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Digital Leadership and Teacher Competence in Higher Education: The Mediating Role of Technology-Based Training in Karachi

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Abstract

The proposed qualitative research examines the effects of digital leadership on teacher competence that can be achieved with the help of technology-based training in Karachi higher education institutions, Pakistan. Based on the Transformational Leadership Theory and Technological Pedagogical Content Knowledge (TPACK) model, semi-structured interviews, focus group discussion and document analysis with a total of 30 participants (20 teachers and 10 administrators) resulted into a collection of data across five public and privately-owned universities. The advice of thematic analysis is that digital leadership is a force of transformation, which is led by ethical role modeling, visionary direction, intellectual stimulation, and an individualized support, rather than an administrative one. Teacher competence proved to be multidimensional and included the skills with technology, pedagogical innovation, communicating, managing a classroom, and assessing abilities. Importantly, technology-based training is the key connector between the vision on the leadership and classroom implementation; it should be effective based on the strategic alignment, quality of content and trainers, feedback systems, and validity. It is proposed that the Digital Pedagogical Leadership (DPL) Model is able to realize sustainable digital transformation through the combination of the synergist dynamics of visionary leadership, structured training ecosystem, and continuous teacher development. Results fill an important research gap in South Asian higher education and provide evidence-based suggestions to policy, leadership practice and the design of professional development in resource-restricted, culturally-specific settings.

Keywords: *Digital leadership; technology-based training; teacher competence; TPACK; transformational leadership; digital pedagogical leadership; professional development.*

1.Introduction

The twenty-first century has transformed a lot in the nature of our knowledge creation, sharing and use. Never before have colleges and universities been under this pressure. They must assist their teachers acquire appropriate skills, tools, and attitudes to perform in classrooms that are full of technology. This is where leadership comes in. Good leaders have come into the view as the prime initiator of actual change in quality of teaching. They require a committed vision, the right talents and actual commitment to digitize transformation to occur (Elçiçek, 2022).

Pakistan has significantly increased higher education in the past two decades. However, adoption of digital means of teaching and learning has been skewed. It can be on the surface in

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most instances. They have spent much on digital infrastructure in big cities universities such as those in Karachi. Nevertheless, that has not necessarily enabled teachers to be more technologically proficient. Other scholars speculate that it is not actually a technological issue. It is more related to bad leadership and lack of an organized pedagogy-based training (Mahmood, 2021). Educators frequently express their feelings that they are not prepared to apply digital tools in a manner that would really benefit learners. They highlight a discrepancy between the professions they want and what institutions do in regard to professional development.

The concept of transformational leadership is not a new one in the field of education research. It's seen as one of the best ways to bring about change. Leaders trickling clear vision, enabling their team to think, and attending to individual needs have a higher chance of creating cultures that accommodate new thoughts and gradual progress (Supriadi et al., 2022). In online learning, these attributes are even more important. Only knowing about digital tools, a leader is not a mere cheerleader of technology. They emulate it, advocate it, and ensure that teachers continue to receive the support they require to ensure their personal growth by becoming truly fluent (Aksal, 2020).

The other important concept is TPACK framework. It is the abbreviation of Technological Pedagogical Content Knowledge. This model gets us an idea of what it is that teachers need to know in order to integrate technology in their teaching of subjects. It does not view tech talents as something distinct. Rather, TPACK will tell you that good digital teaching is the process of seamlessly incorporating content knowledge, the teaching methods and the tech skills together (Rosenberg and Koehler, 2020). This model is used in many teacher education studies. It provides a powerful method of considering and developing professional competencies of the teachers in the digital era.

Although the current body of research on digital leadership and TPACK has been growing, there is still no sufficient research that focuses on the integration of the two in the Karachi higher education system. Majority of available studies are either Western or East Asian based. The experiences of teachers in South Asian cities haven't been studied much (Hallinger & Nguyen, 2020).

