

EXPLORING ICT INTEGRATION PRACTICES IN UNIVERSITY TEACHING: INSIGHTS FROM THE TPACK MODEL

Hafiza Esha Amir¹, Dr. Ahmad Bilal Cheema², Dr. Tariq Saleem Ghayyur^{*3}

¹MPhil Scholar, Institute of Education, University of Sargodha

²Assistant Professor, Institute of Education, University of Sargodha

³Lecturer, Institute of Education, University of Sargodha

^{*3}tariq.saleem@uos.edu.pk

DOI: <https://doi.org/10.5281/zenodo.18171564>

Keywords

Information and Communication Technology, Integration, Teachers' Practices, TPACK Model, Higher Education

Article History

Received: 30 October 2025

Accepted: 18 December 2025

Published: 31 December 2025

Copyright @Author

Corresponding Author: *

Dr. Tariq Saleem Ghayyur

Abstract

The Information and Communication Technology (ICT) has evolved into an essential aspect of education, improving the learning environment, the educational landscape and global learning. The study's goal was investigate university teachers' practices about the Information and Communication Technology integration in their teaching practices on the basis of their competencies and individual variations, while examining the relationships among the Technological Pedagogical Content Knowledge (TPACK) framework. This study employed a correlational research design to explore the relationship among the TPACK framework. A self-designed research instrument was utilized to assess teachers' competencies across three components: Technological Knowledge (TK), Pedagogical Knowledge (PK), and Technological Pedagogical Knowledge (TPK). The research tool was validated through the review of experts and pilot testing prior to data collection. The study's population consisted of 370 university teachers from four faculties. A stratified sampling technique was used to collect data from 108 university teachers. Major findings demonstrated that teachers thought themselves to be capable of using technology in teaching. The teaching faculty, gender and teaching experience had no impact on how they use technology. There was a positive correlation was found between teachers' practices among TPACK components; additionally, a weak association was found between PK and TPK. This study recommends offering the training of ICT and pedagogical support to improve efficient technology integration in university teaching.

INTRODUCTION

The teaching and learning process has moved out of traditional classrooms in the 21st century, requiring an engaging technology-supported environment that fosters collaborative work, critical thinking and digital involvement. Learning is a complicated procedure that enables people to develop their knowledge and abilities, shape their experiences, including formal exploration, informal education, and learning collaboratively (Illeris, 2018).

The systematic application of technology, techniques and resources to enhance learning and teaching is referred to as educational technology. In order to create more efficient and student-focused learning possibilities, it incorporates educational ideas, instructional practices and technology development.

The term educational technology describes the systematic utilization of technology, strategies and resources to improve learning and teaching. According to Reiser & Dempsey (2017), it

integrates instructional ideas, educational practices, and technological advancements to create more effective and student-centered learning opportunities. As Koehler & Mishra (2009) stated, from the perspective of recent education, this process depends more and more on the incorporation of technology to improve student involvement, accessibility and academic achievement. A more engaging and learner-focused learning opportunity is now feasible, due to the innovative force of Information and Communication Technology (ICT), which has transformed conventional educational methods. Marjia & Palmira (2007) state that teachers' ICT integration involves the deliberate and practical use of technology to enhance the growth of learning and teaching. According to Hue Ab Jalil (2013), an ICT competency is knowing how to use digital resources efficiently in the classroom as well as to practice using them. It encompasses fundamental technological skills and the ability to use ICT for instructional purposes. These activities involve the ability to select, get familiar with, and engage with ICT tools ensuing instructional objectives and satisfying learners' needs, which goes further than simply being aware of digital resources (Ali et al., 2024; Kumar et al., 2024). As Wong et al (2025) state, designing technology-supported learning objectives, growing digital stages for knowledge sharing and collaboration and using multimedia to encourage critical thinking and student participation. Additionally, competent teachers constantly analyze the effectiveness of ICT-based methods, modify them to accommodate the multiple learning frameworks and ensure the inclusiveness and comfort (Chen & Zhang, 2025). As Rahman et al (2023) determined that the practices are inclined by teachers' previous experiences, instructional intents, and readiness to invent, which means that ICT integration is a thoughtful and vibrant procedure rather than a static proficiency set.

