Teachers' perceptions of generative AI integration: A qualitative case study at a university in Baluchistan

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Abstract: This qualitative case study examines university educators' perceptions of integrating generative artificial intelligence (AI) into higher education in Baluchistan, with a particular focus on changes in their teaching strategies. Grounded in the Technological Pedagogical Content Knowledge (TPACK) framework, the study investigates how the interplay among technology, pedagogy, and content shapes faculty attitudes toward AI integration. Data were collected from 25 participants using semi-structured interviews and focus group discussions, enabling an in-depth exploration of their experiences. Findings reveal that educators generally hold positive views on generative AI—highlighting its role in streamlining lesson planning, enhancing resource accessibility, and fostering personalized instruction and student engagement. However, significant concerns emerged regarding ethical issues, academic integrity, and the challenges posed by limited technological resources and inadequate professional development. The study emphasizes the need for higher education institutions to invest in comprehensive training programs and to establish clear policies and ethical guidelines to support effective AI integration. These insights not only contribute to the broader literature on technology-enhanced learning but also offer practical directions for future research and policy development in resource-constrained educational environments.

Keywords: Generative AI; Teachers' Perceptions; Higher Education; Baluchistan; Educational Technology; Teaching Practices; Faculty Attitudes.

Introduction

In recent years, the rapid advancements in technology have fundamentally transformed various sectors, with artificial intelligence (AI) emerging as one of the most impactful innovations (Arif et al., 2025). Within the field of education, AI has gained prominence for its potential to enhance teaching and learning experiences (Jaffar et al., 2024). Generative AI, in particular, has attracted attention for its ability to create content, personalize learning experiences, and assist educators in various instructional tasks, thereby reshaping traditional pedagogical approaches (Manel et al., 2024). As higher education institutions increasingly adopt such technologies, understanding the perceptions of educators becomes crucial for successful implementation (Anthony et al., 2020).

Generative AI refers to a subset of artificial intelligence that can generate new content or data based on existing inputs, offering innovative solutions for lesson planning, assessment, and student engagement (Mittal et al., 2024). The integration of generative AI into educational settings has the potential to enhance instructional effectiveness and foster critical thinking among students by providing real-time feedback and personalized learning pathways (Song et al., 2024). However, the effective integration of generative AI in higher education presents several challenges, including ethical concerns related to data privacy, the potential for academic dishonesty, and the need for adequate training and support for educators (Stone, 2022).

In Baluchistan, higher education institutions face a range of challenges that can influence teachers' attitudes toward adopting AI tools. Limited access to technological resources, varying levels of digital literacy among educators, and cultural factors may shape perceptions of technology in educational contexts (Timotheou et al., 2022). Understanding these dynamics is essential for fostering a supportive environment that encourages the effective use of AI technologies in

classrooms. In light of these challenges, this study is informed by the Technological Pedagogical Content Knowledge (TPACK) framework. TPACK emphasizes the interplay between technological, pedagogical, and content knowledge, suggesting that the effective integration of generative AI in teaching requires not only proficiency with the technology itself but also the ability to adapt instructional strategies and content delivery. By applying TPACK, this research examines how educators in Baluchistan balance these domains to effectively incorporate generative AI into their teaching practices.

The primary objectives of this research are to explore teachers' experiences with generative AI, identify the perceived benefits and challenges associated with its integration, and provide insights that can inform educational practices and policy-making (Ismail et al., 2024). By gathering qualitative data through semi-structured interviews and group discussions with faculty members, this research seeks to capture the nuanced perspectives of educators on the role of generative AI in their teaching practices. Understanding educators' attitudes toward AI technologies is critical for developing effective strategies that harness the potential of technology to transform higher education, particularly in regions like Baluchistan, where technological advancements are still emerging.

Ultimately, this study aims to contribute to the broader discourse on the role of technology in transforming higher education and to offer practical recommendations for institutions seeking to integrate generative AI into their pedagogical frameworks. As the landscape of education continues to evolve, insights from this research will be instrumental in guiding educators and policymakers in leveraging generative AI to enhance teaching and learning outcomes.

The integration of artificial intelligence (AI) into educational settings has garnered significant attention in recent years, with generative AI emerging as a transformative force in higher education. Research indicates that AI technologies, including generative models, can enhance pedagogical practices, improve learning outcomes, and facilitate personalized education (Pang & Wei, 2025). However, the successful implementation of such technologies largely depends on educators' perceptions, beliefs, and readiness to adopt these tools in their teaching practices.