This study tries to fill that gap. A qualitative design will be employed in order to examine the impact of the digital leadership (enhanced by technology-based training) on the teaching performance at higher education companies in Karachi. By taking up what teachers and academic leadership really experience, we expect to deliver knowledge which suits the area. It is that knowledge that can influence policy, leadership practice, and the planning of professional development in Pakistani higher education. Hopefully, our results will be not only a contribution to the academic discourse but also assist the institutions interested in developing more digitally skilled and pedagogically creative teaching communities.

1.1 Background and Significance

Digital technology has transformed virtually everything, education being one. In the last two decades, universities around the world have been forced to re-evaluate the way they learn and work. There are new opportunities and challenges associated with such new technological tools as AI platforms and learning management systems (Tondeur et al., 2021). Once a luxury nowadays, good use of these tools has become a matter of necessity among teachers.

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Initial debates centered on Internet access and hardware. The presence of technology does not coincide with an appropriate use (Chai et al., 2021). Proper training and good leadership is equally important. Without them, even the wealthy institutions will not be able to convert tech investments into enhanced teaching.

Higher education has become an escalating phenomenon in Pakistan since the 2000s. There are numerous public and private universities and hundreds of thousands of students in Karachi. Nonetheless, there is still an uneven adoption of digital in teaching (Mahmood, 2021). A number of schools purchased online systems and failed to provide their teachers with knowledge on how to use them effectively. The COVID-19 pandemic increased this gap by imposing upon an unwanted pivot to online learning.

Every university was put to the test by the pandemic. Digitally illiterate teachers performed poorly. Lack of good leadership in institutions led to slow reactions (Basilaia and Kvadzae, 2020). Through these experiences, it was established that successful digital functioning that is long-term relies on good leadership and continual training.

Transformational leadership can be applied in the explanation of how leaders can champion digital change. In this style, one should share a clear vision, promote new ideas, provide personal attention and demonstrate the best example (Mohd Yusof et al., 2021). Digital leaders do not merely tolerate technology, but they promote it and support teachers to get through the difficulties. The style has been associated with increased teacher motivation and performance (Khan et al., 2022).

1.2 Objectives

They consist of

a) General Objective

This study seeks to examine the impact of digital leadership on teachers based on training through technology in higher academic institutions in Karachi.

b) Specific Objectives

1.To find out what digital leadership is, in practice at higher education institutions in Karachi, and how it is implemented.

2. To analyze technology based training programs design, delivery and effectiveness to teachers in Karachi higher education institutions.

3.To find out how digitally competent teachers are in Karachi's higher education institutions, and how well they understand TPACK.

4.To examine the hypothesis that technology-based training is a mediator between digital leadership and teacher effectiveness.

5.To find out the effects of transformational leadership behavior on teacher motivation, confidence and their technology use in teaching.

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6.To determine the institutional and situational obstacles that come between good digital leadership and good technology-based training in the institutions of higher education in Karachi.

7.To provide practical, evidence-based suggestions as to how the digital leadership and the use of technology based training could be refined, in order to make teachers in Karachi higher learning institutions more skilled.

1.3 Research Questions

1.What are the practices of academic leaders in higher education institutions in Karachi in terms of digital leadership practices? So what does it look like?

2.To what level are the training programs in the higher education institutions in Karachi based on technology programs? Do they come in regular intervals and fulfill the actual classroom requirement of teachers?

3.What is the level of digital competence of the teachers in Karachi institutions of higher learning? What is their TPACK (Technological Pedagogical Content Knowledge)?

4.How well does technology based training describe the relationship between the digital leadership and higher education institutions teacher effectiveness in Karachi?

5.What are the impacts of transformational leadership behaviors concerning motivation of teachers, their confidence, as well as their willingness to employ technology in teaching?

6. What are the institutional issues and surrounding challenges that make digital leadership and training not very effective in the institutions of higher learning in Karachi?

7.How can we use evidence-based interventions to enhance digital leadership and technology-based training, to ensure that higher education institutions in Karachi make teachers more competent?

2. Literature Review

Digital education has upended higher education and requires a new model of leadership and new forms of teacher training. The current agreement among researchers is that not only technology is needed to enhance the digital skills of teachers, but also explicit leadership and pedagogy-oriented training. This review applies to two models Transformational Leadership and Technological Pedagogical Content Knowledge (TPACK). Combined, they articulate how institutional leaders can maximize digital skills of teachers by training them using technology.

