PERTUBUHAN
TEKNOLOGI DAN INOVASI
PENDIDIKAN MALAYSIA

Teachers' Competency in Technology, Digital Innovation, and Creativity and Its Role in Supporting Curriculum Reform in Light of UNESCO's Education 2030 Strategy

Rizwan Ahmed [iD] *[a]

[a] Department of Management Sciences, University of Sindh, Jamshore, Pakistan

ABSTRACT

The aim of the study was to assess the effect of the teachers' competencies in technology, digital innovation, and creativity on curriculum changes within the context of UNESCO's Education 2030 Strategy. The change in global educational standards towards sustainable, digitally driven, and inclusive frameworks makes the adaptability of educators an essential factor. The influence of these competencies on core curriculum reform was investigated using PLS-SEM. Responses were gathered from a structured questionnaire from 263 business education teachers from different universities in Karachi, Pakistan. This study also highlights the impact of incorporated institutional support along with a nurturing an innovative and creative mindset towards solving curriculum issues. It has been discovered that there is a definite impact concerning the teacher's ability to facilitate curriculum transformation through digital and creative skills. The study provides new dimensions in respect of educational reforms and shifts within the policies of teaching and instructional systems intended for fulfilling the objectives of Education 2030. It stresses the need for purposeful eective investment in teacher training in creative digital pedagogy so that meaningful advancements towards curriculum changes can be accomplished.

1. Introduction

The integration of information technology, digital competencies, and imaginative pedagogical strategies has been at the forefront of global education reforms for several decades. With the rise of the knowledge economy and digital transformation, contemporary educational paradigms demand that teachers evolve from being content deliverers to dynamic learning facilitators (Ashour et al., 2024; AI-Akash et al., 2024). The UNESCO Education 2030 Agenda underscores the urgency of equipping learners with skills for a technologically fluid and unpredictable future, while simultaneously promoting inclusivity, creativity, and quality in education (Ally, 2019). Existing literature has emphasized that digital competence among teachers significantly enhances curriculum delivery and student engagement. The Technological Pedagogical Content Knowledge (TPACK) framework introduced by Mishra and

Koehler (2006) laid foundational groundwork in conceptualizing the intersection of technology, pedagogy, and content knowledge. Subsequent studies (Hussain & Mari, 2023; Krstikj et al., 2022) expanded on this model by highlighting the growing importance of creativity in designing technology-integrated curricula. Kamel et al. (2025), for instance, demonstrated how educators' digital creativity contributes to improved curriculum flexibility and responsiveness within higher education. The urgency of digital competency became especially pronounced in the post-COVID era, which forced educational institutions worldwide into online or hybrid models. This rapid shift exposed significant deficiencies in teacher preparedness, spanning both developed and developing contexts (Awad et al., 2024; Almagharbeh, 2025). In Pakistan, the Higher Education Commission (HEC) has made commendable efforts toward digital transformation. However, challenges persist, particularly in terms of practical teacher training. Many university educators still lack hands-on experience with digital tools, content creation software, and innovative instructional design practices (Agbonselohbor et al., 2025; Awad, 2024). While curriculum reform has transitioned from a rigid, textbook-driven model to a more participatory, competencies-based approach, its implementation is hampered by insufficient teacher capacity for digital innovation. Almagharbeh et al. (2025) argue that without training teachers in creative design and innovation, such reforms remain cosmetic. Supporting this claim, Awad et al. (2025) emphasize that creative teaching practices are essential for adapting globalized curricula to meet localized, community-specific educational needs. This disconnect is particularly visible in the South Asian context, especially in urban hubs like Karachi. Despite policy-level reform initiatives, practical curriculum enactment in classrooms often remains unchanged (Awad & Mahmoud, 2024; Agbonselohbor et al., 2025). For instance, business school faculty in Karachi frequently exclude market-driven curriculum reform priorities from their academic planning processes (Mtebe, 2020). This gap stems from a limited understanding of how teachers' evolving technical skills and creative capacities influence curriculum reform. Although global policy frameworks support teacher involvement in 21st-century learning transitions, empirical studies highlight that educators frequently lack the digital fluency and creative skillsets necessary to drive meaningful curriculum transformation (Mari & Hussain, 2021; Martinez-Pelaez et al., 2025; Saleh et al., 2025).

Therefore, this study aims to explore the following objectives:
- To examine the extent of digital and creative competence among university-level educators in Karachi, Pakistan.
- To investigate how these competencies influence the practical implementation of curriculum reforms.
- To identify gaps between national curriculum reform policies and classroom-level execution from the educators' perspective.

This study addresses the UNESCO Education 2030 Strategy in how teacher competencies from a technical, digital, and creative perspective can be integrated towards curriculum reform. In contrast to earlier studies that focused only on either the technological skills of the teachers or the outcomes of the curriculum, this study combines three teacher-related elements: technical skills, digital creativity, and imagination as concurrent predictors within a structural model. Its population is bounded to business university teachers in Karachi, which enables sharper focus while still allowing for extrapolation to similar urban academic settings in other developing countries. Responding to the global appeal for innovative teaching methods, including creativity as an independent parameter alongside other skill sets of digital and technical skills adds innovation from a pedagogical standpoint. This study offers evidence empirically using PLS-SEM on the impact of teacher competencies on curriculum reforms undertaken to align with global policies to validate TPACK and digital pedagogy frameworks enhanced with the constructs of creativity and innovation. Subsequently advanced the literature on digital pedagogy by integrating notions of creativity and innovation within TPACK, arguing that implementing curriculum reform enhances these frameworks. Facilitates higher education in Pakistan and curricula in comparable contexts by corroborating the growing need to proactively address such issues to develop strategic actions. Suggests advanced curricular guides for professional development relating to the operational inflection concentrate signaling reforms in teaching at the level of execution. The findings were derived through a quantitative cross-sectional approach that gathered primary data via a self-administered questionnaire from 263 business teachers from universities in Karachi, Pakistan. The tool was modified from validated tools in previous studies for measures of technical skill, digital innovation, creativity, engagement with curriculum reform (Voogt et al., 2015; Liu et al., 2023; Ertmer & Ottenbreit-Leftwich, 2010). The data was processed in SmartPLS software where PLS-SEM was implemented to evaluate direct and mediating effects of the model. For the methodology, reliability and validity were confirmed by measuring composite reliability, AVE, and HTMT ratios.

