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Review Article

Identifying the Criteria for Techno-Pedagogical Competencies of Faculty Members in Blended Learning Implementation: A Review

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ABSTRACT

Background: The rapid shift toward blended learning in higher education, accelerated by the COVID-19 pandemic, underscores the need for faculty to master Techno-Pedagogical Competencies (TPC). While Technological Pedagogical Content Knowledge (TPACK) provides a theoretical foundation, gaps persist in practical frameworks for faculty development. This study identifies and categorizes TPC to guide effective blended learning implementation.

Methods: A qualitative content analysis was conducted for this review. Using Boolean operators, 504 articles (2010–2022) were retrieved from ProQuest, Scopus, Google Scholar, PubMed, and regional databases (SID, Magiran). After screening titles/abstracts and applying inclusion criteria (focus on higher education, faculty TPC, English/Persian language), 14 articles were analyzed in MAXQDA 2020. Open, axial, and selective coding were employed until thematic saturation, yielding 185 initial codes consolidated into 26 components across five categories. Trustworthiness was ensured via peer debriefing (10 experts) and Lawshe's Content Validity Ratio (CVR>70%).

Results: The analysis revealed five key competency areas: EdTech competencies (nine components including instructional design and technology evaluation), professional competencies (four components like innovation adoption and lifelong learning), management and consulting competencies (two components such as progress monitoring), digital teaching competencies (seven components including synchronous/asynchronous strategies), and communication competencies (four components like culturally responsive interaction). Faculty showed particular gaps in technology integration (Technological Knowledge (TK)/Technological Pedagogical Knowledge (TPK) domains) despite strong pedagogical knowledge.

Conclusion: This study presents a comprehensive TPC framework addressing faculty readiness for blended learning. Findings highlight the need for targeted professional development, particularly in technology integration. The framework serves as a roadmap for institutions to design training programs, ensuring faculty can leverage technology to enhance student outcomes in blended environments.

Keywords: Pedagogical Content Knowledge, Teaching, Competency, Faculty Members, Distance, Education, Blended Learning

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Introduction

Technological innovation constantly transforms society in unforeseen ways (1). The integration of technology with education is becoming increasingly important. In recent years, higher education institutions are paying particular attention to the role of information and communication technology in the learning environment (2). However, the COVID-19 pandemic has accelerated the need for teachers to effectively integrate technology into their teaching practices to enhance student learning. The shift from in-person to e-learning during the pandemic has highlighted the importance of technology integration in teaching.

While e-learning has facilitated learning in terms of time and access, it needs more interaction between students and faculty members that is present in in-person education (3). People prefer to learn in a social situation setting. The pattern of learning in a group environment is established in almost everyone's school experience and connects us with our past (4). This has led to the rise of blended learning, which integrates the strengths of both in-person and e-learning. In other words, blended learning is a new paradigm of instructional systems that have made effective learning by integrating face-to-face learning with information and communication technologies (5).

Along with digital technologies, Technological Knowledge (TK) has emerged, requiring knowledge and skills in using technologies that provide comprehensive learning (6). However, implementing blended learning effectively requires more than technological know-how (7). Educators who incorporate information and communication technologies into their teaching methods must adapt and transform their pedagogical approaches. Technological Pedagogical Knowledge (TPK) represents the integration of technology with general pedagogical strategies characterized by an understanding of how teaching and learning can change when particular technologies are used in particular (8).

Technological Content Knowledge (TCK) represents knowledge of technology tools and representations that are used by practitioners within a content discipline (9). In essence, ensuring effective education that integrates technology demands more than just mastery of subject matter, pedagogy, or technology in isolation (8, 10). Koehler and Mishra (8) Technological Pedagogical Content Knowledge (TPACK) is defined as the relation and interaction between content knowledge (subjects to be taught), TK (computers, internet, digital video, and so forth.), pedagogical knowledge (practices, procedures, strategies, and so forth.) to do processes, and methods of teaching and learning), and the change that occurs when these domains are combined.

TPACK is a form of integrated and transformative knowledge teachers must have to effectively and adequately incorporate information and communication technology into the classroom. Faculty with sufficient expertise in TPACK can help the student community in their professional growth and competency levels (11). Faculty often perceive themselves as needing more TPACK, with limited knowledge of technology, and primarily using teacher-centered teaching methods (1). As a result, faculty need professional training programs regarding TPACK to integrate technology into their teaching practices effectively.