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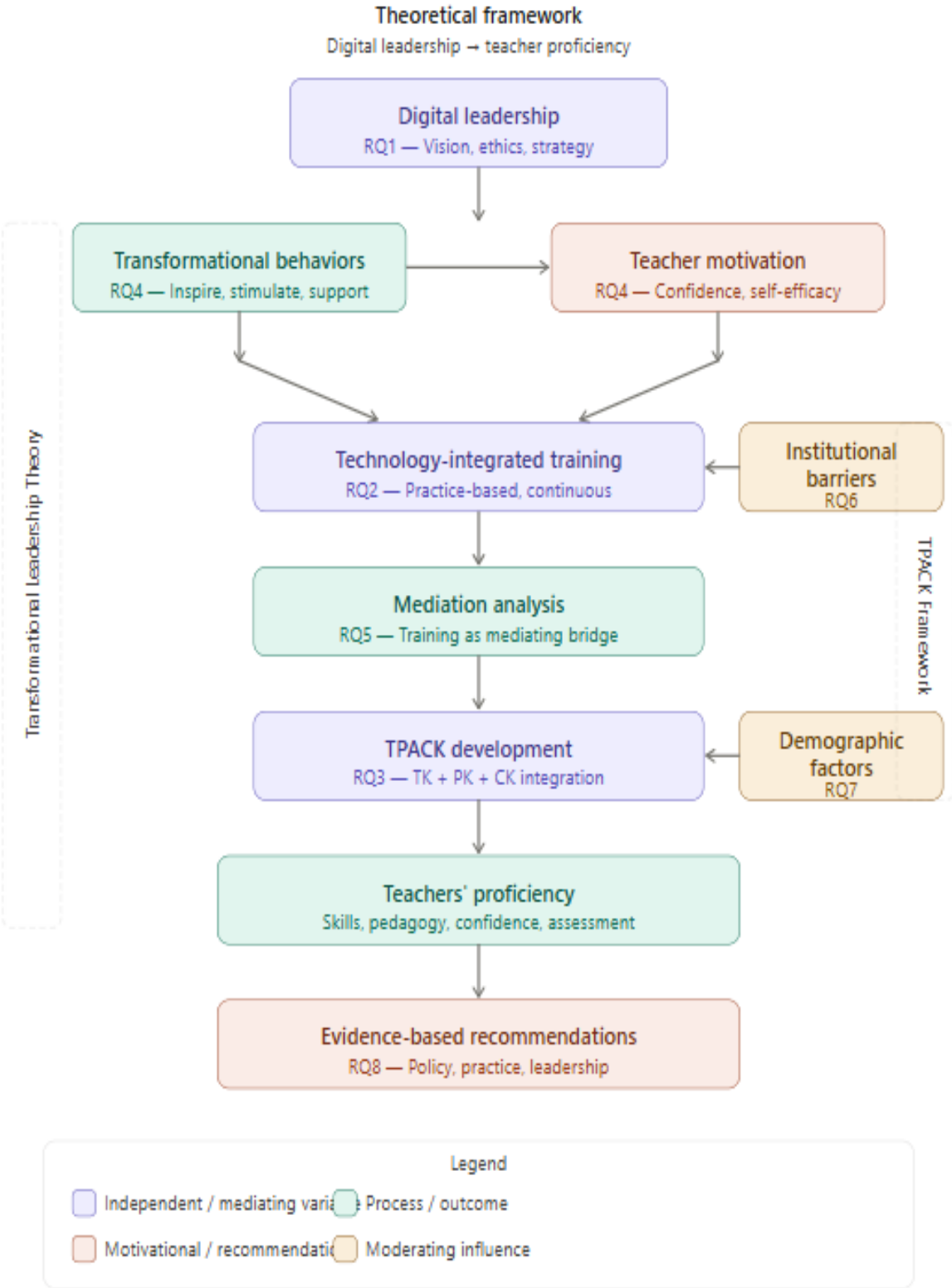
2.1 Transformational Leadership in Educational Contexts

Transformational leadership is an established method of change in education. The model by Bass and Riggio states that these leaders inspire others using a clear vision, promote intellectual development, provide personal attention, and model behavior (Yusof et al., 2021).



