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| RESEARCH ARTICLE

Cultivating Tomorrow's Minds: Faculty Perspectives on Technology-Enhanced Pedagogy in Punjab's Private Universities

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| ABSTRACT
At a time of increasing digital transformation and a global shift in policy regarding the integration of artificial intelligence (AI) into the education sector, it is essential to comprehend the engagement of faculty with new technologies to build equitable, future-ready learning systems. This study set in the interpretative qualitative paradigm explores the perception and experience of augmented minds through the integration of AI and AR within the pedagogical practices of the faculty members of private university of Punjab, Pakistan. The study will achieve the desired aims through 50 in-depth semi-structured interviews of the faculty members belonging to different academic disciplines. Thematic analysis consisting of the six-step framework of Braun & Clarke will be utilized to analyse data. Research shows that there is widespread optimism regarding the pedagogical potential of AI and AR in particular, enhancing student engagement, visualizing complex concepts, personalized learning paths, and collaborative knowledge construction. According to the participants of the study, through the use of immersive AR and adaptable AI systems, more interactive, learner-centered environments can be created in alignment with constructivist principles. Significant institutional and contextual barriers were also identified, such as constraints in technological infrastructure; limited specialized professional development; and academic integrity, cognitive dependence, and equity of access concerns. Faculty members also expressed concern about the changing nature of their work in AI classrooms. This research provides context-specific insights into "Augmented Minds", thereby enriching the global discourse on educational innovation in a developing country context. It shows that technology enhancement and faculty empowerment may be possible with continued institutional support. The findings are directly useful to educational policymakers, curriculum developers, and university administrators interested in integrating AI/AR-enhanced teaching frameworks in various higher education environments.

| KEYWORDS

Augmented Minds; higher education; Pakistan; faculty perceptions; artificial intelligence; technology integration

| ARTICLE INFORMATION

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I. Introduction

1.1. The Global Imperative for Educational Innovation and Digital Transformation

Today, the 21st century has opened its doors to an abundance of technological advances that have greatly altered and transformed this world and the educational system. Educational establishments around the world are rapidly being called to invest in digital tools and artificial intelligence (AI) to improve learning outcomes and prepare graduates for the 21-st century workforce (Popenici & Kerr, 2017). Meanwhile, experts are recognizing that they can take their human cognition further with digital enhancements like augmented reality (AR) and artificial intelligence (AI) that can help make learning easily interactive, innovative and personalized for learners (Popenici & Kerr, 2017). This discourse encompasses the need for more than the mere adoption of tools by teachers but a fundamental shift to a place where humankind may reap the possibilities of augmented minds. Therefore, it becomes more and more important to explore how teachers have understood and are able to implement all this and how effectively they can use technology to enhance and not undermine learning's intellectual value by developing digital transformation.

1.2. Higher Education in Pakistan: Context, Challenges, and the Private Sector Landscape

Pakistan's higher education sector, while fairly young, has grown tremendously since independence, from one university to 209-degree awarding institutions, which includes 83 in the private sector.4 However, despite the consistency in growth, the overall quality of education and research struggle to pick up pace (Miller et al., 2011). The Higher Education Commission (HEC) was established in 2002 to internationalize higher education and provide financial incentivize to publish research papers (Demitriadou et al., 2020). Nonetheless, only seven Pakistani universities make it to international university rankings; only 7 made it to the top 1000 in 2020 (Demitriadou et al., 2020). There have been many concerns about institutional problems that exist due to missing quality management, below-par infrastructure, limited faculty skill sets, with only 21% of full-time faculty with PhD's in 2015 (Miller et al., 2011). There is an interesting tension here, with the government calling for research and technological advancements, while the system is limited to a point where real change in quality and pedagogy may become difficult (Miller et al., 2011). Exploring what digital integration means for faculty in this context is important for achieving effective strategies.

1.3. Conceptualizing "Augmented Minds" in Pedagogy: Beyond Tools to Cognitive Enhancement

The figure of "augmented minds" is not mere use of technology but refers to the purposeful application of tools, especially AI, to augment human perceptual, reasoning, learning and creative capability (Bacca et al., 2014). This closely resonates with the HCI principle of designing technologies that are useful and usable, and also enjoyable and empowering for its end-users, the faculty and students.6 AI in education is by its nature interdisciplinary, as it draws from psychology, linguistics, neuroscience, and pedagogy to build computing systems that can carry out human-like processes like learning, adapting, and self-correcting (Bacca et al., 2014). However, the quest for "augmented minds" is not without issues. While AI can individualize learning and foster inclusion, there are valid concerns that becoming over-reliant upon such tools may inhibit cognitive engagement, critical thought and problem-solving skills, and long-term memory (Cronbach & Suppes, 1969). Hence, we need to understand how faculty perceive this phenomenon and navigate the balance between augmentation and cognitive reliance.