Numerous studies have been conducted in this regard. For instance, Swasti and Sholihatin (12) indicated differences in techno-pedagogical skills among teachers based on age. Teachers aged below 35 possess the speed to adapt to information technology, electronic presentation skills, web-based course development tools, and knowledge of computer security that promotes learning. As a result, they are more proficient in using information and communication technology for online lectures (12) The study's findings can be a foundation for creating a knowledge-sharing development model to improve techno-pedagogical skills to achieve digital competency in blended learning.

Çam and Erdamar (13) conducted a qualitative needs analysis study on faculty members' TPACK. The study's results reveal that faculty members' views were divided into four themes: prior knowledge and perceptions of TPACK, instructional practices, professional characteristics, and the need for self-development. According to the findings, the faculty members perceived themselves as incompetent regarding TPACK due to their limited knowledge of technology. Although they highlighted that they possessed sufficient pedagogical knowledge, they predominantly used teacher-centered instructional methods, such as PowerPoint presentations.

The findings of Akram et al.'s study (14) provide a constructive overview of teachers' digital competencies and technology use in teaching and learning during the COVID-19 pandemic. They also play an essential role in integrating technology into higher education in the post-pandemic era. The study suggests that educational authorities and policymakers assess and enhance teachers' technological competencies to ensure quality online education.

Houshmandi et al. (15) indicated that, as a result of the faculty development program, the faculty had a high level of pedagogical, content, and content-pedagogical knowledge but needed improvement in their technological, technological-content, technological pedagogical, and ultimately, technological-pedagogical content knowledge.

Given the significance of Techno-Pedagogical Competencies (TPC) of faculty members in integrating blended learning in the classroom, it is essential to identify and improve these competencies. Although the literature indicates several competencies that focus on technological or pedagogical dimensions, more studies must be done on TPC. The current research was conducted to identify the criteria for PC of faculty members in blended learning implementation.

Methods

Study Design

This literature review adopted a qualitative approach to analyze the TPC for faculty members to effectively implement blended learning environments. Drawing upon the theoretical framework of TPACK, we conducted a qualitative content analysis of diverse scientific articles (original, review, and literature review) focusing on academic faculty members across various disciplines and institutions within higher education. This diversity ensured a comprehensive understanding of TPC that could be applied across various educational contexts.

Search Strategy

This study, initiated in the spring of 2022, commenced with the compilation of an exhaustive list of research keywords related to "TPC and blended learning" and their synonyms. The subsequent search strategy employed the following Boolean operators and keywords within the databases as mentioned earlier: (Techno* OR digital* OR IT OR technic*) AND (pedagogy*) AND (Competence?* OR Skill* OR Ability* OR "Competency assessment") AND (Blended OR Invert* OR Reverse* OR Flip* OR Online) AND (Class* OR Learn* OR Education* OR Instruct* OR teach*). The search was based on the databases ProQuest, Scopus, Google Scholar, PubMed, Web of Science, SID, Magiran, IranDoc, and NoorMags, which sometimes according to the characteristics of some databases minor changes were made.

Selection Criteria

We established explicit inclusion and exclusion criteria to select relevant research articles for blended learning in 2010-2022. The inclusion criteria included a focus on competencies, mention of technological and pedagogical competencies, relevance to higher education, relevance to faculty, and publication in Persian or English. Exclusion criteria included articles not related to competencies, those mentioning only one of the pedagogical or technological competencies, relevance to education levels other than higher education, non-faculty subjects, and articles in languages other than Persian and English.