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They challenge teachers to be innovative and creative in schools as opposed to merely doing things by the books.

This style has proven to be quite efficient in the process of digital transformation. Supriadi et al. (2022) discovered that those principals who demonstrated transformational leadership, like setting a digital vision and coaching staff, increased teacher motivation and engagement. Transformational leadership is also associated with improved performance of a higher education institution, faculty commitment, and innovative teaching (Alzoubi and Yanamandra, 2020). These leaders do not only provide environments to digital growth by investing in professional development and eliminating barriers (Khan et al., 2022).

2.2 Digital Leadership as an Extension of Transformational Leadership

Digital leadership brings to the digital environment the principles of transformational principles. It implies transforming digital change with the help of strategic visions, technical expertise, and people management (Türel and Dokme, 2021). Digital leaders do this via modeling technology use, promoting it, and providing the teachers the required support (Elçiçek, 2022; Aksal, 2020). Digital leadership is effective in third world economies that have structured professional development, which is usually used to offset the lack of resources (Hallinger and Nguyen, 2020). This is most applicable to Karachi, where institutional resources and the quality of leadership is highly diversified.

2.3 The TPACK Framework and Teachers' Digital Proficiency

TPACK is a combination of three areas of knowledge: content (CK), pedagogy (PK) and technology (TK). The combination of their elements results in advanced competencies, with TPACK being the highest one (Rosenberg and Koehler, 2020). Increased TPACK scores will help teachers to develop interesting and technology-rich lessons (Tanak, 2020). The quality of professional development programs is key in the development of TPACK (Instefjord and Munthe, 2021). Notably, TPACK is contextual, influenced by the culture of leadership, institutional culture, and collaboration, rather than just an individual characteristic (Rosenberg and Koehler, 2020).

2.4 Technology Integrated Training as a Mediating Mechanism

The concept of leadership is not directly proportional to teacher proficiency. Training using technology is also a mediator (Chai et al., 2021). Best training is practical, applicable, continuous, and includes coaching and feedback (Getenet, 2020). A culture of experimentation is enhanced by institutional factors such as resources and institutional support, which predict more than individual teacher characteristics (Tondeur et al., 2021). In Pakistan, the attitudes of teachers towards technology are positive, but lack confidence and skills because of weak leader and unsystematic training (Mahmood, 2021).

2.5 Synthesis and Research Gap

The literature offers a solid base to connect digital leadership, training and teacher proficiency. But the majority of studies are in Western or East Asian backgrounds. Little attention has been paid to South Asian cities like Karachi. Moreover, not many studies combine the three components: leadership, training, and proficiency into a single framework. The paper will address this gap by presenting empirical evidence in a setting with underrepresentation.

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3. Methodology

A qualitative design was employed in this study to gain insight into how digital leadership and trainings based on technology influence the competence of teachers in Karachi schools of higher learning. The researchers emphasized practical experiences and perceptions of participants, rather than numbers. A sample size of 30 individuals (20 teachers and 10 administrators) of five public and private universities in Karachi was used to gather data. The sample of respondents was selected according to certain requirements: teachers were to possess a minimum number of two years of experience; administrators needed a minimum of two years of work in a leadership position involving training or digital approach. Semi-structured interviews and focus group discussions (six groups of 3-5 people each) served as the key methods of data collection. Institutional documents were also reviewed by the researchers. The interviews and discussions were recorded, written down word-to-word and took 45 90 minutes.

4. Data Analysis

Reflexive Thematic Analysis data were analyzed in one step, in accordance with the six-step process suggested by Braun and Clarke and with NVivo software. To ensure trustworthiness, the researchers used member checking, detailed descriptions, an audit trail, and reflective journaling (Lincoln & Guba, 2020). Ethical guidelines such as confidentiality, anonymity, voluntary participation and the right to withdrawal were adhered to.