1.4. Research Gap, Significance, and Guiding Questions of the Study

Despite the rising international conversation related to alignment of AI & technology with higher education, a significant gap exists in qualitative data related to those teaching in the private universities of Pakistan. In fact, the literature does not provide any insight into the complex idea of 'Augmented Minds'**(**Demitriadou et al., 2020). Most research offers either a discussion of challenges being faced or a measurement of technology adoption. The lived experiences of faculty members regarding the complex concept of 'Augmented Minds' remain largely neglected. The significance of the study is that it will help to know how the faculty members of the private universities of Punjab are integrating technologies. The results will facilitate better insights into the hurdles and opportunities unique to this region helping in more effective and equitable digital transformation policy and practice. Additionally, through a case study approach focusing on developing country startups, this research contributes to global discourse on human-AI academic collaboration. This research is guided by the following key questions.

1. How do faculty members in private universities in Punjab perceive the concept of "Augmented Minds" in relation to their pedagogical practices?
2. What are the perceived benefits and challenges of integrating technology for cognitive augmentation in their teaching and learning environments?
3. What forms of institutional support and professional development do faculty members require to effectively leverage technology for augmented learning?
4. How do faculty members believe technology integration impacts student cognitive engagement, critical thinking, and their own evolving professional roles?

2. Literature Review

2.1. Theoretical Underpinnings: Constructivism, Human-Computer Interaction, and Cognitive Load Theory

The theoretical framework for this research study is underpinned by three interrelated perspectives namely; constructivism; Human-Computer Interaction (HCI); and cognitive load theory. According to the constructivism theory of learning, knowledge is not a foregone conclusion in learning. Learning environments reinforced by technology such as Augmented Minds are aligned with constructivist principles in that they facilitate a shift in the pedagogical focus from teacher to learner enabling students to actively engage in the construction of knowledge (Gerlich, 2025). Augmented Reality (AR) can be employed to facilitate learning by placing students in contact with more authentic problems in a context they are already connected to and participating in collaborative learning efforts and shared virtual environments (Gerlich, 2025).

In conjunction to constructivism, HCI offers an essential means of evaluating “Augmented Minds” in practice. Human computer Interaction focuses on useful, usable and enjoyable information and computer technology for end user.6 For technology to effectively enhance cognitive processes during educational scenarios, the interface and functions should be designed in an intuitive and frictionless manner to enable engagement maximally with technology. Both educators and students should be able to adapt to the technology easily and comfortably **(**Miller et al., 2011). This viewpoint underlines user-centered and participatory design, where technology is designed with a goal of empowering people not creating new barriers.6.

In conclusion, Cognitive Load Theory emphasizes the dangers of integrating too much technology into lessons. While technology enhances learning, it can create extraneous cognitive load if not designed or used properly. This theory makes a distinction between intrinsic cognitive load which is inherent to the task, germane cognitive load which is related to schema construction and extraneous cognitive load which is induced by poor instructional design. Reliance on AI, for instance, has the potential to decrease cognitive engagement with the content and information. It also impacts the information and the long-term retention of the information, as a result, the information does not receive critical scrutiny but rather passive acceptance. So, it is important to study how the faculty manage and perceive cognitive load in technology-rich environments as it ensures initiatives meant to create Augmented minds do eventually not hinder deep learning. These three theoretical perspectives together provide a strong base for understanding the connection between technology, pedagogy and human. This is pivotal in this study.

2.2. Global Discourse on Artificial Intelligence and Cognitive Augmentation in Higher Education

Artificial Intelligence and cognitive augmentation technologies for higher education are current topic of discourse of the global academic community. The struggles and opportunities that accompanies technology were discussed in this discourse. Artificial Intelligence (AI) technologies facilitate adaptive learning and intelligent tutoring which can transform conventional approaches to pedagogy by personalizing instruction according to individual learning needs **(**Cronbach & Suppes, 1969). Cognitive augmentation (the use of AR for learning) is quite popular **(**Popenici & Kerr, 2017). It is hailed as an innovative medium for learning that can create exciting learning experiences by creating conducive spaces that combine different physical realities and digital content.1 Proponents argue that it has the capacity to boost student engagement, facilitate collaborative learning and build learning capacity **(**Popenici & Kerr, 2017).

Yet, global discussion also includes growing worries regarding the more global effects of AI on human thought and development. Research shows that AI tools can help personalized learning, but their excessive use may hinder cognitive engagement and affect long-term memory retention (Cronbach & Suppes, 1969). For example, studies state that memory may erode with over exposure to AI as it should support but not replace human-driven learning strategies (Cronbach & Suppes, 1969). Further, the impact of AI on critical thinking and problem-solving skills is a concern as studies show that students may accept AI-provided information as it is without critically engaging with it thus reducing cognitive engagement (Cronbach & Suppes, 1969). Even creativity which is a hallmark of human intelligence may be impacted as it is found that AI-supported students score better on fluency, but they may incur cognitive fixation and low creative confidence that hampers the cognitive

engagement process (Cronbach & Suppes, 1969). Thus, the dual narrative of promise and peril here begs for the implementation to follow well-planned roadmaps that ensure AI integration is driven by specific cognitive-learning goals (Cronbach & Suppes, 1969). Global conversations are thus stressing the need for a balanced approach where AI is an enabler that maximizes human strengths while depriving them of liabilities (Cronbach & Suppes, 1969).