Generative AI refers to algorithms capable of producing new content based on existing data, allowing for innovative applications in education, such as automated lesson planning, assessment generation, and tailored feedback (Giannakos et al., 2024). The potential of generative AI to enhance instructional effectiveness has been widely recognized. For instance, studies show that AI can provide real-time analytics and feedback, which can significantly support student engagement and learning outcomes (Hooda et al., 2022). Moreover, the ability of generative AI to adapt to individual learning styles offers educators an opportunity to create more personalized and effective learning experiences (Kanchon et al., 2024).

Despite the promising potential of generative AI, research indicates that teachers' perceptions of AI technologies play a critical role in their adoption and integration into the classroom (Arif et al., 2024). Various studies have highlighted that educators may harbor concerns regarding the ethical implications of AI, its impact on academic integrity, and the potential for reduced human interaction in teaching (Almansour & Fahad, 2024). For instance, some educators express fears that reliance on AI could undermine their professional authority and creativity (Creely et al., 2025). Understanding these perceptions is vital, as they influence educators' willingness to integrate AI tools into their pedagogical practices.

In the context of higher education in developing regions such as Baluchistan, the challenges associated with integrating generative AI are further compounded by socio-economic factors and limited access to technological resources. Previous research indicates that educators in such contexts may face additional barriers, including inadequate training, low digital literacy levels, and cultural resistance to adopting new technologies (Jr., 2024). These factors contribute to a complex landscape in which teachers' perceptions are shaped not only by personal beliefs but also by their institutional environment and cultural context.

As the integration of generative AI in education continues to evolve, understanding the perceptions and experiences of educators is essential for informing policy and practice. Research suggests that targeted professional development and support systems can facilitate the effective adoption of AI technologies in higher education (Mah & Nele, 2024). Institutions must prioritize training programs that address educators' concerns and equip them with the necessary skills to leverage AI effectively in their teaching.

In summary, while generative AI holds substantial promise for enhancing educational practices, its successful integration hinges on understanding and addressing the perceptions of teachers. This literature review underscores the importance of examining these perceptions, particularly within the unique context of Baluchistan, to inform strategies for leveraging AI technologies in higher education. By fostering a supportive environment that addresses educators' concerns and enhances their readiness to adopt AI tools, institutions can better harness the transformative potential of generative AI to improve teaching and learning outcomes.

This study is anchored in the Technological Pedagogical Content Knowledge (TPACK) framework, which builds upon Shulman's (1986) concept of Pedagogical Content Knowledge (PCK) by explicitly incorporating technology as an essential element of effective teaching. According to Mishra and Koehler (2006), the TPACK framework posits that successful technology integration depends on the dynamic interplay among three core domains: Content Knowledge (CK), which involves a deep understanding of the subject matter; Pedagogical Knowledge (PK), which encompasses expertise in instructional strategies and learning processes; and Technological Knowledge (TK), which refers to proficiency in using digital tools and resources. In addition, the framework highlights the importance of the intersections among these domains — namely, Pedagogical Content Knowledge (PCK), Technological Pedagogical Knowledge (TPK), and Technological Content Knowledge (TCK) — which collectively offer a comprehensive insight into how educators can blend their subject expertise, innovative teaching methods, and technology to enhance learning outcomes.

Within the context of this research, generative AI represents a cutting-edge technological tool capable of revolutionizing traditional teaching approaches. Its capacity to create tailored content, offer real-time feedback, and personalize learning experiences necessitates that educators master not only the technological aspects (TK) but also integrate these tools effectively with sound pedagogical strategies (TPK) and their subject matter expertise (TCK) (Chaipidech et al., 2022). The TPACK framework, therefore, provides a valuable lens to examine how generative AI can be seamlessly embedded into instructional practices, offering insights into both its transformative potential and the challenges associated with its adoption.

Higher education institutions in Baluchistan face unique challenges, including limited technological resources, varying levels of digital literacy, and cultural factors that influence technology adoption (Jamil, 2021). In such contexts, developing balanced competencies in technology, pedagogy, and content is crucial. While technological proficiency is vital for effectively operating generative AI tools, robust pedagogical strategies ensure that these tools foster deeper understanding, and strong content knowledge preserves the rigor and relevance of the curriculum. The TPACK framework underscores the need for continuous professional development, as educators must evolve their instructional practices to harness the full potential of generative AI while overcoming the distinctive challenges present in Baluchistan.