This research study uses Mishra and Koehler's (2006) Technological Pedagogical Content (TPACK) framework, because of its theoretical nature for analyzing teachers' competencies about ICT tools' incorporation. This paradigm provides a thorough view of various teacher types participating in effective technology-

enhanced education. This research study particularly focuses on two important factors: pedagogical and technological knowledge and their intersection. The Content knowledge is excluded due to its discipline-specific nature, which varies greatly across academic fields at the university level, and therefore less relevant to the large context of the study. Technological knowledge is defined as the ability of educators' awareness of, proficiency with and confidence level with digital tools and strategies in the educational environment. It includes their capability to select suitable digital tools, use them efficiently and troubleshoot simple technical difficulties. Pedagogical Knowledge (PK) is defined as the inclusive understanding of instructional approaches, student learning procedure and effective classroom management strategies that support a significant learning setting (Angeli and Valanides, 2009). According to Mishra & Kohler (2009), the connection of TK and PK is important because it imitates how teachers apply technology in their teaching to improve instructional excellence, adaptive student engagement, and support better learning results.

The purpose of this study was to assess teachers' practices regarding the integration of ICT in university teaching.

The objectives of the study were:

1. Explore teachers' proficiency in using Information and Communication tools in teaching.
2. Examine differences in ICT integration practices of university teachers based on gender, faculty and length of teaching experience.
3. Analyze the relationship between the components of teachers' practices of ICT integration, comprising TK, PK and TPK.

Research Design

This study employed a descriptive-correlational research design to assess university teachers' self-reported proficiency in integrating ICT into teaching practices and to examine the interrelationship between the components of ICT integration practices, namely TK, PK and TPK.

Sampling and Sample

Stratified sampling was done to select an appropriate sample from the teaching faculty of

Sargodha University. Five departments were randomly chosen from Arts and Humanities, Social Sciences and Natural Sciences and three from Computer Sciences and Information Technology. A total of 108 teachers participated

in this study, with equal representation of males and females, ensuring a diverse and inclusive sample for examining ICT-related practices.

Table 1: Demographic overview of the Sample based on Teaching Faculties, Gender and length of teaching experience

Teaching Faculties	Gender		Years of Teaching Experience				Total	Percentage
	Female	Male	1-5	6-10	11-15	16-20		
Arts and Humanities	15	15	7	14	3	6	30	27%
Physical Sciences	15	15	9	9	5	7	30	27%
Computer Sciences and Information Technology	9	9	2	7	6	3	18	16%
Social Sciences	15	15	7	7	9	7	30	27%
Total	54	54	26	36	23	23	108	100%

Research Tool

A self-developed questionnaire was used to assess university teachers' competence regarding the integration of ICT, grounded in the TPACK model. The research instrument emphasizes three main components, which are Technological Knowledge, Pedagogical Knowledge and the intersection Technological Pedagogical Knowledge. Strongly agree to strongly disagree was the response format on a five-point Likert scale used in this instrument. To ensure the validity of the research tool, 10 Subject Matter Experts reviewed it. A pilot study was conducted on 30 randomly selected university teachers. Based on the pilot data, item analysis and revision were made. Cronbach's

alpha was calculated as 0.81 for the practices scale, indicating high internal consistency and suitability for a research instrument.

Data were collected by the researcher through personal visits to teachers from four faculties at the University of Sargodha.