It was especially beneficial to use PLS-SEM because the emphasis was on predicting outcomes and exploring relationships among constructs.

2. Theoretical Background

Educators actively participate in UNESCO's educational strategies as part of Education 2030, focuses on the teachers' roles within the frameworks of technology, innovation, and creativity. This study aims to provide insights using a variety of theories that offer a comprehensive understanding of the actions, teaching methods, and systems levels related to the teachers and curriculum change. Key to this understanding is the TPACK framework which argues that effective instructional change requires an in-depth incorporation of technology, pedagogy, and subject matter by teachers. With technology integration mastery, university instructors go beyond mere utilization to innovative construction of student-focused, reformed-aligned teaching. Prior empirical work supports this. Martinez-Pelaez et al. (2025) revealed that teachers with high TPACK competency actively participated in the curricular delivery realignment aimed at integrating digital learning. In parallel, Subih et al. (2024) reported that US teachers who had higher confidence in their digital-pedagogy integration skills were more willing to implement curriculum changes that supported national policy objectives. Alongside this, the Diffusion of Innovations theory (Sahi, 2006) offers a behavioral foundation for this research, arguing that curriculum reforming teachers within institutions tend to be early adopters and thus serve as curriculum change facilitators. This is particularly important concerning digital change in teaching. In Hong Kong, Martinez-Pelaez et al. (2025) demonstrated that the use of technological pedagogical tools by teachers predicted their active participation in new form curriculum planning. Hussain & Mari (2023) reported that the change-minded Saudi university educators advocated for the adoption of localized and culturally-responsive curriculum which expedited policy endorsement and execution at the faculty governance level. Creativity is yet another core construct that plays an especially transformative role when viewed through the prism of Mezirow's Transformative Learning Theory (2018). Teachers displaying creatively progressive pedagogical practices tend to reflect on deeper levels and critique and go beyond the traditional curriculum content to design content that is forward-looking and inclusive (Alsharawneh et al., 2025). Awad & Mahmoud (2024) corroborated that hybrid educators's creative reflection processes led to redefinition of assessment models corresponding with 21st century competencies. This was further built by AI-Akash et al. (2024) who argued that creativity facilitates curriculum authorship by teachers, increasing ownership and success of reforms. Along with these theories, perspectives from constructivist learning highlight that knowledge is constructed by students from experiences provided to them by the teachers. Teachers who apply digital creativity and innovation to devise those environments—especially through multimedia, simulations, and collaboration—merge curriculum design with constructivist principles (Ally, 2019). Almagharbeh (2025) noted that educators employing engagement tools like flipped learning, case-based digital modules, and peers taught other students were better aligned with policy-curriculum changes. In the Pakistani context, Alsharawneh et al. (2025) demonstrated that adopting such creative constructivist approaches markedly enhanced the engagement and responsiveness to curriculum change initiatives. This is where the theory of Competency Based Education (CBE) (Johnstone & Soares, 2014) integrates the other limbs of this framework. It advocates for educators to possess the very skills that their educational institutes seek to develop in students(EISayary, 2023). EI Gareh et al. (2025) conceded that teachers' alignment with reforms was secondary to their competency based advocacy when they possessed outcome based instructional design and digital assessment competencies. Din et al. (2024) similarly highlighted the absence of creative and digital skills among the faculty in the University of Karachi as a significant impediment to the alignment with thePakistan higher education curriculum reforms. Supporting evidence adds to this complex framework. Ong & Annamalai (2024) reported that the ability to create digitally enhanced curriculums enabled some Chinese teachers to integrate AI technologies into instruction as teaching. Hussain & Mari (2023) described that in Karachi, faculty were heavily restrained in supporting curricular changes due to inadequate training in digital innovations. Kamel et al. (2025) further described the lack of institutional guidance in preparing teachers adequately with the creativity and technology needed to foster reform. Mari & Hussain (2022) in the Gulf confirmed that educators who underwent training on hybrid teaching were more aligned with the Education 2030 vision on competencies, especially on equity, access, and innovation. This research builds a strong conceptual framework by synthesizing literature and research from various but related theories and empirical insights. This framework suggests that dynamic capabilities of teachers, in particular their technical skills, competencies in digital innovation, and creativity, each have substantial and independent contributions to the teachers' capacity to enable curriculum change alignment with international strategies. This utilizes data gathered

from business university teachers in Karachi, a region that is both under-explored and rapidly evolving, through Partial Least Squares Structural Equation Modeling (PLS-SEM) to evaluate these relationships empirically.

2.1 Technical Skills and a Teacher's Competency

The technical skills of teachers represent the basic level of competence that allows educators to participate meaningfully with curriculum changes, especially those relating to global initiatives like UNESCO's Education 2030. There is always curriculum literacy in which educators who are aware of educational technologies, digital literacy, and infrastructural tools such as Learning Management Systems (LMS), multimedia, and virtual classrooms tend to have greater capacity to adopt and implement innovations in curriculum (Almagharbeh, 2025). Different studies such as Alsaraireh et al. (2024) also discuss the impact of integrated technical skills on the capability of teachers to implement methodologies that increase the relevance and quality of curriculum delivery. In emerging markets like Pakistan, Alsaraireh et al. (2023) reveal that the technical competencies provided through training directly influence teachers' meaningful participation in curriculum change processes. Moreover, Hussain & Khan (2025) underscore the importance of having adequate technical skills in teaching for effective engagement in national and international digital education reforms. On the other hand, a lack of technical knowledge has emerged as a significant barrier, hindering teacher engagement in reform processes, as reported by (Hussain, 2023). Consequently, above average technical skills are needed for teachers to efficiently participate in curriculum reform programs, which makes its benefits on teacher competency both rationally valid and psychologically proven.

H1: There is a constructive correlation between the level of Technical skills and the adequacy of teachers' competencies in implementing curriculum reform based on UNESCO's Education 2030 Strategy.