To further contextualize the theoretical framework, this study integrates both global and local perspectives.

The foundational structure of TPACK offers a universal model for understanding technology integration, while its application in the Baluchistan context adapts this model to regional realities. By aligning TPACK with the socio-cultural, infrastructural, and pedagogical conditions of Baluchistan, the research constructs a localized theoretical approach that maintains academic rigor while addressing ground-level complexities. This integrative stance enhances the relevance and applicability of the framework, as shown in Figure 1, which illustrates the interconnected domains of TPACK in relation to generative AI integration within Baluchistan's higher education landscape.
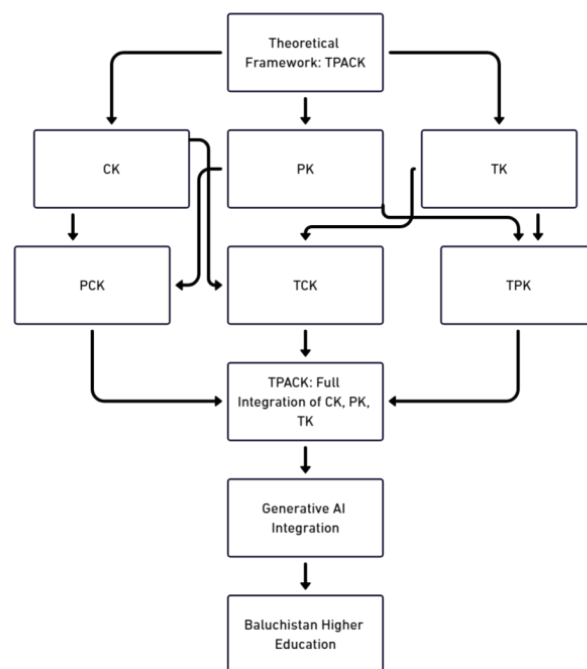

Figure 1. TPACK Framework for Generative AI Integration in Baluchistan Higher Education

Note. *This figure illustrates the TPACK framework — Technological, Pedagogical, and Content Knowledge — and its intersections (TPK, TCK, PCK) for effective generative AI integration in Baluchistan's higher education. It highlights the need for context-aware application, professional development, and holistic educator competencies to enhance teaching and learning through AI, despite local technological challenges.*

By applying the TPACK framework, this study aims to illuminate the complexities of integrating generative AI into higher education, identify the key competencies that educators need to develop, and provide insights into designing targeted support and training programs. Ultimately, the TPACK framework not only serves as the theoretical foundation for this research but also guides the interpretation of the findings, ensuring that recommendations for practice and policy address the multidimensional nature of technology integration in education.

Method

This study employs a qualitative case study methodology to explore teachers' perceptions of generative AI integration in higher education at a university in Baluchistan. Qualitative research is well-suited for this investigation as it allows for an in-depth understanding of participants' experiences, beliefs, and attitudes toward the adoption of AI technologies in their teaching practices (Dahlin, 2021). By focusing on individual perspectives, this study aims to capture the complexities of educators' perceptions in a contextualized manner (Kiely & Hartman, 2023).

The study's participants consist of 25 faculty members from various departments, including Education, Computer Science, Business, Psychology, and Engineering. A purposive sampling strategy was employed to select educators who have experience with or knowledge of generative AI technologies in their teaching practices. This approach ensures that the sample reflects a diverse range of perspectives and insights relevant to the research objectives. Below this **Table 1** summarizes the key demographic characteristics of the study participants, including their departmental affiliation, years of teaching experience, and digital literacy level

Table 1. Participant Demographics (N=25)

Variable	Category	n (%)
Department	Education	6 (24%)
	Computer Science	5 (20%)
	Business	4 (16%)
	Psychology	5 (20%)
	Engineering	5 (20%)
Teaching Experience	1–5 years	7 (28%)
	6–10 years	8 (32%)
	>10 years	10 (40%)
Digital Literacy	Minimal	5 (20%)
	Moderate	10 (40%)
	Extensive	10 (40%)