2.3. Faculty Readiness, Adoption, and Challenges in Integrating Technology into Pedagogy

The readiness and capability of faculty members have a huge impact on using technology for pedagogical innovation. According to findings globally, it is inferred that educators are not yet ready for technology adoption mostly in higher education. Accessible resources, professional development opportunities, as well as attitudes to change influence readiness. A study referenced in a meta-analysis stated that lecturers or professors in higher education perceive AR technology to be essential for learning. However, those teachers' readiness for the creation of AR-based learning design is low **(**Popenici & Kerr, 2017). Readiness percentage for higher education lecturers is reported to be only 21%. That percentage is far lower than that of elementary school lecturers **(**Popenici & Kerr, 2017). With such a low percentage, it indicates a systemic deficiency for higher education staff to be equipped with similar AR development capabilities.

Teachers face many challenges in using technology apart from being prepared. The challenges include poor infrastructure, lack of required hardware and software, and lack of adequate technical support. Because of the heavy teaching and research loads, faculties usually have time constraints that limit their curiosity to learn and use modern technologies in their class. The institutional shortcomings in Pakistan's higher education, e.g., absence of quality management and low-quality teaching–create further obstacles for these faculty members to embrace technology-integrated pedagogy (Boyer, 1990). The requirements for increasing numbers of publications along with various academic and institutional pressures can also negatively affect faculty well-being and their ability to innovate in teaching practices.4 A proper understanding of barrier systems will help design appropriate interventions to aid the faculty in their technological pedagogical journey.

2.4. The Unique Context of Private Higher Education and Academic Publishing in Punjab, Pakistan

The private sector of higher education in Punjab, Pakistan offers a unique set of opportunities and challenges that impact the deployment of technology and "Augmented Minds." There is an increase in private university numbers which provides a bigger access to higher education but there are still doubts over their quality **(**Demitriadou et al., 2020). On the one hand, the Higher Education Commission (HEC) has been pushing for research and linking faculty promotions to publications. This has resulted in a notable increase in research from Pakistan **(**Demitriadou et al., 2020). However, on the other hand, the serious reservation about the overall quality of research is coupled with the unpreparedness of junior faculty whose research skills and mentorships were mostly lacking**(**Demitriadou et al., 2020) .

This context creates a special situation for faculty members. As the demand for publication and innovation rises, they often find themselves working in institutions with little to no fixed standards, poor technical infrastructure, and little or no support for advanced pedagogies (Demitriadou et al., 2020). The "publish or perish" principle can shift the focus from the innovation of teaching, potentially shrinking the time and resources that faculty can spend on the adoption of computer technology for cognitive enhancement. In addition, issues such as low enrolment rates, high drop-out rates, and the need for a more effective pedagogical approach and examination reform highlight internal constraints that hinder teachers and students from achieving the best results (Demitriadou et al., 2020). The knowledge of such institutional and professional constraints is important as it influences faculty members' attitudes, readiness, and ability to use technology for developing "Augmented Minds" in classrooms.

3. Research Methodology

3.1. Research Paradigm and Approach

In this study researchers adopted an Interpretivist research paradigm. This is because reality is socially constructed. Consequently, we might see that human experience is interpreted. 9 The main objective is to explore the experience of faculty members regarding "Augmented Minds" and the use of technology in teaching. In view of this aim, a qualitative research approach was used. Qualitative study method is especially useful in exploring complex phenomena, understanding the underlying reasons, opinions or motivations, and providing rich, in-depth insights that quantitative methods may overlook (Delello et al., 2015). This method allowed me to deeply engage with the participants' lived experiences, beliefs, and contextual factors that shaped their views related to technology integration in teaching.

3.2. Participant Selection and Sampling Strategy

The researcher in qualitative research purposely and intentionally chooses individuals to better answer the research questions and enhance understanding of the phenomenon of interest **(**Delello et al., 2015). This study utilized a purposive sampling

strategy whereby the researcher selected faculty members who can best provide the rich and diverse information regarding technology integration and cognitive augmentation in private universities of Punjab. The 50 faculty members from five private universities located in Faisalabad, Gujrat, Sahiwal, Samundri, and Lahore constituted the target population. This geographic spread reflects a likelihood of variations in institutional development together with differences in access to resources across these cities.