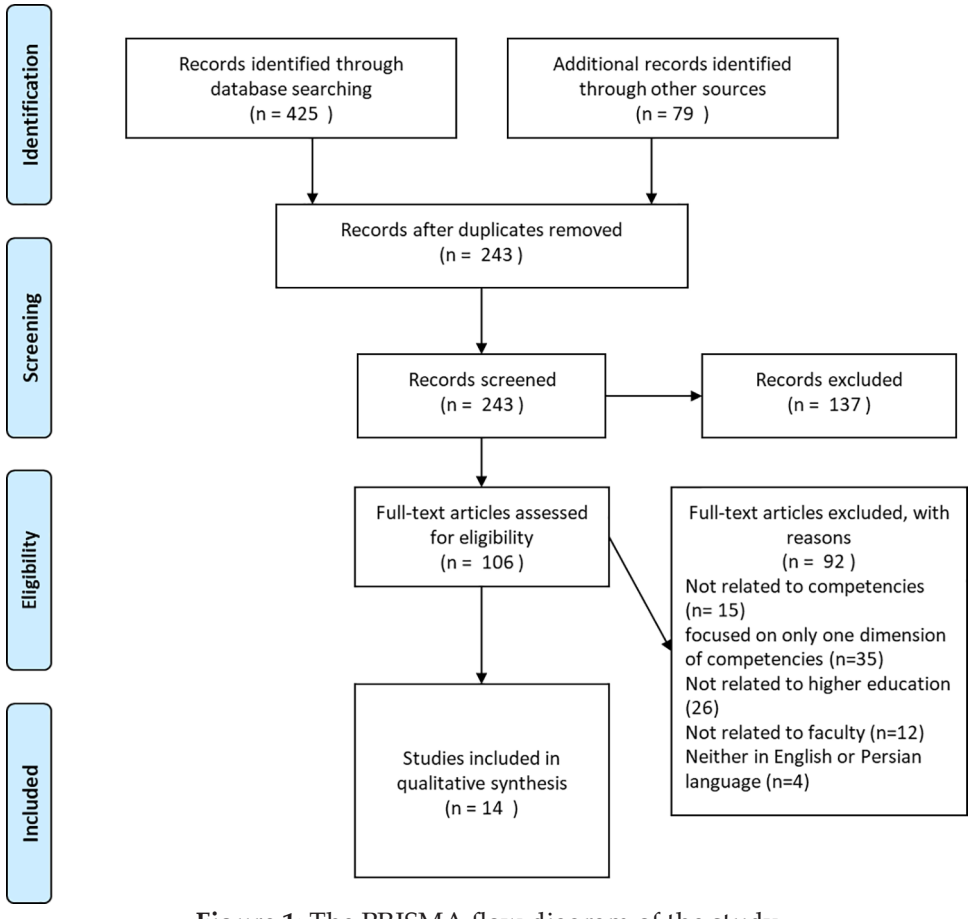

Figure 1: The PRISMA flow diagram of the study

Our search initially yielded 504 articles across multiple databases (Figure 1). After removing duplicates using JabRef reference manager software, 243 unique articles remained. We reviewed the titles, abstracts, and full texts of 106 pieces, applying the inclusion and exclusion criteria to select the final research sample. A total of 14 articles met the inclusion criteria and were included in the study (Table 1).

Coding Procedure

To identify and categorize the research data, we utilized MAX QDA 2020 software. Our qualitative data analysis followed the methods of Barney, Glaser, and Anselm (16, 17) Strauss, which involve three primary processes: open coding, axial coding, and selective coding. This coding process continued until data saturation was achieved, meaning no new codes or categories emerged, and additional coding yielded only novel insights (18). Saturation was determined through consensus among the research team, comprising experts in educational technology and qualitative research methodologies.

In total, three articles from 2010 to 2022 were included in the analysis. The titles of the articles included in the study are shown in Table 1 (19-31).

To address potential researcher bias, our research team consisted of individuals with expertise in educational technology and qualitative research methodologies. One team member possessed significant experience in educational technology, providing valuable insights into the nuances of TPC. We maintained reflexivity throughout the study, acknowledging and managing any personal biases or preconceptions that might have influenced the research process and findings.

Trustworthiness Strategy

Ensuring data trustworthiness in qualitative research is crucial for maintaining rigor and validity. In this study, we established reliability through the following means:

Table 1: List of articles included in content analysis

Article No.	Title	Author/s	Publication year	The number of extracted codes
1	Pedagogical aspects of the development of teachers' digital competence	Larisa et al. (19)	2010	9
2	On the Question of Pedagogical Digital Competency	Мезенцева et al. (20)	2020	36
3	Digital competency as the basis of a lecturer's readiness for innovative pedagogical activity	Куõрушко et al. (21)	2020	4
4	Transformation of Pedagogical Communicative Competency During Creation Digital Online Courses	Grunis et al. (22)	2020	12
5	Review Article Techno-Pedagogical Skills for 21st Century Digital Classrooms: An Extensive Literature Review.	Asad et al. (23)	2021	17
6	An examination of teachers' strategies to foster student engagement in blended learning in higher education	Heilporn et al. (24)	2021	17
7	Digital competency as a cross-cutting axis of higher education teachers' pedagogical competencies in the European higher education area	Pérez et al. (25)	2012	13
8	Online Course Instructional Design From The Professors' Pedagogic Knowledge And Technological Skills	McAnally-Salas et al. (26)	2010	5
9	Developing Technical Competency for the Virtual Classroom: Managing Technology-driven Pedagogy, Faculty Development, and the Hidden Workload	McPherson et al. (27)	2018	14
10	ICT Skills in University Teachers, the Knowledge, Use, and Pedagogical Appropriation of These Technologies	Barrera et al. (28)	2018	26
11	Evolving visual arts' faculty pedagogical skills through technology integration in higher education	Akram et al. (29)	2021	9
12	Digital Leadership to Improve the Pedagogical Competency of University English Lecturers in Samarinda	Masrur (30)	2021	3
13	Technology Integration in Higher Education During COVID-19: An Assessment of Online Teaching Competencies Through Technological Pedagogical Content Knowledge Model	Akram et al. (14)	2021	5
14	Internet skills of medical faculty and students: Is there a difference?	O'Doherty et al. (31)	2019	15
Total				185