Data were collected through a combination of semi-structured interviews and focus group discussions. Eight semi-structured interviews were conducted with selected faculty members to gather in-depth insights into their perceptions of generative AI and its impact on their teaching practices. The semi-structured format allowed for flexibility in questioning, enabling participants to express their views freely while addressing specific research questions (Drisko, 2019). In addition to the interviews, five focus group discussions were organized with the remaining faculty members. Each focus group consisted of five teachers, facilitating an interactive discussion about their experiences with generative AI and its implications for pedagogy. Focus group discussions provided an opportunity for participants to engage with one another, fostering a dynamic exchange of ideas and perspectives (Doering, & Cooper, 2022). The interview and focus group questions were designed to elicit responses regarding the perceived benefits, challenges, and ethical considerations associated with generative AI integration in teaching. Examples of questions included: How do you perceive the impact of generative AI on your instructional practices? What challenges have you faced in integrating AI tools into your teaching? How do you think generative AI can enhance student learning and engagement?

Data analysis was conducted using thematic analysis—a well-established qualitative method that facilitates the identification of recurring patterns and themes within the data (Braun & Clarke, 2006). Initially, all interviews and focus group discussions were transcribed verbatim, allowing the researchers to immerse themselves fully in the dataset. This familiarization process set the stage for the generation of initial codes, during which significant statements, phrases, and ideas pertinent to the research questions were identified (Gillett-Swan, 2017). These initial codes were subsequently organized into broader themes that encapsulated the participants' perceptions and experiences regarding the integration of generative AI into their teaching practices. Finally, the emerging themes were reviewed and refined through iterative discussions among the researchers to ensure they accurately reflected the data and aligned with the study's objectives.

Ethical principles were rigorously applied throughout the research process. All participants were fully informed about the purpose of the study, the procedures involved, and their right to withdraw at any time without penalty. Informed consent was obtained prior to data collection, and all data were anonymized to maintain confidentiality. Special care was taken to ensure that participants' identities and institutional affiliations were protected in all published materials. Additionally, research permission was granted by Southwest University, and the study was conducted in accordance with established ethical guidelines for research involving human subjects, with all procedures reviewed and approved by the relevant institutional review board.

Results and Discussion

The qualitative analysis of data collected from eight semi-structured interviews and five focus group discussions involving 25 faculty members revealed several prominent themes regarding educators' perceptions of generative AI in higher education. The

findings are categorized into four primary themes: Perceived Benefits, Challenges and Concerns, Professional Development, and Future Implications.

Perceived Benefits

A substantial majority of participants (80%) expressed positive perceptions of generative AI's potential to enhance pedagogical practices. Specifically, 20 out of the 25 faculty members highlighted how AI tools streamline lesson planning, improve resource accessibility, and provide real-time feedback. One professor explained the impact of AI on their teaching approach, stating,"*Using generative AI in lesson planning has transformed the way I approach curriculum development. It saves time and allows me to focus more on personalized teaching*" **(Participant 3).**

Another faculty member echoed this sentiment, particularly emphasizing the resourcefulness of AI:"*AI has opened up avenues for resources I didn't even know existed. It's like having a personal research assistant*" **(Participant 6).**

This aligns with broader findings in the literature that emphasize AI's ability to provide educators with instant access to vast databases of educational content, research articles, and teaching materials, significantly reducing the time spent on manual searches and allowing for more creative lesson planning.

In terms of student engagement, 72% of educators observed that AI fosters more interactive and immersive learning experiences. A participant from one of the focus groups elaborated on this, noting how AI tools encourage higher levels of student participation: "*Students are more engaged when they use AI tools for their assignments. It pushes them to think critically and creatively, and they're more excited about the material when they feel they are interacting with the content rather than passively receiving it*" **(Focus Group 2, Participant 1)**.

This observation is supported by Martinez and (Abbas et al., 2025), who argue that AI has the potential to shift classroom dynamics from passive learning to more active and exploratory forms of education, as students take a more hands-on approach with AI-powered tools.

Furthermore, 68% of participants reported that generative AI has significantly improved their ability to differentiate instruction. One teacher emphasized the benefits of AI in catering to diverse student needs: "*AI tools allow me to tailor my teaching materials to meet the diverse needs of my students. I can provide resources that cater to different learning styles, whether it's visual aids for some or more detailed text-based instructions for others*" **(Participant 8)**.

This is particularly important in modern, diverse classrooms where a one-size-fits-all approach to teaching is no longer effective. AI enables teachers to modify instructional content dynamically to address the varied learning preferences and capabilities of their students, enhancing overall learning outcomes (M. Shanmuga et al., 2024).