In selecting the faculty, care is taken to obtain experience from a wide range of departments. Thus, the faculty selected are from the English Language and Humanities; Engineering (Mechanical, Civil, Electrical, etc.); Nursing and Optometry; IT; Mathematics, etc. The diversity of the departmental collaboration was essential as how "Augmented Minds" applies varies greatly across subjects. The IT and Engineering faculty may be used to the device similarly to the Humanities or Nursing faculty may have their own challenges or have different advantages. A total of 50 interviews were deemed satisfactory for saturated data, which is a point where no new concepts or themes arise due to more interviews being conducted (Delello et al., 2015). Informed consent and ensuring anonymity of participants must take place (Yuan et al., 2008).

3.3. Data Collection: Semi-Structured Interviews

The main data were collected through in-depth…, semi-structured interviews. The researcher opted for this method because of its flexibility to collect through some pre-determined themes while allowing the participants to elaborate on emergent themes and to narrate their life in detail **(**Delello et al., 2015). In other words, semi-structured interviews are often used in qualitative research to get qualitative data since it is said to be particularly useful to get rich data with regard to the "why" of what happens. The duration of each interview was about 60-90 minutes, allowing the participants to express their views adequately.

The research questions informed the construction of an interview guide, pilot testing the interviews to fine-tune phrases in the process. The study investigated the faculty members' concept of "Augmented Minds" and Artificial Intelligence in education. It also sought insight into the technologies being used at present, the perceived value or challenges, usages of institutional support and professional development, and the impact of the technology on students' learning and their own professionalism. The interviews were conducted in a conversational yet pointed manner encouraging participants to share their experiences and views freely.

With the consent of the participants, all interviews were audio-recorded as it helped in gathering data. The recordings were transcribed verbatim afterward (Delello et al., 2015). There was repeated reading of the raw data (Ibáñez & Delgado-Kloos, 2018). This is an important element of qualitative analysis to uncover recurring patterns and connections. The capacity of the researcher to engage with informants, connect-up ideas during the interview and think on his feet are valuable characteristics to have for the data collection process (Ibáñez & Delgado-Kloos, 2018).

3.4. Data Analysis: Thematic Analysis

1. Thematic analysis, a widely used and flexible method for identifying, analysing, and reporting patterns (themes) within qualitative data was used to analyse the transcribed interviews (Guba & Lincoln, 1989). The use of thematic analysis allowed for a systematic and in-depth examination of the large data set in a purposeful manner by transforming interviews from raw transcripts to analysis . The analysis procedure embraced the six stages of Braun & Clarke (2006).

2. **Familiarization with the data:** In the first step, we went through all the interviews repeatedly to get an overall sense of the entire dataset and take notes of some initial ideas or potential areas of interest **(**Ibáñez & Delgado-Kloos, 2018). This stage was crucial in gaining an understanding of the whole set as well as each interview before the segments of text were identified.

3. **Generating initial codes:** The data were codified systematically after the familiarization. This was done by reading through the data, word by word and coding parts that shared the same meaning or idea. This study employed an inductive method, in which codes were generated from the data.

4. **Searching for themes:** The codes were categorized into potential broader themes based on their meanings. This meant searching for patterns across different codes and capturing anything that appeared to be important in the data (Guba & Lincoln, 1989).

5. **Reviewing themes:** The entire data set was thoroughly reviewed to confirm that the provisional themes were truly representative, and no relevant data was being ignored. This process happened iteratively so the themes were refined, split, combined and internal and external themes were checked **(**Ibáñez & Delgado-Kloos, 2018).

6. **Defining and naming themes:** Each theme definition clearly articulated what the theme represented and how that helped answer the research question. Every theme was assigned to be a succinct and descriptive label (Guba & Lincoln, 1989).
7. **Producing the report:** The last chore required bringing the specified themes together in a fluent and intelligible narrative, underpinned with direct quotations from the participants, to present the findings (Hyland, 2016). Findings contextualization with existing knowledge and theories perspective **(**Delello et al., 2015).

The memos of the analysis reflect the author's changing thoughts about the data as well as emerging patterns (Ibáñez & Delgado-Kloos, 2018).

3.5. Ensuring Rigor and Trustworthiness

In order to enhance the credibility and trustworthiness of the qualitative findings, the study employed several strategies consistent with accepted standards of rigor in qualitative research (Abdullah et al., 2026). These included maintenance of prolonged engagement through repeated reading and careful coding, detailed memo-writing to record decisions that may affect analysis, and systematic cross-examination of conclusions by comparing coded segments and exploring alternative explanations (Ibáñez & Delgado-Kloos, 2018; Johnson et al., 2011). The detailed and transparent description of the process of data collection through to interpretation also lends to the dependability and confirmability of the study(Abdullah et al., 2026).

IV. Findings: Faculty Voices on Augmented Minds

The analysis of the thematic coding of the 50 interviews of the faculty revealed 4 major themes that reflect the perception and experience of the faculty working with "Augmented Minds" or technology-enhanced pedagogy in private universities of Punjab. These themes sum up the opportunities, challenges, support structure and perceived consequences for their roles and cognitive development of students.