4.1 Cross-Institutional Thematic Findings

Reflexive Thematic Analysis data were analyzed in one step, in accordance with the six-step process suggested by Braun and Clarke, with NVivo software. To ensure trustworthiness, the researchers used member checking, detailed descriptions, an audit trail, and reflective journaling (Lincoln & Guba, 2020). Ethical guidelines such as confidentiality, anonymity, voluntary participation and the right to withdrawal were adhered to.

4.2 THEME 1: Transformational Digital Leadership as a Catalyst for Change

Digital leadership is not directional. It relates to transforming attitudes, behaviors, and culture in relation to technology. Four key dimensions emerged from the data.

Ethical digital role modeling: Organizational leaders should be role models by modeling good academic practices, responsible AI usage, and protection of privacy. Such practices were a natural follow-up of teachers.

- Inspirational and visionary leadership: It is characterized by leaders possessing clear digital visions congruent with institutional aims. This lessened skepticism and increased faith in teachers to utilize digital tools.
- Intellectual stimulation and innovation: Leaders provided encouragement to teachers to experiment, practice, and to think out regarding digital methods.
- Individual support: Leaders employed one-on-one mentoring and need-based training as well as emotional support to assist those teachers, who lack confidence with technology.

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4.3 THEME 2: Multidimensional Enhancement of Teachers' Proficiency

There was an increase of teacher competence in five areas.

- Technology skills: Teachers indicated increased digital usage, increased showcased research skills, and confidence.
- Teaching techniques: Educators embraced blended learning, flipped classrooms and outcome-based learning.
- Communication: Online tools turned team work and work communication into a routine.
- Classroom management: The teachers became better users of the learning management systems and digital discipline strategies.
- Assessment: Digital rubrics and learning analytics enabled a more open and transparent approach to assessment.

4.4 THEME 3: Training as a Bridge with Technology

Training connects vision of leadership to competence of teachers. Training effectiveness was determined by five factors.

- Fit: The best training occurred where there was a fit between training and institutional strategy and subject areas.
- Quality of content: The training was required to be outcome-oriented and updated.
- The level of trainers: Good trainers, who provided clear instructions and proper continuous support were essential.
- Assessment and feedback: not all universities had a regular evaluation and feedback program.

The issues of academic honesty and responsible AI use:

4.5 Integrative Interpretation (Core Finding)

Digital leadership has no direct impact on teacher competence. It operates via training that is integrated with technology. The effectiveness of this process is based on the quality of training, practices in ethics as well as institutional support.

4.6 Theoretical Link

The results have two theories.

Firstly, the Transformational Leadership Theory demonstrates that leadership inspires, gives encouragement and transforms teachers.

Second, the Technology Acceptance Model demonstrates that training can enable teachers to regard digital tools as useful and easy to use.

To summarize, good leadership will inspire teachers, skills will be taught and teachers will be competent and confident. In case of a poor training or neglect of ethics, the impact is limited.

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4.7 Triangulation of Themes

The author of the research integrated the interview data, observations, and the documents of the institution to enhance credibility. The results indicate a definite cause and effect trend:

Digital leadership → Structured technology-driven education exponent more teacher digital skills.

Leaders who were positive influenced the teachers to adopt digital tools. Supportive leaders boosted teacher confidence and minimized fear of technology. One of the benefits of training was that it provided teachers with practical skills such as working with virtual learning environments, online assessment tools and video conferencing. Several teachers indicated that constant encouragement saw them through the resistance to confidence.

The digitally committed leaders fostered a culture of peer learning and sharing of knowledge as well as an open communication culture. When leaders were cooperative and communicative, teachers were more open to the new technologies. This affirmed that digital transformation was not solely on technology, but human relationships and institutional culture.

There were issues still persisted like bad infrastructure, lower dependability of the internet and no technical support. There was also the evidence of the difference between generations: young faculty was more adapted, whereas old faculty was not at first. The barriers were however overcome with time under supportive leadership.