Credibility: To enhance credibility, we engaged in peer debriefing, involving 10 faculty members of educational technology who reviewed the research findings. We also employed Lawshe's Content Validity Ratio (CVR) methods to assess the identified codes' validity and alignment with research objectives (32-34). The consensus of the experts for each criterion was between 70 and 100 percent.

Transferability: We enhanced transferability by providing comprehensive descriptions of research methods, data collection, and the contextual framework, enabling readers to evaluate the relevance of findings in different settings.

Table 2: Categories and Codes of the Qualitative Content Analysis

Article number	Condensed Meaning Unit	Components	Category
2- 8-10-13	Knowledge and skills for using different instructional strategies with new technologies in educational processes.	Instructional Strategies	EdTech Competencies
10-9-2-3-13-11	The ability to empower learners in how to use new educational technologies.	Learner-Empowerment in using technology	
6-2-8-14	Instructional designing in-person, e-learning, and blended learning activities for learners.	Multi-Mode-learning Design	
7-2	The knowledge required for tutoring learners using in-person, e-learning, and blended learning technologies.	Tutoring with technology	
2-6-7-9	Knowledge of evaluation using technologies appropriate to the objective in in-person, e-learning, and blended learning	Technology Evaluation and media literacy	
14-10	The ability to filter information available online according to learning objectives.	Info-Filtering	
2-7-9-8	Knowledge of learner-centered approaches ot new methods and technologies.	Learner-Centered-Design	
2-9-6	The ability of instructional design according to the goals of various methods and technologies.	Tech – instructional design	
5-4	Sufficient knowledge and understanding of technologies to develop higher-level thinking skills in learners.	Higher-Order-Thinking improvement strategy via technology	
2-5-8-10	Accept innovations and update their educational process according to changes in knowledge and technology.	Innovation Adoption	Professional Competencies
1-2-9-7-5-13-12	redisnoc tsum yehT it essential to upgrade and develop their technology knowledge and professional skills.		
2-9	Have a critical and analytical attitude toward knowledge and digital tools in educational areas.	Critical Thinking	
2-9-13	Observe ethical considerations in the use of educational technologies and content.		
13-11-5	To be professionally present in social networks, participate with learners, and guide them.	Professional Digital Presence	
1-5-10-13-9	Keep your knowledge and educational skills up-to-date with the latest science and technology.	Lifelong Learning	
1-2-7-8-9-10-5	I participate in specialized conferences and share knowledge and experiences with other specialists in face-to-face, e-learning, and blended spaces.		
1-5-2-6-9-7-11	Monitoring and managing learners' activities and, generally, the teaching and learning process using different technologies is necessary.	Technology-based monitoring of teaching and learning	Management and consulting competencies
10-14	Ability to manage resources and media used by learners in the teaching process.	Instructional media and materials management	

2-7-10	Know the fundamental differences between in-person, e-learning, and blended learning methods.	Knowledge of different learning methods	Digital Teaching Competencies
6-5	The importance of holding synchronous and asynchronous classes in blended learning.	Synchronous and asynchronous teaching	
8-12-2-5	Complete understanding of educational potentials and limitations for the effective integration of technology tuoba learning sevitcejbo in teaching	Technology noitargetnI in noitacudE	
2-6-7-9	Assessing learners in the learning process with the correct integration of technology	Assessing learners based on technology	
5-6-14	Creativity in choosing teaching methods and tools, presenting assignments, and creating content using different technologies	Creative use of technology in teaching	
4-8-7-5-10-9-12	Having the necessary knowledge about educational and training processes, considering the variety of technologies and multimedia approaches	Teaching – Learning processes with technology	
2-12-13-9-4	Digital hardware and software skills for effective use of technologies in teaching	Digital skills for teaching	
4-6-2-8-7-	Use technologies in line with communication and interactions between learners in in-person, e-learning, and blended learning environments.	Tech-use for Communication and Interaction	Communi-cation and collaboration Competencies
4-9	Attention to individual and cultural differences in choosing the type of technology, content, and communication method in education.	Diversity Consideration	
5-9-2	Interaction with professionals and students from other countries in a digital environment.	Global Collaboration	
4-13-2	Engaging speech ability suits in-person, e-learning, and blended learning environments.	Effective Communication Skills	

*EdTech: Education Technology

Dependability: We maintained an exhaustive audit trail documenting the research process, including data collection, coding decisions, and analysis procedures, to ensure the reliability and consistency of findings.