4.1. Theme 1: Perceptions of AI's Potential for Pedagogical Enhancement

The faculty is very positive about the aspects of pedagogy and the use of AI or assisted learning tools. Many participants stated that these technologies might be useful to make learning more interactive and interesting outside an instructor's lecture. As an example, an Engineering faculty member from Lahore explained, "Students can use simulation software and AR to see complex concepts such as fluid dynamics or structural integrity, which can't be covered by using a textbook – it puts the abstract into a tangible and interactive space." This is consistent with the idea that students would be better able to view and interact with the world in new ways with AR, to analyze realistic problems (Gerlich, 2025).

Faculty emphasized the potential for personalized learning pathways beyond engagement. A head of IT department in Faisalabad explained: "AI-driven adaptive learning systems could modify content to suit the need of individual students. They can identify the strengths and weaknesses of learners and provide them support accordingly. This can give us the power to customize solutions for different learners at the same time. As such in a class, some students take time to learn while others are quick. We can use AI to facilitate learning by making provisions for slow and fast learners." This view has resonance since AI could Individualize instruction to the needs of particular learners **(**Cronbach & Suppes, 1969). Academics from the English Language and Humanities departments also found much to recommend it, particularly for language learning. There, AI-powered tools could provide real-time feedback on pronunciation and grammar or grant them access to a wide variety of literary resources. An English faculty of Gujrat remarked that it is like having a tutor for every student.

In addition, participants saw technology as a way to promote collaborative learning even from a distance. A Nursing faculty from Sahiwal said, "Perhaps some software, with overlays, that can simulate clinical experiences with students from other institutes or even our international institutes. It will ease the process of learning as one doesn't have to be in a particular place for this." This reflects the understanding that AR technology could support collaborative learning. This would allow students and teachers in different physical locations to simultaneously participate in a rich and immersive shared learning experience (Gerlich, 2025). Faculty also believed that technology would provide options for student accessibility and rich resources as opposed to visiting a library physically. The general feeling is that these tools can enhance the learning experience if integrated effectively. So, making them more dynamic, relevant, and responsive to the demands of the modern world.

4.2. Theme 2: Challenges in Integrating Augmented Learning Tools

With the potential acknowledged, the faculty articulated a wide array of challenges that hamper augmented learning tools and "Augmented Minds." All universities shared a common concern about their technological backbone not being sufficient. While we discuss on AI and AR, a teacher of Mathematics from Samundri observed, there are classrooms which do not even have reliable internet, enough computing power or even a projector. This lack of infrastructure affects the possibility of implementing

advanced digital pedagogies. The absence of modern labs and specialized research equipment, which are crucial for HCI research and student opportunities, was a constant source of irritation (Braun & Clarke, 2006).

A serious issue identified was the absence of holistic and transformative professional development. Several universities provided ad hoc workshops for their faculty. However, they found these often insufficient, generic or not suited to their discipline. A Mechanical Engineering teacher in Faisalabad stated, "They give us a laptop and ask us to use it. There is no systematic training on using the complex software or creating AR content relevant to our course. We are to figure it out." As the results show, lecturers in higher education often display low readiness to create AR-based learning tools.1 The time needed to learn and adapt to new technology, coupled with already heavy teaching loads and research pressures, further complicates things. A Humanities lecturer from Lahore shared, "I am required to publish for a promotion , teach multiple courses, and learn a new software in my spare time? I can't take it"

Some faculty expressed a concern with the cost of new technologies and the availability and sustainability of these technologies. Private universities are more flexible but usually lack resources and funding which hinders the use of technology in large volume. A barrier sometimes cited is the cost of the specialized software, hardware and technical support. Ultimately, another challenge that was often there was the hesitation to change and resistance in culture among certain faculty as they were reluctant to shift from past practices. At the same time the students also demonstrated resistance in learning since they had been used to learning passively. To tackle these issues, the institution's leadership must be mobilized, not equipment.

4.3. Theme 3: Institutional Support and Professional Development Needs

The role of the institutional environment towards the ability of faculty to be equipped and willing to utilize Augmented Minds was one of the factors that influenced. The vision of digital transformation that the institutions convey to students does not match the support that is offered to the faculty. Educating with modern technology was sometimes said to be without means and mechanisms in universities, which claimed to be committed to teaching with modernity. A member of the Electrical Engineering faculty from Gujrat said that the university management talks about innovation but the IT support are not proactive rather reactive. He said we need pedagogical technologists, not just network engineers who can assist us to work proactively with these tools in the classroom.

Participants emphasized the need for organized and ongoing professional development. While planning various technical options for software programs of various software vendors, we considered that the first two options would not only be teaching software, but more specifically pedagogy learning which involves the use of the software in learning more specifically in subject learning. The rewording of the Sample: "We need workshops that demonstrate how virtual reality could use to simulate patient encounters with; or AI could be used to analyse student performance data, not only how to use PowerPoint". Targeted training is needed as higher educational lecturers are not ready for developing AR-based tools (Popenici & Kerr, 2017). Faculty indicated the need for peer-to-peer learning and mentoring programmes with others, with experienced faculty helping in the integration of technologies.