5.1 Findings

This paper investigated the impact of digital leadership on teacher competence, in the case of technology-based training in higher education institutions in Karachi.

1) Digital leadership is not only administration, but a transformational power. Leaders are ethical role models, are visionary, offer incentives toward innovating, and grant personal assistance.

2) Teacher competence is multidimensional. It encompasses technology, instruction, communication, classroom management and assessment.

3) The connection among leadership and teacher competence is that training bridges the gap between the two. Building success requires that things be aligned, that the quality of the content, the quality of the trainers and the feedback systems and that it be ethically consistent.

5.2 Discussion

1) Digital leadership is perceived by the members of the faculty. It develops capacity and transforms institutions. Such leaders are ethical role models, have clear visions, promote experimentation, and mentoring at a personal level.

2) The competency of teachers is more than technical. It encompasses teaching, instruction, classroom practices, and evaluation. Educators said that they were using digital tools, online communication, and research skills more effectively. Several associated digital competences with professional survival. Blended learning, inverted classrooms, and student-centered learning were some of the pedagogical benefits.

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3) Training is most effective when coupled with subject areas and institutional objectives. The competence of trainers and the continuous support is important. Nevertheless, the lack of coherent system evaluation and ethical considerations on AI and data privacy halts the growth.

The combination of the three themes supports the view that transformational leadership determines the path, TPACK offers the learning framework and technology-based training transforms leadership vision to classroom change.

5.3 Implications for Future Research

1.To monitor the development of digital leadership and TPACK in the long term, longitudinal studies are required.

2.Comparative studies would be done in the other cities and countries to ensure that these findings are valid outside Karachi.

3.Further studies are required on whether AI use in teacher training is ethical.

4.The psychological elements of digital adoption, e.g., anxiety, self-efficacy, and emotional resilience, need to be examined.

5.The Digital Pedagogical Leadership Model proposed in this study should be experimented with the help of quantitative and mixed methods.

5.4 Suggested Model: Digital Pedagogical Leadership (DPL)

DP model is rooted on Transformational Leadership theory and the TPACK model. It demonstrates that teacher competence is influenced indirectly by digital leadership via structured systems of support. There are five dimensions in this model:

1.Visionary leadership - institutions digital direction.

2.Instructional technology coaching - offers personal guidance.

3.Training ecosystem centered around technology - the fundamental stepping point in between vision and practice.

4.Considerate digital practice - promotes continuous, evidence-based development.

5.Ethical pedagogical use of technology- makes sure use of technology is responsible.