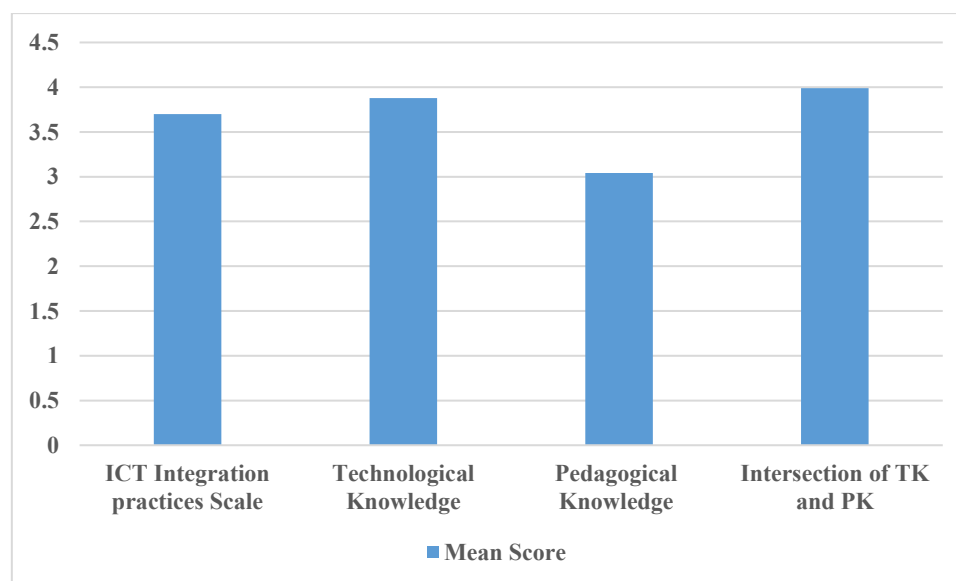
Data Analysis

The collected data were analyzed using the Statistical Package for Social Sciences (SPSS), and descriptive and inferential methods were applied. Descriptive statistics (mean and standard deviation) were used for summarizing teachers' responses about ICT integration practices, and inferential statistics include t-test, ANOVA and Pearson correlation coefficient.

Table 2: Descriptive analysis of ICT Integration Practices Scale and its Factors among University Teachers

Scale and Its Factors	Mean Score	Standard Deviation
ICT Integration Practices Scale	3.70	0.49
Technological Knowledge	3.88	0.57
Pedagogical Knowledge	3.04	0.72
Intersection of TK and PK	3.99	0.61

Graph 1



University teachers perceive themselves as competent to apply ICT tools in their instructional practices, as shown by the Scale Mean = 3.70 with a St. d = 0.49. Across the factors, the technological knowledge mean is 3.88 out of 5.0, showing teachers' ability to use technological tools in their teaching, the pedagogical (Mean = 3.04, St. d = 0.72),

indicating teachers feel less competent in employing pedagogical practices aligned with ICT-based learning context. The Intersection of TK and PK (Mean score = 3.99 with standard deviation = 0.61), demonstrating that teachers feel capable of blending technology and pedagogy in their instructional practices to enhance their teaching.

Table 3: Gender-Based Contrastive Analysis of Differences in Means of University Teachers' ICT Integration Practices

Gender	N	Mean Score	Standard Deviation	t-value	Degree of Freedom	Significance (2-tailed)
Male	54	70.00	9.23	0.365	106	0.716
Female	54	70.67	9.74			

No statistically significant difference between the practice levels of male and female teachers' integration of ICT. The female teachers' value of mean value is 70.00 with St. d = 9.23, and the

male teachers' mean is 70.67 and St. d is 9.74, suggesting that gender does not influence teachers' capacity to incorporate Information and Communication technology into teaching.

Table 4: Analysis of Variance on University Teachers' ICT Integration Practices across Faculties

Comparison across Teaching Faculties		Sum of Squares	Degree of freedom	Mean Square	F-value	Sig. value
Comparison across Teaching Faculties	Between Groups	339.20	3	113.07	1.28	0.287
	Within Groups	9214.80	104	88.80		
	Total	9554.00	107			
Comparison across	Between Groups	413.12	3	161.11	1.85	0.143
	Within Groups	9020.61	104	87.22		

Teaching Faculties	Total	9433.73	107
-----------------------	-------	---------	-----

There is no significant difference in university teachers' ICT integration based on their

teaching faculties ($F=1.28$, $p=0.287 > 0.05$) and teaching experiences ($F=1.85$, $p=0.143 > 0.05$).