2.2 Digital Innovation Capabilities and Teacher's Competency

Teachers' digital innovation competencies include their ability to creatively assimilate new digital tools and technologies into redesign frameworks for instructional delivery and curriculum to align with international education benchmarks. Considerable evidence finds that teachers who are more skilled in digital innovation through technology are more proactive in restructuring curricula, especially in contexts with shifting technologies (Mahmoud et al., 2025). For example, Kamel et al., (2025) showcased that educators, who have been innovative with digital resources such as adaptive learning systems and AI-driven applications, enhance curricular content relevance and liveliness. Equally, Hussain & Mari (2023) noted that university lecturers who had strong digital innovation capabilities played a central role in adapting curricula to culturally relevant and anticipatory frameworks during national educational reforms. Din et al., (2024) additionally verified that teachers' proficiency in using state-of-the-art technologies affects the extent to which they actively participate in curriculum development aligned with the principles set by Education 2030 such as inclusivity, creativity, and lifelong learning. Supporting these findings, Almagharbeh et al., (2019) remarked that in the context of Pakistan, faculties of higher learning who possessed higher skills in digital innovation were more proactive to reforms that incorporated multimedia, virtual teamwork, and hands-on learning experiences. On the flip side, Abdelkader et al. (2024) noted that lack of digital innovation skills contribute to ineffectiveness and resisting change in efforts to reform curriculum. Therefore, digital innovation skills help educators move beyond the confines of conventional teaching paradigms and are critical for accomplishing curriculum changes in harmony with UNESCO's visionary educational strategies, which substantiates the hypothesis.

H2: There is a direct relationship between having Digital innovation competencies and the level of a teacher's competencies in aiding curriculum reform in relation to the 2030 strategy for UNESCO's Education Vision.

2.3 Creativity skills and teacher's competency

A teacher's creativity skills, including developing relevant teaching and learning strategies, constructing different and engaging activities, and flexibly tailoring content, are important in heightening their competency to enable transformative curriculum reform initiatives. There's a consistent expectation among scholars that teachers with high creative capacities are better able to rethink and reformulate curricula that aligns with the 21st century skills mandate issued by UNESCO (Villar-Onrubia et al., (2022). Worku et al. (2025) demonstrated that creative teaching enhances the integration of 21st century skills, critical thinking, problem solving, and learner-centered approaches to pedagogy into the curriculum redesign. Yacoub et al. (2025) emphasized teacher creativity as fundamental for

cultivating professional ownership of curriculum change, collaborative inventive culture, and overcoming institutional inertia. Within higher education, Tomczyk (2024) found that university faculty who creatively design courses tend to engage more meaningfully with curriculum reforms and integrate interdisciplinary and multicultural content. In the same manner, Tomzyk & Fedeli (2021) linked creativity to the use of new digital technologies and learning activities which are essential for modernizing the curriculum. In Pakistan, Subih et al. (2024) found that the absence of creative pedagogical skills among the teachers severely constrained their ability to adapt the curricula to meet varying reform agendas at the regional, national, and international levels. Ong & Annamalai (2024) validated once again that creative educators are instrumental in integrating sustainability, inclusivity, and lifelong learning into curricula. Additionally, Mari & Hussain (2021) highlighted that creativity, when blended with technical and digital skills, enhances the effectiveness of teachers in implementing reforms. Therefore, the influence of creativity skills on enhancing teachers' competencies towards curriculum reform at all educational levels is profoundly corroborated by an overwhelming body of empirical research and theoretical constructs governed by UNESCO's Education 2030 framework.

H3: Creativity skills have a positive correlation with the level of teachers' competency in supporting curriculum reform according to the strategy defined in UNESCO's Education 2030 agenda.
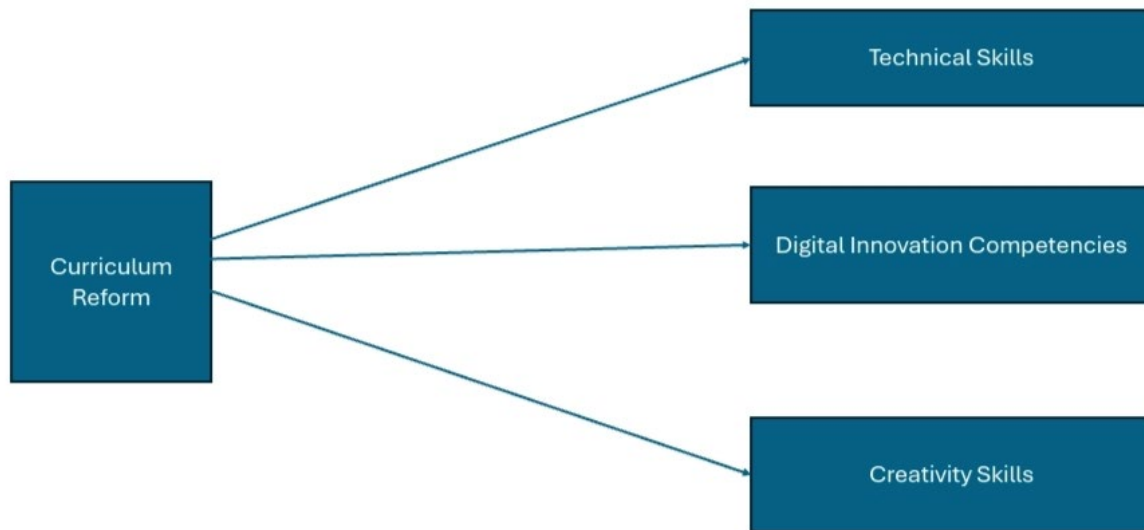
Figure 1. Conceptual Model

Methodology

This investigation adopted a quantitative approach using a structured questionnaire to collect data from business university teachers in Karachi, Pakistan. A survey method was selected due to its ability to reach a broad respondent base across various institutions within the designated timeframe (January to April 2025). Although qualitative methods such as interviews could have offered deeper insights, the quantitative survey enabled broader generalization and robust statistical analysis using Partial Least Squares Structural Equation Modeling (PLS-SEM), which is suitable for complex, multi-construct models.