Confirmability: To ensure objectivity and neutrality, we engaged in reflexivity, periodically reflecting on personal biases and preconceptions.

Results

For identifying the criteria, we employed MaxQDA 2020 for analysis, yielding 185 initial meaning units. After merging duplicates, 28 condensed meaning units and 26 components emerged, which were categorized into five main themes.

The results of the qualitative content analysis are presented below, with the identified competencies summarized in Table 2. After the content validity of CVR, one of the sub-components in EdTech competencies was removed as shown in Figure 2.

First competency, education technology (EdTech) competencies of faculty members refer to the knowledge, skills, and abilities required to effectively integrate technology into instructional strategies, empower learners in using technology, design multi-mode learning experiences, tutor learners using technology, evaluate the effectiveness of technology, filter information to meet learning objectives, design instruction with a learner-centered approach, design instruction with a technology-centered system, Improving higher-order thinking

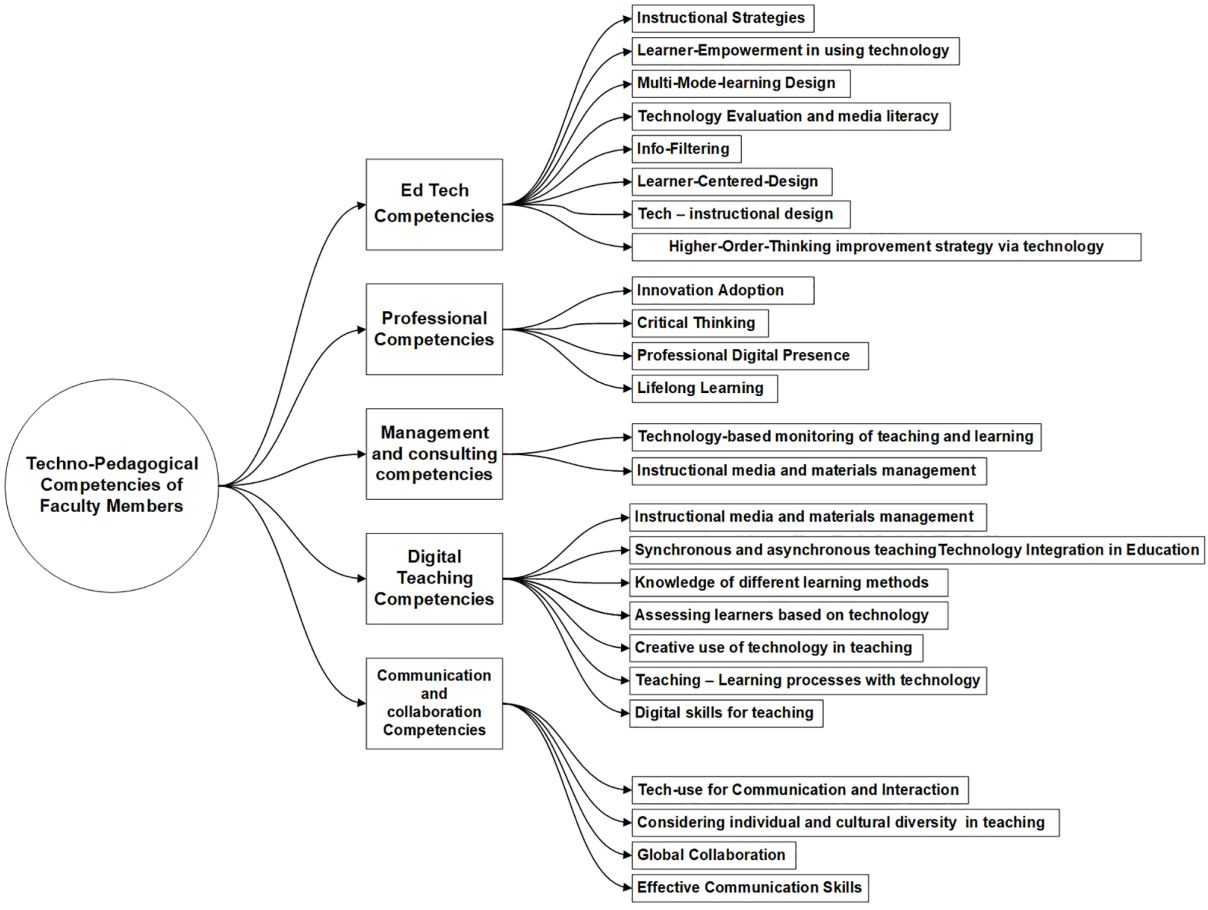

Figure 2: Techno-Pedagogical Competencies Model of Faculty in Effective Implementation of Blended Learning.

skills through technology integration. This capability enables departments to effectively implement blended learning in higher education and improve student outcomes.

This study revealed a vital category of TPC for faculty: professional personality competency. Mastering these competencies is crucial for seamless technology integration in blended learning and encompasses the skills, knowledge, and dispositions educators need. They include:

Innovation Adoption: Enthusiastically embrace and integrate new technologies and teaching methods into practice.

Critical Thinking: Evaluate the effectiveness and appropriateness of technology integration in educational contexts.

Professional Digital Presence: Cultivate a professional online persona across various digital tools and platforms.

Lifelong Learning: Demonstrate a commitment to continuous professional development to stay current with technological advancements and pedagogical practices.

These qualifications are essential to ensure that teachers have the skills needed to meet the demands of the digital age and provide students with high-quality, technologically advanced learning experiences.

The faculty's third category of TPC revealed in this study is management and consulting competencies.

Management and consultancy skills refer to the skills and knowledge required to manage and advise effectively in education, especially technology-based teaching and learning. These skills include:

- Monitoring technology-based teaching and learning: The ability to use technology to manage teaching and learning activities, such as monitoring student progress, assessing learning outcomes, and providing feedback to students and teachers.

- Instructional media and materials management: managing instructional media and materials, including selecting, designing, and adapting appropriate media and materials to support teaching and learning activities. This may include managing physical resources, such as textbooks, classroom materials, and digital resources.