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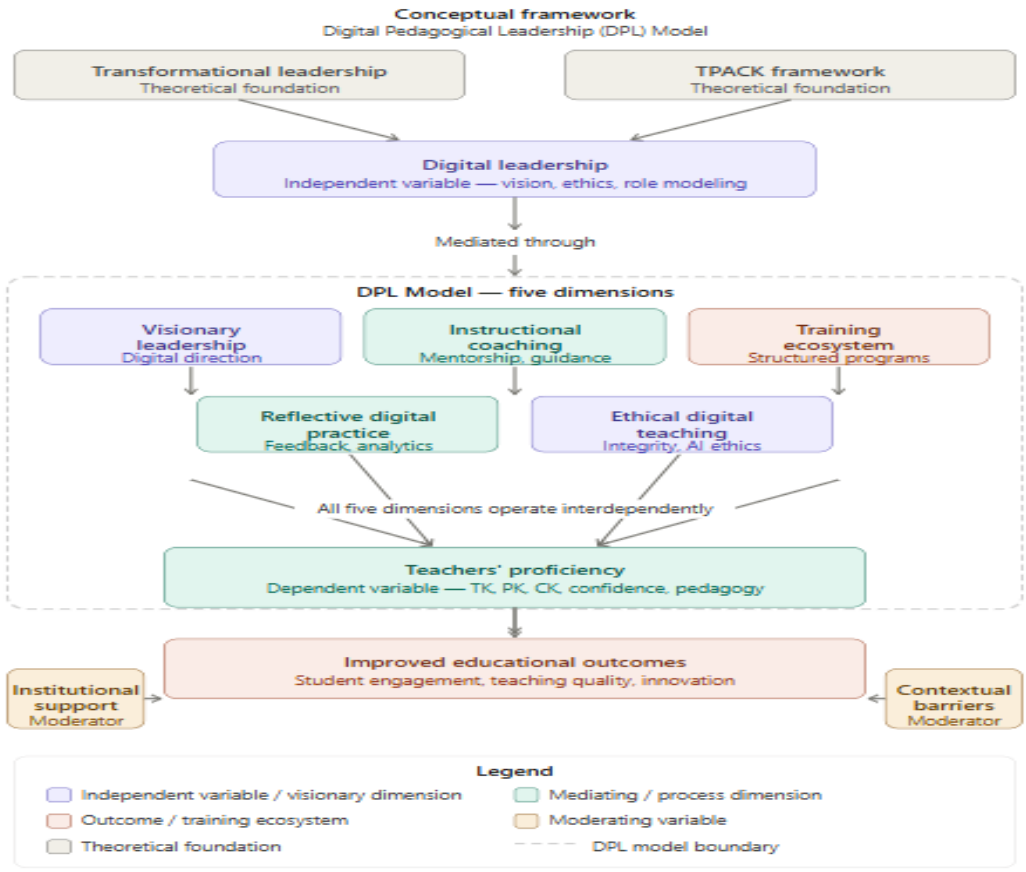
Collectively, these dimensions provide a platform on which an environment of gradual synthesis of technological, pedagogical, and content knowledge exists among teachers. Digital leadership, training and teacher competence are the sustaining outcome, bridge and driving force respectively in the DPL model.



5.5 Limitations of the Studies

1. The paper was only confined to Karachi hence the results may not be generalized to the entire Pakistani population.

2.The qualitative design has in-depth information but lacks the capacity to generalize statistically.

3.Interviews and focus group data, which are self-reported, can be influenced by social desirability bias.

4.The research is cross-sectional and thus only a single point of time will be taken into consideration, and therefore no long-term effects will be accessed.

5.The voices of students were not heard, and it was left to perceive the complete experience of digital transformation.

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5.6 Result

The findings indicate that digital leadership is a key factor in assisting teachers to embrace technology. Leaders also shape the culture within an institution by providing an example of ethical conduct and communicating a definite digital vision. The most important connection between classroom practice and leadership, which strengthens teacher faith and ability, is technology-integrated training. The teacher competence is not only technical but also pedagogical innovation, flexibility, and self-efficacy. Leadership and training should not be separate and without the two, digital transformation will not be successful. The rich and diversified higher education landscape in Karachi requires long-term, contextually relevant interventions that would bring about a tangible change.

6. Contributions to the Field

1.Offers new empirical evidence in Karachi that currently lacks a digital presence in research on leadership in South Asian universities.

2. Assimilates the theory of Transformational Leadership and TPACK framework into a single explanatory model.

3.Demonstrates that training through technology mediates the relationship between leadership and teacher competence.

4.Suggests Digital Pedagogical Leadership Model as a new quantum of thinking.

5.Illuminates on psychological dimensions of embracing digital, e.g., teacher confidence and self-efficacy.

6.1 Recommendations

1.Professional development must be an on-going working progress rather than a one-time workshop.

2.Academic leaders must be internet-savvy, have clear objectives, and with faculty at the individual level.

3.Policy makers ought to establish sources of funding to leadership development and technology training.

4.Institutions should have effective feedback and evaluation mechanisms to monitor the effectiveness of training.

5. The path of training must be responsive to gender and levels of experience to suit different needs of the faculty.

6.3 Conclusion

Universal digital transformation in higher education needs visionary change leadership, systematic training, and continual teacher enhancement. Digital leadership starts the change. It

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is achieved through technology-based training. The outcome is shown in teacher competence. To create effective, efficient and innovative teaching communities capable of operating in the digital era, the institutions of Karachi need holistic and context sensitive strategies that merge leadership, training and institutional aims into ability, confidence, and innovativeness.

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