Similarly, the faculty called for clearer institutional policies on technology use, intellectual property rights for products created digitally, and innovation incentives. The existing system that associates promotions to publications closely was viewed as disincentivizing time spent on pedagogic innovation by some (Demitriadou et al., 2020). "An IT faculty from a university in Lahore pointed out, A research paper counts more towards my promotion than spending hours on an interactive AR module." It suggests the need for revising measures of performance for recognizing and rewarding efforts to use technology for teaching. An adequate budget for financing hardware, software licenses and technical support to is regularly considered a basic need to create an enabling environment for "Augmented Minds."

4.4. Theme 4: Impact on Faculty Roles and Cognitive Engagement

The faculty views the integration of "Augmented Minds" technologies as having significant implications for their evolving professional roles and the cognitive engagement of students. Numerous participants acknowledged a shift in their roles from being the sole originator of knowledge to becoming the facilitator of learning, the curator of digital resources, and the designer of technology-rich learning experiences. A faculty member of English Language personified by Faisalabad stated, "I do not lecture my students, rather I guide them through platforms of interactive learning in classroom to make my students critical evaluators of information from AI and learners who solve problems collaboratively. This is the constructivist shift towards learning-centred environments." (Gerlich, 2025).

This evolution did not come without anxiety, particularly about the use of technology hindering students' thinking and memory. A Mathematics teacher from Gujrat raised a pertinent question: "If AI is inventing theorems or writing essay, wouldn't this lead to failure to develop the basic cognitive skills? The learners would just be passive consumers." This directly echoes the literature

warning about the dangers of AI lowering cognitive engagement. This could result in passive acceptance, and not questioning the information received in critical ways. Some faculty members also expressed concerns about the black box nature of some AI tools. Would they understand and assess learner's learning if they are not in the loop of the process?

On the other hand, some faculty stated that technology can promote higher order thinking. An Optometry faculty member based in Sahiwal stated, "Rather than memorising definitions and principles, AI can remember the basics for us, which allows for conversations about important things in class – analysis of cases and tackling difficult problems. We can spend more time applying the knowledge rather than just learning them." It shows that AI may also become an enabler to creative potential rather than a disabler if a well-planned roadmap is established (Cronbach & Suppes, 1969). The faculty member also sees his cognitive load increase and is now compelled to upskill himself to learn new tools, change his teaching strategy, and think about ethical issues involving AI. Many educators have found this experience to be demanding yet intellectually stimulating, compelling them to progress in tandem with the rapid pace of digital technology. The interplay of technology in education challenges and redefines teaching and learning but requires maintaining a balance for optimum cognitive augmentation rather than replacement of human teaching and learning capabilities.

5. Discussion

5.1. Aligning Findings with Global Trends and Theories

The results of the study in private universities of Punjab are found matching with the results about technology findings in higher education worldwide, which has been drawn by the authors from the previous studies. Much of the faculty feels that technology can promote pedagogy in terms of engagement, personalization and collaboration. The excitement surrounding the possibility of using AI to create personalized learning experiences aligns with the worldwide discussion on differentiation as one of the promises of intelligent tutoring systems **(**Cronbach & Suppes, 1969).

Moreover, the concerns raised by faculty members regarding inadequate infrastructure, limited professional development, and insufficient time challenges are not unique to Pakistan. Quite the opposite, these are also cited in literature as barriers to the use of technology in higher education institutions globally. The low readiness of higher education lecturers for the creation of AR-based tools, as per the literature, was very much evident through the expressed needs by faculty for a more systematic and discipline-specific training support. In other words, the global systemic dynamics of an accelerating technological pace, coupled with institutional overload and educator under-load were clearly at play as faculty expert users called for more guidance and support.

The faculty emphasizes how educational technologies are usable and functional, which reflects the theoretical basis of Human-Computer Interaction (HCI). According to Young and Laffey (2003), the demand for intuitive design and strong technical support demonstrates the critical role of human-computer interaction in technology implementation (Braun & Clarke, 2006). If technologies do not offer usefulness, usability, and enjoyment, they cannot possess pedagogical potential. Concerns regarding the impact of technology on students' critical thinking and retention of memory directly validate the relevance of Cognitive Load Theory. This theory warns us that the over-reliance of AI could lead to a situation where extraneous cognitive load occurs, and information is consumed passively (Cronbach & Suppes, 1969). The current study contributes to the literature by providing empirical data from a particular context that resonates with broader theory and practice issues across the globe in 'Augmented Minds.'