Table 5: Analysis of the Relationship between the Factors of University Teachers' ICT Integration Practices Scale

Factors of Practices Scale	TK	PK
Pedagogical Knowledge	$r = 0.488$ $p = 0.00$	
Intersection of TK and PK	$r = 0.601$ $p = 0.00$	$r = 0.183$ $p = 0.00$

The correlation between factors influencing teachers' ICT integration practices indicates a moderate positive relationship ($r = 0.488$) between teachers' technical abilities and their practices in utilizing ICT tools for teaching. The teachers' technological and intersection of TK and PK are also strongly correlated with each other ($r = 0.601$), indicating teachers' competency in technological tools and the incorporation of both technology and pedagogy in instructional practices. A weak association was observed between teachers' pedagogical practices and their intersection of TK and PK ($r = 0.183$), demonstrating that teachers' good pedagogical practices do not necessarily mean that they are also effective in integrating them.

Discussion

University teachers feel competent in utilizing ICT tools; however, their ability to integrate these tools effectively into their pedagogical practices remains comparatively low. This statement is supported by the fact that Tondeur et al (2017) say that a large proportion of university teachers cannot accommodate new teaching methods to align with technological tools, as they need improved training in integrating technology and pedagogy. Moreover, in agreement with Ertmer et al (2012), a teacher with technology knowledge usually has several limitations to make instructional decisions within his/her comfort zone in relation to the integration of ICT with a student-centered approach. These facts back the findings of the current study; the university teachers are technically sound, but there is a missing link between translating the skills into pedagogy and

passing on such risks to enhance better learning outcomes. Having technological competence alone is insufficient; teachers need explicit training that integrates technology into pedagogy to ensure effective ICT integration (Tondeur et al., 2017; Koehler & Mishra, 2009). Likewise, teachers tend to work within their comfort zones and practice tools in limited ways rather than adopting new, student-centered methods (Ertmer, 2012; Redecker, 2019). The study concluded that the ICT integration competence was the same in male and female university teachers across teaching faculties with varied teaching experience; thus, there was no difference. Backed by the works of Mahdi et al (2013) and Dolighan (2021), which state the lack of significant differences between teaching experiences and genders of the teachers in terms of their competence. This implies that the difficulties of ICT integration are systematic, not demographic, where institutional reactions are needed instead of depending on individual characteristics (Kotlyarova et al, 2019). The works by Kotlyarova et al (2019) and Redecker (2019) also stress that digital literacy is one of the core skills that any higher education teacher should have, no matter what their background and discipline are. Digital knowledge nowadays is additional than the simple use of tools; it strains the assistances to critical association technology with instruction to improve attractive and competent learning settings (Redecker, 2019; Deng et al., 2016). The successful integration of ICT in teaching not only depends on good pedagogical skills, but it does depends on the capacity to combine the skills in both areas of pedagogy and technology.

This is reflected by the works of Tondeur et al (2017), who pointed out that ICT integration cannot succeed without the knowledge of pedagogical knowledge, but the aptitude to apply technologies differently with goals. Thus, professional growth has to go beyond fundamental ICT skills and aim at developing teachers' pedagogical incorporation skills, which make them capable of creating enabling student-centered, technology-supported learning experiences (Deng et al., 2012; Koehler & Mishra, 2009). Educators who can combine pedagogy and technology are more comfortable and capable of establishing effective learning experiences (Deng et al, 2016). The finding confirms that the real barrier is neither access to technology nor technical competence, but the capability or perceive and implement ICT from a pedagogical perspective (Ertmer & Ottenbreit-Leftwich, 2012).

Recommendation

Based on the findings of this study and the discussion, it is recommended that.