3.1 Sampling Strategy:

The study employed a purposive sampling technique to target faculty members from five prominent public and private universities in Karachi: Institute of Business Administration (IBA), University of Karachi, Bahria University, SZABIST, and Hamdard University. These institutions were selected based on their influential role in shaping business education and active engagement in curriculum development aligned with national and international education reform agendas. The purposive strategy was justified by the need to focus on educators who are directly involved in curriculum planning and delivery within business faculties.

A total of 320 questionnaires were distributed both in-person (during departmental meetings) and via online platforms. Out of these, 263 valid responses were collected, yielding an effective response rate of 82.2%, which was deemed sufficient for rigorous SEM analysis and reflective of the academic diversity within Karachi's business education sector.

3.2 Ethical Considerations:

Ethical approval for this study was obtained from the University of Sindh, Jamshore, Pakistan. All participants were briefed about the research purpose, assured of confidentiality, and informed that their participation was voluntary. Informed consent was obtained from all respondents prior to their participation in the survey.

3.3 Instrumentation:

The survey instrument was developed based on an extensive review of prior literature and validated constructs relevant to educational technology, teacher creativity, and curriculum reform. It included four primary constructs:

- Technical Skills: Proficiency in using educational technologies, tools, and software for instructional delivery (Hussain, 2025).

- Digital Innovation Competencies: Ability to adopt innovative platforms and digital aids for enhancing creativity in teaching (Hussain & Khan, 2025; El Gareh et al., 2025).

- Creativity: Engagement in designing novel learning experiences and pedagogical approaches (Hussain & Khan, 2025).

- Teacher Competence in Curriculum Reform: Teachers' contributions toward aligning classroom teaching with UNESCO Education 2030 curriculum reforms (Hussain, 2023; 2024; Gisbert Cervera & Caena, 2022).

All items were measured using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), allowing respondents to express varying levels of agreement. Examples of sample items include:

- Professional Skills: "I and my staff members facilitate the learning activities in our academic programs using the course management tools that the unit has set up" (Hussain, 1988).

- Emerging Technology Engagement: "I use new digital technologies for better student participation in my courses" (Hussain, 2024).

- Creative Thinking Skills: "In my classes, I implement original activities aimed at fostering critical analysis or evaluation of tasks within the students" (Hussain, 2023).

- Curriculum Reform Competence: "I contribute to the development of curricular frameworks for education systems responsive to global trends" (Gisbert Cervera & Caena, 2022).

3.4 Demographic Data:

Demographic information collected included age, gender, highest educational qualification, years of teaching experience, and university affiliation. These variables helped contextualize the results and analyze the diversity within the sample. Notably, 47% of the respondents were aged between 35–45 years, while 33% were over 45, indicating a mature and experienced academic population. This profile suggests that many respondents had likely experienced multiple cycles of curriculum change and were in positions to influence institutional pedagogical practices.

4. Data Analysis

4.1 Descriptive Analysis

The responses obtained through the five-point Likert scale, wherein 1 denotes "Strongly Disagree" and 5 represents "Strongly Agree", were used to compute the descriptive statistics for each construct within the study model. For easier understanding, the mean scores were classified into categories using the interval classification by Kwateng and Darko (2017): 1.00–1.80 = Very Low; 1.81–2.60 = Low; 2.61–3.40 = Moderate; 3.41–4.20 = High; 4.21–5.00 = Very High. The analysis of the data shows that participants largely agreed on the significance and existence of the fundamental competencies among business university teachers in Karachi. Participants perceived a mean score of 3.12 (SD = 0.79) on technical skills, which demonstrates a moderate level of educational technology and digital tools proficiency. The mean score for digital innovation competencies was 3.18 (SD = 0.83), which indicates a moderate to high level of adoption of innovative digital practices in teaching and curriculum interaction. The means for creativity skills construct was somewhat higher at 3.39 (SD = 0.91). This indicates that information technology teachers consider themselves moderately creative in formulating instructional design and curricular development plans. Additionally, respondents evaluate their level of engagement and expertise in curriculum development activities relevant to the Education 2030 Strategy by UNESCO as actively engaged, where teacher competency in curriculum reform received a mean score of 3.46 (SD = 0.68), categorized as high.

4.2 Reliability and Validity of the Model

The assessment of the reliability and validity of the measurement model was performed to ensure the constructs utilized in this study were reliable and accurate. The validity of the measurement model was confirmed by the external loadings of all measurement items whose loadings supported their contribution to the latent constructs. These loadings also confirmed that the data met the requirements for structural equation modeling and path analysis. The internal consistency reliability was evaluated through the Cronbach's alpha which presumes all the indicators of the respective construct rest on the same latent variable. The findings indicate that in all the constructs, there is strong reliability as the value of Cronbach's alpha in all the constructs was found to be between 0.78 and 0.90, which is above the generally accepted benchmark of 0.70. This signifies a high degree of internal consistency and reliability of the measurement scales used. The study evaluated convergent validity using Average Variance Extracted (AVE) as suggested by Fornell and Larcker (1981). AVE values exceeding 0.50 verify that the constructs account for more than half of the variance of their indicators which proves construct validity and relevance. Each of the constructs in this study had AVE values above 0.50 which means they had adequate convergent validity. Reliability was also assessed through the means of outer loadings. Outer loadings of 0.708 or higher are regarded as optimal, although values slightly below 0.70 are also viewed as satisfying and acceptable. In this research, the loadings were between 0.69 and 0.88, with most of them exceeding the benchmark, thus the measurement items were shown to adequately capture their respective constructs. Measurements of Composite Reliability (CR) were equally calculated and all were greater than 0.80, thus reinforcing the trustworthiness of the model.