These competencies require a strong understanding of instructional design principles and the ability to manage and consult on technology in education effectively. They also need strong communication and collaboration skills, often involving working with instructors, administrators, and other stakeholders to support effective teaching and learning practices.

The fourth category of TPC of faculty revealed in this study is digital teaching competencies. Digital learning competence refers to teachers' skills and knowledge that enable them to effectively integrate technology into teaching practice. These competencies encompass a range of areas, including understanding different learning methods, utilizing synchronous and asynchronous teaching methods, incorporating technology in education, assessing learners based on technology, creatively using technology in teaching, leveraging technology for teaching-learning processes, and possessing digital skills for teaching. In summary, digital teaching competencies enable educators to effectively use technology to enhance student learning outcomes and support their success in a rapidly evolving digital world.

Finally, the fifth category of TPC of faculty revealed in this study is communication and collaboration competencies.

Communication and collaboration competencies refer to skills and knowledge that enable individuals to effectively use technology to communicate and interact with others in an inclusive and culturally sensitive manner, both locally and globally. These competencies involve:

- Tech-use for communication and interaction: the ability to use various technologies to facilitate communication and interaction between individuals and groups in different settings, such as in-person, e-learning, and blended learning environments.

- Diversity consideration: the awareness and sensitivity to individual and cultural differences and the ability to choose appropriate technology, content, and communication methods that are inclusive and accessible to all learners.

- Global collaboration: the ability to interact and collaborate with professionals and students from other countries using technology, such as video conferencing, online collaboration tools, social media platforms, etc.

- Effective communication skills: communicating ideas and information clearly and effectively using various communication channels and modes, including verbal and nonverbal communication, written communication, and visual aids. Practical communication skills involve active listening, feedback, and adapting communication styles to different audiences and contexts.

Discussion

Today's global environment, where technology is present in every aspect of life, has created an urgent need for educational institutions to adapt to a blended learning environment. This study was conducted to determine the educational technology skills of professors and teachers in the effective use of blended learning. in universities. While the literature review shows the increasing challenges faced by school members in the implementation of blended learning, it also emphasizes the need for teachers to have the necessary skills and knowledge for the e-learning school. The challenges faced by faculty members are multifaceted. Despite their robust scientific and pedagogical knowledge, some individuals need help integrating technology into their teaching practices. Conversely, those with solid technological acumen often need a more profound understanding of pedagogical principles. This divide underscores the

importance of bridging the gap between technology and pedagogy to ensure a successful university education.