1. Human Resource (HR) Department, National Academy for Higher Education (NAHE), and the Higher Education Institutions (HEIs) should come up with a systematic ICT training course for university teachers. All these training programs start with an initial face-to-face learning that helps the students to build confidence before introducing digital-based learning (blended or full digital). The methodology may streamline how teachers effectively integrate the pedagogical strategies with digital tools in the teaching process itself.
2. The Higher Education Institutions (HEIs) should provide continuous learning, which includes updated technologies like Artificial Intelligence and digital pedagogy. Teachers can stay up to date with the changes in technology by attending workshops and practical training sessions organized by experts who will update teachers on the latest trends in technology and how they can improve their teaching procedures.
3. The Higher Education Department (HED) and Higher Education Institutions (HEIs) should define baseline digital competency standards of university teachers. These criteria are able to lead the framework of professional growth and can improve the

common and efficient incorporation of ICT throughout Higher Education.

References

- Ali, A. (2024). Perceptions and Potential: Investigating the Integration of Digital Game-Based Language Learning (Doctoral dissertation, Auckland University of Technology).
- Angeli, C., & Valanides, N. (2009). Epistemological and methodological issues for the conceptualization, development, and assessment of ICT-TPCK: Advances in technological pedagogical content knowledge (TPCK). *Computers & education*, 52(1), 154-168.
- Chen, F., Zhang, Y., & Chen, G. (2025). Exploring the effects of technology-supported collaborative inquiry and students' ICT competency on scientific literacy and subject knowledge in rural science classrooms. *Education and Information Technologies*, 1-28.
- Deng, F.; Chai, C.S.; Chin-Chung, T.; Min-Hsien, L. (2016). The relationship among Chinese practising teachers' epistemic beliefs, pedagogical beliefs and their beliefs about the use of ICT. *J. Educ. Technol. Soc.* 2016, 17, 245-256.
- Dolighan T, Teacher efficacy for online teaching during the COVID-19 pandemic. *Brock Educ J* 30(1).
- Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. *Computers & education*, 59(2), 423-435.
- Hue, L.T., Ab Jalil, H. (2013): Attitudes towards ICT Integration into Curriculum and Usage among University Lecturers in Vietnam. *International Journal of Instruction*, 6(2),53-66.
- Illeris, K. (2018). *The fundamentals of learning: Theories, methods, and practices*. Routledge.
- Koehler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education*, 9(1), 60-70.

- Kotlyarova, IO., Volchenkova, KN., Semenova, YV., Chuvashova, AD. and Lyashenko, MV. (2019), 'Development of Digital Competence of Technical Specialists in the Electronic Information and Education Environment. Proceedings of the 2019 International Conference Quality Management, Transport and Information Security, Information Technologies (IT&QM&IS), Sochi, Russia, 2019, 617-621
- Kumar, P. (2024). E-learning ecosystem in higher education institutions: Trends and practices. In *Preparing students for the future educational paradigm* (pp. 1-18). IGI Global Scientific Publishing.
- Mahdi, H. S., & Al-Dera, A. S. A. (2013). The Impact of Teachers' Age, Gender and Experience on the Use of Information and Communication Technology in EFL Teaching. *English Language Teaching*, 6(6), 57-67.
- Marjia, B. and Palmira, P. (2007). Would-be teachers' competence in applying ICT: Exposition and preconditions for development. *Informatics in Education-International Journal*, 6, 397-410.
- Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A new framework for teacher knowledge. *Teachers College Record*, 108(6), 1017-1054.
- Rahman, M. M., & Singh, M. K. M. (2023). The relationship between oral corrective feedback beliefs, practices, and influence of prior language learning experience of EFL teachers: multiple case studies. *Education Research International*, 2023(1), 6681434.
- Redecker, C., & Punie, Y. (2019). *The future of learning: Preparing for change*. Springer.
- Reiser, R. A., & Dempsey, J. V. (2017). *Trends and issues in instructional design and technology* (4th ed.). Pearson.
- Tondeur, J., Van Braak, J., Ertmer, P. A., and Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and technology use in education: a systematic review of qualitative evidence. *Edu. Tech. Res. Devel.* 65, 555-575. doi: 10.1007/s11423-016-9481-2
- Wong, J. M. S., & Li, K. C. (2025). Technology-Enabled Institutional Readiness for Agile-Blended Learning: A Framework for Educational Innovation. *SN Computer Science*, 6(3), 279.