Table 1. Reliability and Validity of Constructs

Constructs	Item	Outer loadings	Cronbach' s alpha	AVE	CR
Technical skills (TS)	TS1	0.732	0.876	0.659	0.823
	TS2	0.691			
	TS3	0.754			
	TS4	0.723			
	TS5	0.837			
	TS6	0.704			
Digital Innovation Competencies (DIS)	DIS1	0.819	0.891	0.681	0.859
	DIS2	0.858			
	DIS3	0.779			
	DIS4	0.743			
	DIS5	0.791			
	DIS6	0.726			
	DIS7	0.821			
	DIS8	0.804			
Creativity Skills (CS)	CS1	0.813	0.785	0.636	0.832
	CS2	0.722			
	CS3	0.789			
	CS4	0.773			
	CS5	0.705			
	CS6	0.718			
	CS7	0.849			
	CS8	0.739			
Teacher Competency in Curriculum Reform (TCCR)	TCCR1	0.838	0.822	0.595	0.803
	TCCR2	0.808			
	TCCR3	0.769			
	TCCR4	0.750			
	TCCR5	0.762			
	TCCR6	0.788			
	TCCR7	0.705			
	TCCR8	0.865			
	TCCR9	0.773			
	TCCR10	0.755			

4.3 Discriminant Validity

Discriminant validity is a crucial aspect of measurement model evaluation that ensures each construct distinctly measures a unique concept, without excessive overlap with other constructs. This study employed two rigorous criteria to assess discriminant validity: the Fornell-Larcker criterion (Fornell & Larcker, 1981) and the Heterotrait-Monotrait (HTMT) ratio (Henseler et al., 2015). According to the Fornell-Larcker criterion, the square root of the Average Variance Extracted (AVE) for each construct must be greater than the highest correlation of that construct with any other construct in the model. This criterion was met across all constructs, demonstrating that each latent variable captures more variance from its indicators than it shares with other constructs. Additionally, the HTMT ratio was calculated for all pairs of constructs. The HTMT values were all below the conservative threshold of 0.85, well within the recommended upper limit of 0.90, indicating strong discriminant validity and minimizing concerns of construct multicollinearity or redundancy. These findings collectively confirm that the constructs—Technical Skills (TS), Digital Innovation Skills (DIS), Creativity Skills (CS), and Teacher Competency in Curriculum Reform (TCCR)—are conceptually distinct and measured with precision. This robust discriminant validity supports the integrity of the measurement model and validates the data quality for subsequent structural analysis and hypothesis testing.

Table 2. Discriminant Validity (Fornell-Larcker Criterion & HTMT Ratios)

Constructs	TS	DIS	CS	TCCR
TS	0.872			
DIS	0.693	0.796		
CS	0.658	0.629	0.839	
TCCR	0.645	0.594	0.701	0.881

Note: Bold diagonal values represent the square root of AVE for each construct; off-diagonal values are the correlations between constructs.

Table 3. Hypotheses Testing Results

Hypotheses	Path	Path Coefficients (β)	T-value	P-value	Results
H1	TS>TCCR	0.523	10.487	0.000	Supported
H2	DI>TCCR	0.566	9.842	0.000	Supported
H3	CS>TCCR	0.541	11.176	0.000	Supported

The results from the structural model indicate that all of the proposed hypotheses were supported. The effect of technical skills on curriculum reform (CR) was considerable (β = 0.523, t = 10.487, p < 0.001), meaning that teachers with strong technical skills tend to comply with current curricular and instructional reforms. vAlso, digital innovation skills had a considerable positive effect on CR (β = 0.566, t = 9.842, p < 0.001) supporting the argument that the knowledge and use of digital tools improves teachers' abilities to implement technology-oriented changes.vAdditionally, creativity skills had a positive and considerable effect on CR (β = 0.541, t = 11.176, p < 0.001) indicating that creative teaching strategies enable teachers to modify and design learning materials for various learners and promote critical thinking in students.b All path coefficients are strong and statistically significant at the 0.001 level, which suggests that this model is well-fitted confirming the main argument of this study which is that multi-dimensional teacher competencies are fundamental drivers of effective curriculum reform based on UNESCO's directions for education policies worldwide.

5. Discussion

This study explored how technical skills, digital innovation competencies, and creativity contribute to business university teachers' competencies in implementing curriculum reform, aligned with UNESCO's Education 2030 agenda in Pakistan. The findings empirically confirm that all three competencies significantly and positively influence teacher effectiveness in curriculum reform efforts, highlighting the need for a multifaceted skillset in higher education. Teachers self-reported higher levels of creativity, followed by technical skills and digital innovation competencies. This finding echoes Bitegeko et al. (2024), who emphasized the adaptability that creative thinking brings to evolving curricula. Likewise, Armutcu et al. (2025) and Aslam et al. (2025) reaffirm that technical proficiency enables the effective application of digital tools, which is essential for pedagogical innovation. The strong relationship between digital innovation competencies and curriculum reform supports Dreidi et al. (2024), who found that educators' ability to digitally transform content is integral to aligning with global educational shifts. This is reinforced by UNESCO's advocacy for digital frameworks in its 2030 education vision (ElSayary, 2023). Creativity, as validated by Caena & Redecker (2019) and Ghonim & Awad (2025), not only fosters critical thinking but enhances instructional design tailored to diverse learner needs. Importantly, this study reveals interconnectedness among the constructs: creativity supports innovative use of digital tools, and both are rooted in a baseline of technical competence. While each competency independently predicts teacher competency in curriculum reform, their synergistic interaction— though not directly tested—suggests that integrated professional development programs may produce stronger outcomes than siloed training. Future research should explore this intersection empirically. From a comparative perspective, while similar skill demands are being emphasized globally—such as in Finland's teacher training reforms or Singapore's digital competency frameworks—Pakistan still faces infrastructure and policy-level barriers. Therefore, the findings underscore an urgent need for contextual adaptation of global standards to local realities, especially in developing nations where teacher support systems may be underdeveloped. The demographic insights showed that teachers with higher academic qualifications and longer experience reported greater competency levels,

aligning with Din et al. (2024), who posited that such traits serve as moderating factors in curriculum innovation efficacy.

Theoretical Implications

This study extends the theoretical discourse on curriculum reform by positioning teacher competencies as multidimensional and interdependent constructs. It contributes to the UNESCO Education 2030 framework by empirically validating the roles of technical skills, digital innovation, and creativity in enhancing instructional effectiveness. It also supports a constructivist view of teacher learning, where competencies are developed through dynamic interaction with technology and pedagogical challenges. Moreover, it introduces the idea of "inter-curriculum reform competence"—a concept representing the integration of various competencies that collectively drive reform outcomes. Future theoretical models should further explore the mediating or moderating relationships among these skillsets.

Practical Implications

For policymakers: There is a need to design integrated teacher training modules that simultaneously build technical, digital, and creative capacities rather than focusing on them in isolation.