In today's educational landscape, blended learning has become a pivotal approach. It maximizes the advantages of technology, such as accessibility and flexibility, while retaining the benefits of face-to-face instruction, including social interaction and immediate feedback. Therefore, faculty members' proficiency in TPC becomes indispensable for effective education delivery in virtual or physical classrooms.

TPC refers to the skills and knowledge required to effectively integrate technology into the teaching and learning process. These capabilities enable educators to design and deliver compelling blended experiences that meet student needs. Defining technological competencies can help teachers to have the necessary skills and knowledge to use technology effectively in teaching. This question was confirmed in a study conducted by Posada. The leadership of content, pedagogy, and technology alone must respond to effective learning integrated with ICT. It is necessary to be trained and experienced in the places where these components engage and position each other. In addition to learning content and teaching/learning strategies, you also need to know which technology tools should be used and how they can be applied, as their use can content and dynamics change teaching and learning. (35, 36).

In the post-COVID era, e-learning will continue to be a part of the teaching process in educational centers, alongside in-person learning. Therefore, identifying the necessary Techno-Pedagogical competencies for academic faculty is critical to ensure that they can effectively use technology in their teaching, regardless of whether they teach in an e-learning or face-to-face environment.

To identify the necessary techno-pedagogical competencies, the researchers, by reviewing international studies, used a rigorous coding process to determine the competencies required for the effective implementation of blended learning. The current research has identified the pedagogical technology competencies needed to effectively implement blended learning, and in general, the need to do this research is consistent with previous research; For example, Cham and Erdamar (13) conducted a qualitative needs analysis of faculty's technology pedagogical content knowledge (TPACK). The study's results reveal that faculty members perceived themselves as incompetent regarding TPACK due to their limited knowledge of technology. The study highlighted the need for self-development and professional development programs to enhance faculty members' TPC. Similarly, Akram et al. study (14) showed that teachers have adequate levels of knowledge in all domains of TPACK, with the highest competence found in content knowledge (CK). In contrast, technical knowledge (TK) was reported to be at a very low level. The authors proposed using professional development programs to enhance teachers' TPACK for integrating information communication and technology into pedagogical practices.

Houshmandi et al. (15) said that professors should improve their TK, technology content, TK of education, and, finally, knowledge of educational technology content. The study highlighted the significance of professional development programs in enhancing faculty members' TPC's to ensure quality online education.

The resulting competencies have been categorized into several categories, including EdTech Competencies, Professional Techno-Pedagogical Competencies, Communication Techno-Pedagogical Competencies, Management and Consulting Techno-Pedagogical Competencies, and Digital Techno-Pedagogical Competencies.

EdTech Competencies: This competency shows that faculty members should be able to effectively use their educational knowledge and TK in comprehensive educational design to apply educational strategies with technology to empower learners in the correct and effective use of educational technologies. Learners should use in filtering the information obtained and select the required

items also raise the high-level thinking of the learners in different educational platforms of face-to-face, e-learning, and blended learning and also for evaluation during training and at the end of the training, they can use academic knowledge and knowledge, by technology should consider appropriate assessments for learners. This competency is consistent with the results of Mezentceva et al. (20) Research educational competence, knowledge of a wide range of tools that can be used for educational purposes in different fields or a particular subject. Ability to critically analyze the academic context and identify appropriate digital tools, use appropriate teaching techniques, methods, and techniques to design learning experiences using the tools and select appropriate assessment strategies. Ability to use different instructional formats, including online and blended learning, to use different strategies to promote student independence.

Professional teaching and technology skills: These skills suggest that teachers actively engage in new technologies and knowledge and can use technology, educational materials, and digital tools with ethical considerations. These members should continuously learn and participate in specialized conferences, keep their knowledge and skills up-to-date, and share their knowledge with other specialists.

Ability to interact with students, peers, and other stakeholders in a digital environment. Demonstrate a positive attitude towards professional methods related to educational technology, encourage students to accept it, show empathy and patience in the event of technical failure and communication, and observe the rules of Internet behavior. The ability to develop scaffolding techniques to help yourself and students learn new educational techniques more quickly and effectively. The project aims to provide an opportunity for the professional community to develop new digital skills and exchange best practices. Practice thinking about your professional digital experience (28).

Faculty should pay attention to the individual and cultural differences of students in the use of teaching tools and media. This includes the use of different technologies in blended learning environments that involve interaction with and between students. These members should have effective and efficient relations with learners, researchers, and experts internationally by establishing effective communication.