5.2. Divergences and Nuances in the Pakistani Context

Although a number of findings are generalizable, this study also yields important divergences and nuances specific to the context of higher education in Pakistan, especially private universities in Punjab. Pakistan's higher education system presents a dilemma for faculty; will they seek quantity or quality in their outputs? **(**Demitriadou et al., 2020). The pressure is on faculty to publish in order to be promoted. According to the literature, this pressure is much greater than the incentive to innovate in their pedagogy or to utilize technology **(**Demitriadou et al., 2020). As a result, while faculty are aware of global trends like "Augmented Minds" and see their potential, the reward structure embedded in their institution may not align with that reality. This is because the use of these tools in teaching requires time and effort, which is not of equivalent institutional value. This can be contrasted with contexts where professional progression enshrines excellent teaching and innovation more explicitly.

Moreover, the basic infrastructure problems, such as unreliable internet and insufficient computing power, in some Pakistani institutions seem to be much more serious than in other economies that are ahead of Pakistan in the development ladder **(**Demitriadou et al., 2020). While it is a worldwide problem, when it comes to more advanced "Augmented Minds" technologies, the deep and wide existence of such basic resources deficits in some Private Universities of Punjab creates a larger barrier to entry. The results also highlight the unique phenomenon of skill gaps among faculty in Pakistan. Only a small fraction of faculty members hold PhDs, and many junior faculty do not receive the mentoring required to develop advanced research and teaching

skills. This makes the shift to complex AI-enabled pedagogies an even greater challenge without targeted, sustained and context-sensitive professional development.

The study also reveals that the perception of "Augmented Minds" is influenced by the local socio-cultural milieu. The faculty acknowledge the advantages; however, there is a clear undercurrent of concern about ensuring the human touch in education and avoiding excessive dependence on technology, in all likelihood, reflecting a general societal wariness of rapid technological changes. As such, "Augmented Minds" strategies will have to pay attention to local fears rather than being copied from afar. This adds a complicating factor to the global conversation.

5.3. Theoretical Contributions

The article contextually applies and extends existing frameworks, making several theoretical contributions in the study. This paper seeks to provide a multidimensional perspective on the research development of "Augmented Minds" from the viewpoint of the faculty using constructivism, HCI, and cognitive load theory. The use of constructivist principles in education has received widespread endorsement and proliferation in teaching and learning pedagogy throughout the world. Moreover, technology integration increasingly and effectively promotes shifts to learner-centered environments globally, including in a developing country known to be constantly challenged by the insurmountable barriers of the status quo. The results validate empirically the relevance of HCI in EDTECH. The usability and experience of the tools and technology are most important for the faculty in adopting and effectively incorporating teaching, even in low-resource settings.

Crucially, the research adds value to the existing theorising about cognition and artificial intelligence. By documenting faculty concerns about a decline in critical thinking and memory retention due to over-reliance on AI, it offers qualitative evidence that complements Cognitive Load Theory's warnings in real-world educational contexts **(**Cronbach & Suppes, 1969). This entails that "Augmented Minds" must be theoretically sharpened to highlight the systemic opposition between augmentation and liability, rather than advocating for a purely benevolent imagined future. The study also indirectly contributes the diffusion of innovations theory through unpacking the constraining and supporting factors regarding the (mis-)adoption of complex technological innovations (like AI in pedagogy) in a particular institutional and national culture, which brings into view the interplay between perceptions, institutions, and wider systems.

5.4. Practical Implications for Policy and Practice

The results of this investigation possess important implications for policymakers, university administrators and faculty in Pakistan and similar developing environments looking to use technologies for "Augmented Minds." For the policymakers, the research reveals an urgent need to reconsider the policies of the Higher Education Commission (HEC) to reduce the focus on research publications and provide incentives for pedagogical innovation and technology adoption. Revising the promotional criteria to clearly acknowledge and incentivize establishing and implementing technology-enabled teaching methods can motivate faculty substantially. Moreover, policies should address the basic infrastructure deficits in the universities and ensure the basic availability of reliable internet and computing resources to all. These are prerequisites for any advanced digital initiatives **(**Boyer, 1990).

The research underlines the need for university administrators to have effective and continuous professional development programs. Training should be discipline-specific, practical and pedagogically-oriented towards the use of the relevant 'Augmented Minds' tools, rather than generic software training **(**Popenici & Kerr, 2017). Educated investments in dedicated pedagogical technologists, as well as strong technical support teams, should be made to help faculty integrate more complex technologies. Establishing a culture that promotes peer learning and mentorship can further create a more conducive atmosphere for technology adoption. School administrators must ensure that upfront the technology strategy is clearly communicated and the financial resources are adequate for ongoing technology purchase and maintenance.

The research points to the need for faculty to engage in professional development and be reflective about implementation of technology. With the implementation of "Augmented Minds" in classrooms, it is crucial to be mindful of cognitive effects on pupils when working with faculty. Creating a pedagogically intentional learning environment to foster student questioning about technology, instead of consuming content, can overcome personal impediments to technology use, and it can also be achieved by building a coalition among colleagues in other curriculum areas and taking a proactive stance in seeking institutional support. Overall, the successful implementation of 'Augmented Minds' requires a multi-stakeholder, context sensitive and best-practices approach.