For educational institutions: Curriculum developers must align teacher development strategies with both national policies and international benchmarks like the SDGs, particularly SDG 4 on quality education.

For teacher trainers: Programs should incorporate experiential learning, collaborative digital tools, and creative problem-solving workshops to equip teachers with relevant reform-oriented skills. The findings reinforce the idea that teacher competency development is a critical pillar in achieving quality education and curriculum responsiveness, especially in under-resourced contexts like Pakistan.

Limitations and Future Research Directions

While the study offers important contributions, several limitations should be acknowledged. The study's cross-sectional nature limits causal inferences. Future research should adopt longitudinal designs or time-series approaches to track how teachers' competencies evolve and influence curriculum outcomes over time. Data was collected exclusively from business university teachers in Karachi. This limits generalizability to other disciplines, geographic regions, or educational systems. Comparative studies across different subject domains, cities, or countries would broaden the applicability of the findings. Reliance on self-reported data may introduce social desirability bias. Participants could have overestimated their competency levels or success in implementing reforms. Future studies should incorporate triangulated methods, such as peer reviews, classroom observations, or student feedback, for more objective assessments. The study focused only on three competencies—technical skills, digital innovation, and creativity. Other relevant competencies like pedagogical content knowledge, emotional intelligence, adaptability, and leadership were not examined. A more comprehensive model would yield a deeper understanding of teachers' multifaceted influence on educational reform. The model did not include institutional support, resource availability, or policy infrastructure as potential moderators or mediators. These contextual variables may significantly influence how teacher competencies translate into curriculum reform outcomes. Future research should consider these environmental and systemic factors. As educational technologies continue to evolve, there is a growing need to investigate emerging competencies and pedagogical strategies aligned with UNESCO's Education 2030 vision. Future studies should focus on adaptive frameworks that respond to technological advances, artificial intelligence, and hybrid learning models. By addressing these limitations, future research can more robustly inform global education policy and practice, advancing the discourse on teacher competency development in transformative educational reform.

6. Conclusion

This study contributes to the growing body of literature on teacher competencies by empirically demonstrating how technical skills, digital innovation, and creativity significantly enhance business university teachers' capacity to implement curriculum reform in line with UNESCO's Education 2030 strategy. The results confirm that these competencies, while distinct, collectively foster teaching responsiveness, adaptability, and innovation—key drivers of effective educational transformation in developing country contexts. By focusing on educators in business universities in Karachi, Pakistan, the study offers valuable localized insights, while also aligning with global frameworks advocating for inclusive and quality education. Notably, the research highlights that creativity was perceived as the strongest competency, followed by technical skills and digital innovation, suggesting differentiated strengths among educators that should guide professional development planning. The findings underscore the need for holistic teacher development programs that integrate digital fluency, creative pedagogy, and technical competence. These programs must be context-sensitive yet globally informed, reflecting the multifaceted demands placed on educators in a digitally evolving academic landscape. Ultimately, this research provides actionable insights for policymakers, institutions, and curriculum designers working toward achieving SDG 4, which envisions equitable and high-quality education for all.

References

Ally, M. (2019). Competency profile of the digital and online teacher in future education. *International Review of Research in Open and Distributed Learning, 20(2).*

Awad, A., Shemais, M., & Al-Embabi, M. (2024). Driving HR performance through digital transformation in educational directorates: A strategic imperative. *Problems and Perspectives in Management, 22(4), 163-173.*

Almagharbeh, W. T. (2025). The impact of AI-based decision support systems on nursing workflows in critical care units. *International nursing review, 72(2), e13011.*

Almagharbeh, W., Alhassan, M., AlMotlaq, M., & Taher, R. (2019). Family needs of critically ill patients in Central Jordan: a family perspective. *Hospitals, 12(16), 18-19.*

Al-Akash, H., Aldarawsheh, A., Elshatarat, R., Sawalha, M., Saifan, A., Al-Nsair, N., … & Eltayeb, M. (2024). "We do others' Jobs": a qualitative study of non-nursing task challenges and proposed solutions. *BMC nursing, 23(1), 478.*

Awad, A., Kordy, A., Hassan, A., & Aal, H. A. (2025). The role of blockchain technology in advancing supply chain innovation: A *descriptive-analytical study.*

Awad, A. (2024). Artificial intelligence and marketing innovation: The mediating role of organizational culture. *Innovative Marketing, 20(3), 170.*

Almagharbeh, W. T., Alfanash, H. A., Alnawafleh, K. A., Alasmari, A. A., Alsaraireh, F. A., Dreidi, M. M., & Nashwan, A. J. (2025). Application of artificial intelligence in nursing practice: a qualitative study of Jordanian nurses' perspectives. *BMC nursing, 24(1), 92.*

Agbonselohbor, B., Aslanoğlu, A., Bilgiç, N., Alsharawneh, A., Elshatarat, R. A., Saleh, Z. T., … & Eltayeb, M. M. (2025). Associated factors of Nigerian Nurses' Emotion regulation, perceived stress, and coping mechanism during COVID-19 Pandamic: a cross-sectional study. *African Health Sciences, 25(1), 84-110.*

Awad, A., & Mahmoud, M. (2024). Impact of electronic customer relationship management on competitive advantage: Mediating role of customer satisfaction in EgyptAir. *Problems and Perspectives in Management, 22(3), 276.*

Ashour, A. M., Masa'deh, R., Hamaideh, S. H., Elshatarat, R. A., Yacoub, M. I., Almagharbeh, W. T., … & Eltayeb, M. M. (2024). Examining the influence of anxiety and depression on medication adherence among patients diagnosed with acute myocardial infarction. *BMC psychology, 12(1), 473.*

Abdelkader, R., Maabreh, R. S., Al-Dgheim, R., Altarawneh, N. S., Alrabab'a, M. H., Zaiton, H., … & Elshatarat, R. A. (2024). The impact of tobacco use and nicotine addiction on health: A literature review of nursing interventions for smoking cessation. *Journal of Integrative Nursing, 6(4), 218-230.*