Additionally, as discussed in later research, Cozar-Gutierrez et al. (37) state the following: Technological culture, which has been present in all educational processes in a short time, determines the method of teaching, learning, and interpersonal relations between members of the university community. The possibilities offered by ICT today through educational tools, digital tools, and virtual learning environments, according to different learning styles, offer the possibility to create or choose specific, more stimulating, and personalized activities. Awareness of this will undoubtedly improve the quality of education in the higher education context and provide students with new educational opportunities and personal enrichment technical-educational qualifications in management and consulting.

Another vital competency of faculty members is managing and supervising students' activities. This supervision and management should include comprehensive guidance and counseling, even outside the classroom, on how students perform in choosing the resources used by students. These results are also consistent with research.

Although these technologies are present every day in social networks, recreation, and entertainment, it is important to be aware of the knowledge and usefulness of ICT in the daily lives of university professors and teachers. The society of the future needs people with the knowledge and training to use ICT appropriately at all personal, educational, professional, and social levels (20, 28). Digital technical-pedagogical competencies (digital technical-pedagogical personalities) are classified.

Faculty members should pay attention to how to hold e-learning and blended classes and also master multimedia approaches for the

correct use of educational methods in these classes and prevent problems in the process of holding educational classes by mastering educational software and hardware. Have the necessary creativity in using technology in education.

Research such as Figueiredo and Sarmiento (38) shows that college teachers are currently going through a period where students' technical skills are higher than teachers'. Lack of teaching on the use of ICT and different educational programs that can be included in the classroom, in which scenarios are facilitated that allow the presentation of several levels of activity according to the teacher's knowledge, since teachers with basic levels of computer science (20);) The COVID-19 pandemic has created an urgent need for educational institutions to adapt to virtual learning environments.

Conclusion

This research was conducted to know the scientific and technological competence of faculty members in using blended learning effectively in higher education. The literature review shows faculty members have Blearing problems. In general, the emergence of technology has made education and interaction in learning environments more critical. The use of e-learning in higher education is also becoming more widespread due to the COVID-19 pandemic. Even after this pandemic, it has continued due to the apparent advantages of e-learning. Still, there are also shortcomings, including the lack of benefits of direct communication in the classroom's educational activities that show the importance of attending the class, and the lack of knowledge and ability and sufficient teachers and faculty members in the correct use of technology in teaching was also revealed. Recognizing the weaknesses and identifying the techno-educational competencies needed by teachers and faculty members in using blended learning can be considered a suitable solution for some problems that have arisen to meet educational needs.

This study highlights the transformative role of technology in modern education as e-learning has become an integral part of university education. The COVID-19 pandemic has catalyzed this transformation, but it extends beyond it, owing to the evident advantages of e-learning.

Despite the benefits, the study has brought to light certain limitations of e-learning, notably the absence of direct classroom interactions. Additionally, it has revealed a significant gap in TK and pedagogical skills among faculty members. Professional Techno-Pedagogical Competencies are paramount in addressing these challenges. Enable faculty to effectively integrate technology into teaching methods and optimize online and face-to-face learning. To further develop this area, future research could examine specific strategies and practices needed to develop these skills among faculty. Additionally, exploring the impact of improved Techno-Pedagogical Competencies on student outcomes would be valuable.

Therefore, this study emphasizes the importance of providing teachers with the necessary skills and knowledge to guide the development process. By addressing the identified challenges through focused professional development initiatives and continuous improvement, educational institutions can ensure the delivery of high-quality education that meets the diverse needs of students in both virtual and physical learning environments.

Limitation and Suggestion

The current study has identified two significant limitations, the first being the limited availability of research on technological pedagogical competencies related explicitly to faculty. The researcher thoroughly examined available sources and selected relevant codes from existing studies to address this limitation. This approach enabled the identification and extraction of pertinent information, thereby mitigating the impact of this limitation on the present research.

The second limitation pertained to the lack of research on the technological pedagogical

competencies of faculty in integrated education. The researcher focused on in-person and blended learning in selecting articles to overcome this limitation. Despite this limitation, the researcher comprehensively analyzed the available literature and extracted relevant information to support the research objectives.

Authors' Contribution

SS and ER designed the study. SS collected the data in consultation with ER. SS and ER analyzed the data. SS drafted the manuscript. ER finalized the manuscript. All authors reviewed the manuscript and approved the final version. They take full responsibility for the content and writing of this article.

Conflict of Interest

The authors declare no conflict of interest.

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