6. Conclusion

6.1. Recapitulation of Key Contributions

The research of Augmented Minds has used a qualitative inquiry to fully examine faculty perceptions and experiences of using technology in the classroom at private universities in the province of Punjab, Pakistan. Increased interaction and personalization in learning have proven the effectiveness of technology in education, especially during the pandemic. It has also revealed gaps in the digital infrastructure, professional development and cognitive overload. Educational technology literature receives a much-needed addition through this study with its local-specific global insight that showcases how certain global developed countries' trends are often at odds with local specific. It highlights the need of strong institutional backing and stresses the intricate dependency between technology, pedagogy and the diverse roles of educators today.

6.2. Limitations of the Study

There were some limitations to this study, which was comprehensive. It is a qualitative study, and results cannot be generalized statistically in Pakistan or in other context. Interviews can produce very rich data but may be subject to social desirability bias. These findings could be complemented in the future by incremental, observational or quantitative measures. While it would be great to only have the faculty discourse, it would have been better to have some student's perspective as well to gain a fuller understanding of the "Augmented Minds" phenomenon.

6.3. Future Research Directions

Future research can be conducted using mixed methods approach on the empowerment of "Augmented Minds" technologies on the learning outcomes and cognition of the students in the Pakistani universities. Longitudinal studies can determine whether and how faculty preparedness has changed over time and whether and how technology use has changed based on different models of technology professional development. Comparative studies of the public and private universities in Pakistan and with the universities of other developing countries can be done to understand the best practices and situation-specific solutions that facilitate successful digital transformation. The authors also suggested ethics and ethics issues related to AI in education, particularly from the lens of data privacy and algorithmic bias in the context of Pakistan.

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References

[1] Abdullah, I., Nabi, S. W., Akhtar, J., & Javed, N. (2026). Research culture in Pakistan's Higher Education Institutions (HEIs): Examining the consequences of publication driven policies. *Societal Impacts*, *7*. https://doi.org/10.1016/j.socimp.2026.100183

[2] Bacca, J., Baldiris, S., Fabregat, R., Graf, S., & Kinshuk. (2014). Augmented reality trends in education: A systematic review of research and applications. *Educational Technology & Society, 17*(4), 133–149. https://dugi-doc.udg.edu/bitstream/handle/10256/17763/AugmentedRealityByNcNd.pdf

[3] Boyer, E. L. (1990). *Scholarship reconsidered: Priorities of the professoriate*. Princeton University Press, 3175 Princeton Pike, Lawrenceville, NJ 08648..

[4] Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

[5] Cronbach, L. J., & Suppes, P. (Eds.). (1969). *Research for tomorrow's schools: Disciplined inquiry for education*. Macmillan.

[6] Delello, J. A., McWhorter, R. R., & Camp, K. M. (2015). Integrating augmented reality in higher education: A multidisciplinary study of student perceptions. *Journal of Educational Multimedia and Hypermedia, 24*(3), 209–233. https://www.learntechlib.org/primary/p/148455/.

[7] Demitriadou, E., Stavroulia, K.-E., & Lanitis, A. (2020). Comparative evaluation of virtual and augmented reality for teaching mathematics in primary education. Education and Information Technologies, 25(1), 381–401. https://doi.org/10.1007/s10639-019-09973-5

[8] Gerlich, M. (2025). AI tools in society: Impacts on cognitive offloading and the future of critical thinking. Societies, 15(1), 6. https://doi.org/10.3390/soc15010006

[9] Guba, E. G., & Lincoln, Y. S. (1989). Fourth generation evaluation. Sage Publications.

[10] Hyland, K. (2016). Academic publishing and the myth of linguistic injustice. Journal of Second Language Writing, 31, 58–69. https://doi.org/10.1016/j.jslw.2016.01.005

[11] Ibáñez, M. B., & Delgado-Kloos, C. (2018). Augmented reality for STEM learning: A systematic review. Computers & Education, 123, 109–123. https://doi.org/10.1016/j.compedu.2018.05.002

[12] Johnson, L., Smith, R., Willis, H., Levine, A., and Haywood, K., (2011). The 2011 Horizon Report. Austin, Texas: The New Media Consortium..

[13] Miller, A. N., Taylor, S. G., & Bedeian, A. G. (2011). Publish or perish: Academic life as management faculty live it. Career Development International, 16(5), 422–445. https://doi.org/10.1108/13620431111167751

[14] Popenici, S. A. D., & Kerr, S. (2017). Exploring the impact of artificial intelligence on teaching and learning in higher education. Research and Practice in Technology Enhanced Learning, 12(1), 1–13. https://doi.org/10.1186/s41039-017-0062-8

[15] Yuan, M. L., Ong, S. K., & Nee, A. Y. C. (2008). Augmented reality for assembly guidance using a virtual interactive tool. International Journal of Production Research, 46(7), 1745–1767. https://doi.org/10.1080/00207540600972935