory and effective learning and teaching and contribute to the sustainable digitalization of higher education institutions.

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