Aslam, S., Majeed, M. U., & Hussain, Z. (2025). The Effect of NFTs Metaverse Engagement and Digital Personalization on Brand Accessibility: The Mediating Role of Inclusive Brand Strategies. In *Metaverse and Sustainable Business Models in SMEs (pp. 291-316). IGI Global Scientific Publishing.*

Armutcu, B., Majeed, M. U., Hussain, Z., & Aslam, S. (2025). The impact of digital voice of customer and product lifecycle management on Quality 4.0: moderating role of AI in SMEs. *Journal of Manufacturing Technology Management, (ahead-of-print).*

Alsaraireh, F., Al-Oran, H., & Al-Magharbeh, W. (2023). The Impact of Stress on Sleep Pattern and Academic Performance among Nursing Students in Jordan: A Cross Sectional Study. *ASEAN Journal of Psychiatry, 24(4), 1-15.*

Alsharawneh, A., Elshatarat, R. A., Alsulami, G. S., Alrabab'a, M. H., Al-Za'areer, M. S., Alhumaidi, B. N., … & Saleh, Z. T. (2025). Triage decisions and health outcomes among oncology patients: a comparative study of medical and surgical cancer cases in emergency departments. *BMC Emergency Medicine, 25(1), 69.*

Alsharawneh, A., Sawalha, M., Tabar, N. A., Elshatarat, R. A., Almarwani, A. M., Saleh, Z. T., … & Eltayeb, M. M. (2024). Impact of triage nurses' recognition of acute coronary syndrome on patients' clinical outcomes: A retrospective study. *Heart & Lung, 68, 60-67.*

Alsaraireh, M., Al-Kalaldeh, M., Alnawafleh, K., Dwairej, D. A., & Almagharbeh, W. (2025). Associated Factors Influencing Quality of Life and Knowledge Among Type 2 Diabetic Patients: A Cross-Sectional Study. *Current Diabetes Reviews, 21(2), E090224226838.*

Aldarawsheh, A. A., Saifan, A. R., Sawalha, M. A., Assaf, E. A., Alrimawi, I., Elshatarat, R. A., … & Eltayeb, M. M. (2024). Exploring the causes and consequences of non-nursing tasks among nurses in Jordan: An in-depth qualitative investigation. *Applied Nursing Research, 77, 151791.*

Bitegeko, R. M., Lawrent, G., & Cosmas, J. (2024). Applying the UNESCO ICT competency framework to evaluate digital competencies among undergraduate students in teacher education in Tanzania. *Educational Technology Quarterly, 2024(3), 298-318.*

Blyznyuk, T. (2018). Formation of teachers' digital competence: domestic challenges and foreign experience. *Journal of vasyl stefanyk precarpathian National University, 5(1), 40-46.*

Caena, F., & Redecker, C. (2019). Aligning teacher competence frameworks to 21st century challenges: The case for the European Digital Competence Framework for Educators (Digcompedu). *European journal of education, 54(3), 356-369.*

Dreidi, M., Abed, D., Salameh, H., Sbeih, I. A., Asmar, S., Salameh, S., … & Almagharbeh, W. T. (2024). The effect of self-esteem on stress and coping mechanisms among nursing students during clinical training in Palestinian universities. *International Journal of Practice-based Learning in Health and Social Care, 12(1), 59-69.*

Din, A. L., Qamar, N., Abaid, T., Akhter, N., Alfanash, H. A., & Almagharbeh, W. T. (2024). Daily Management Insights: A Social Phenomenological Study Of Head Nurses. *Frontiers in Health Informatics, 13(4).*

El Gareh, F., Elmenssouri, A., Oulamine, A., & Hussain, Z. (2025). A PRISMA-Based Systematic Review on Organizational Commitment and Logistic Performance. *Knowledge Sharing and Fostering Collaborative Business Culture, 213-240.*

ElSayary, A. (2023). The impact of a professional upskilling training programme on developing teachers' digital competence. *Journal of Computer Assisted Learning, 39(4), 1154-1166.*

Espejo Villar, L. B., Lázaro Herrero, L., & Álvarez-López, G. (2022). UNESCO strategy and digital policies for teacher training: The deconstruction of innovation in Spain. *Journal of New Approaches in Educational Research, 11(1), 15-30.*

Falloon, G. (2020). From digital literacy to digital competence: the teacher digital competency (TDC) framework. *Educational technology research and development, 68(5), 2449-2472.*

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of marketing research*, *18*(1), 39-50.

Ghonim, A., & Awad, A. (2025). Leveraging E-Marketing for enhancing customer knowledge management: A systematic review of tourism strategies in the Saudi Arabian context. *Journal of Ecohumanism, 3(8).*

Gisbert Cervera, M., & Caena, F. (2022). Teachers' digital competence for global teacher education. *European Journal of Teacher Education, 45(4), 451-455.*

Hassan, H. M., Zubair, A., Helal, M. H., Almagharbeh, W. T., & Elmagzoub, R. M. (2025). New hope and promise with CRISPR-Cas9 technology for the treatment of HIV. *Functional & Integrative Genomics, 25(1), 1-11.*

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the academy of marketing science*, *43*, 115-135.

Hussain, Z., & Khan, A. (2025). Driving Retail Growth: The Interplay of Customer-Centric Technology, Customer Accountability and Organisational Culture. In *Marketing 5.0: The Role of Human-Mimicking Technology (pp. 13-26). Emerald Publishing Limited.*

Hussain, Z. (2023). A Study of Employees' Perceptions on Industry Revolution 5.0 and Its Advantages: A Case Study of the Manufacturing Industry of Pakistan. *Business, Technology and Finance, 25.*

Hussain, Z. (2024). Electronic Word of Mouth (eWOM) and Consumer Purchasing Behaviour: A Study in Karachi's Digital Era. In *Digital Influence on Consumer Habits: Marketing Challenges and Opportunities (pp. 159-169). Emerald Publishing Limited.*

Hussain, Z., & Mari, A. K. (2023). Legal Protection of Customer Privacy on E-commerce: A comparative study of Iranian and American Law. *International Journal of Marketing, Communication and New Media, (12).*

Hussain, Z. (1988, May). Enhancing Transparency and Accountability in Sadaqah Crowdfunding Platforms: Leveraging Blockchain Technology for Optimal User Experience. In *Annual International Conference on the Theory and Applications of Cryptographic Techniques (pp. 351-367). Cham: Springer Nature Switzerland.*

Hussain, Z. (2025). AI-driven personalization and purchase intention in modest fashion: Sharia compliance as moderator. *International Journal of Halal Industry, 1(1), 33-45.*

Hussain, Z. (2023). The Use of Web 3.0 in University E-learning, Quality Assurance, and Knowledge Management. In *Advances in Distance Learning in Times of Pandemic (pp. 155-176). Chapman and Hall/CRC.*

Johnstone, S. M., & Soares, L. (2014). Principles for developing competency-based education programs. *Change: The Magazine of Higher Learning, 46(2), 12-19.*

Krstikj, A., Sosa Godina, J., García Bañuelos, L., González Peña, O. I., Quintero Milián, H. N., Urbina Coronado, P. D., & Vanoye García, A. Y. (2022). Analysis of competency assessment of educational innovation in upper secondary school and higher education: a mapping review. *Sustainability, 14(13), 8089.*

Kamel, M., Aleya, S., Almagharbeh, W. T., Aleya, L., & Abdel-Daim, M. M. (2025). The emergence of highly pathogenic avian influenza H5N1 in dairy cattle: implications for public health, animal health, and pandemic preparedness. *European Journal of Clinical Microbiology & Infectious Diseases, 1-17.*

Mtebe, J. S. (2020). Applying UNESCO ICT competency framework to evaluate teachers' ICT Competence Levels in Tanzania. In *Handbook of research on innovative pedagogies and best practices in teacher education (pp. 350-366). IGI Global.*

Mahmoud, M., Shma, T., Aziz, A., & Awad, A. (2025). Integrating knowledge management with smart technologies in public pharmaceutical organizations. *Knowledge and Performance Management*, 9(1), 31.

Mari, I. H., & Hussain, Z. (2021). Climate Change in Pakistan: Govt Efforts to Reduce the Climat Change Threats. *European journal of innovation in nonformal education, 1(1), 1.*

Mezirow, J. (2018). Transformative learning theory. In *Contemporary theories of learning (pp. 114-128). Routledge.*

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers college record, 108(6), 1017-1054.*

Martínez-Pérez, S., Cabero-Almenara, J., Barroso-Osuna, J., & Palacios-Rodríguez, A. (2022, June). T-MOOC for initial teacher training in digital competences: Technology and educational innovation. In *Frontiers in Education (Vol. 7, p. 846998). Frontiers Media SA.*

Ong, Q. K. L., & Annamalai, N. (2024). Technological pedagogical content knowledge for twenty-first century learning skills: The game changer for teachers of industrial revolution 5.0. *Education and information technologies, 29(2), 1939-1980.*

Saleh, Z. T., Aslanoğlu, A., Almagharbeh, W. T., Fadila, D. E. S., Nagoor Thangam, M. M., Al-Dgheim, R., … & Ebeid, I. A. (2025). Reducing sedentary behavior improves depressive symptoms among patients with heart failure enrolled in a home-based mobile health app cardiac rehabilitation. *Journal of Nursing Scholarship, 57(3), 394-403.*

Saleh, Z. T., Aslanoğlu, A., Elshatarat, R. A., Al-Za'areer, M. S., Almagharbeh, W. T., Alhejaili, A. A., … & Alasmari, A. A. (2025). Exploring the reasons and significant influencing factors of serious turnover intentions among nurses in Saudi Arabia. *Journal of Education and Health Promotion, 14(1), 206.*

Sahin, I. (2006). Detailed review of Rogers' diffusion of innovations theory and educational technology-related studies based on Rogers' theory. *Turkish Online Journal of Educational Technology-TOJET, 5(2), 14-23.*

Saleh, Z. T., Aslanoglu, A., Al-Dgheim, R., Sawalha, M. A., Elshatarat, R. A., Al-Akash, H. Y., … & Alharbi, M. K. (2024). Effectiveness of Triage Professionals' Knowledge and Experience on Their Ability in Early Diagnosis and Consequent Treatment of Acute Coronary Syndrome: A Literature Review Study. *Research Journal of Pharmacy and Technology, 17(8), 4075-4082.*

Subih, M., Elshatarat, R. A., Sawalha, M. A., Almarwani, A. M., Alhadidi, M., Alrahahleh, M., … & Mohamed, N. A. (2024). Exploring the Impact of Cardiac Rehabilitation Programs on Health-Related Quality of Life and physiological outcomes in patients Post Coronary artery bypass grafts: a systematic review. *Reviews in Cardiovascular Medicine, 25(4), 145.*

Tomczyk, Ł. (2024). Digital competence among pre-service teachers: A global perspective on curriculum change as viewed by experts from 33 countries. *Evaluation and Program Planning, 105, 102449.*

Tomczyk, L., & Fedeli, L. (2021). Digital Literacy among Teachers—Mapping Theoretical Frameworks: TPACK, DigCompEdu, UNESCO, NETS-T, DigiLit Leicester. In *Proceedings of the 38th International Business Information Management Association (IBIMA) (pp. 244-252). International Business Information Management Association.*

Villar-Onrubia, D., Morini, L., Marín, V. I., & Nascimbeni, F. (2022). Critical digital literacy as a key for (post) digital citizenship: an international review of teacher competence frameworks. *Journal of e-Learning and Knowledge Society, 18(3), 128-139.*

Worku, M., Belay, S., Molla, T., Amare, A., Tigabie, M., Almagharbeh, W. T., & Assefa, M. (2025). Bloodstream infections with emphasis on Methicillin-resistant Staphylococcus aureus at the University of Gondar Comprehensive Specialized and Referral Hospital, Northwest Ethiopia. *BMC Infectious Diseases, 25(1), 1-6.*

Yacoub, M. I., Aslanoğlu, A., Khraim, F., Alsharawneh, A., Abdelkader, R., Almagharbeh, W. T., … & Saleh, Z. T. (2025). Comparing E-Cigarettes and traditional cigarettes in relation to myocardial infarction, arrhythmias, and sudden cardiac death: a systematic review and meta-analysis. *Biological Research For Nursing, 27(1), 168-185.*