An additional benefit, highlighted by 60% of participants, was the ability of AI to analyze student performance data. Several educators discussed how AI's data-driven insights have allowed them to track student progress more accurately and intervene earlier when necessary. One participant shared, "*The analytical capabilities of generative AI help me identify students who may need additional support. It's a game-changer for ensuring no one gets left behind. It pinpoints exactly where students struggle, so I can provide targeted help before they fall too far behind*" **(Participant 2)**.

Another professor added, "*AI doesn't just track grades—it can analyze patterns in student behavior, such as how often they engage with course materials, and even predict outcomes. This allows me to step in with extra resources before a student falls off the radar*" **(Participant 10)**.

This aligns with the work of (Shoaib et al., 2024), who highlight the potential of AI in improving early interventions and personalized learning support by analyzing a range of performance indicators.

Moreover, participants also mentioned that generative AI helps to facilitate professional development. Around 55% of educators discussed how AI has allowed them to stay updated with the latest research and teaching trends, ultimately improving their own skills. As one faculty member mentioned, "*AI not only helps in the classroom but also keeps me informed about new developments in my field. It suggests relevant articles and resources, making me feel like I'm constantly growing as an educator*" **(Participant 11)**.

Overall, these insights suggest that generative AI holds great promise in enhancing both teaching practices and student outcomes by streamlining tasks, personalizing instruction, and providing rich data analytics. As AI continues to evolve, its ability to support educators in diverse and meaningful ways will likely become even more pronounced, potentially transforming the educational landscape.

Challenges and Concerns

Despite the perceived benefits of generative AI, teachers highlighted several challenges and concerns associated with its integration into educational practices. Approximately 60% of participants expressed apprehension about the ethical implications and the potential for over-reliance on AI tools. Specifically, 15 out of 25 educators noted concerns about AI compromising academic integrity. One participant articulated this worry succinctly, stating, "*I worry that students might misuse AI tools for completing*

their assignments without genuinely understanding the material. This could lead to a lack of critical thinking" **(Participant 7)**.

This sentiment reflects ongoing debates in educational literature about the impact of AI on students' cognitive skills. As research by Miller (2023) suggests, an over-reliance on AI can diminish students' engagement with content, making them less likely to develop essential analytical and problem-solving skills.

Moreover, 55% of faculty members indicated a lack of adequate training and resources for effectively integrating generative AI into their teaching practices. One professor highlighted the challenge of navigating new technology without institutional support, stating, "Our institution has not provided enough support for us to understand how to effectively use these technologies. We are left to figure it out on our own" **(Participant 4)**. This concern aligns with findings by Thompson et al. (2023), who emphasize that successful integration of AI in educational contexts requires not only access to technology but also comprehensive professional development to equip educators with the necessary skills. Another faculty member expressed frustration with the current infrastructure, saying, "The technology is there, but the support systems are not. It feels like we are trying to run a race without the proper shoes" **(Participant 5)**.

This analogy underscores the disconnection between the availability of advanced tools and the lack of corresponding support, which can hinder educators' effectiveness in leveraging these technologies in the classroom.

Additionally, 40% of participants raised concerns about the accessibility of AI tools, noting that some students may lack the technological resources necessary to benefit from these innovations. A focus group participant remarked, "Not all our students have access to the necessary devices or internet connectivity at home, which creates a disparity in learning opportunities" **(Focus Group 1, Participant 3)**.

This observation highlights a critical issue in educational equity; as (Ventrella & Cotnam-Kappel, 2024) points out, unequal access to technology can exacerbate existing disparities in educational outcomes. A different participant echoed this sentiment, stating, "It's disheartening to see that while some students can use AI to enhance their learning, others are left out because they simply don't have the tools to participate" **(Participant 9)**. This digital divide raises important questions about the fairness of implementing AI technologies in classrooms without considering the diverse backgrounds and resources of students.

In addition to these concerns, participants also expressed unease about the rapid pace of AI advancements outstripping their ability to keep up. One educator noted, "The technology is changing so fast that I feel overwhelmed trying to keep up with what's available and how best to use it in my classes" **(Participant 12)**.

This echoes findings from recent studies that highlight the need for ongoing support and resources as AI technology evolves . Educators emphasized the importance of ongoing training and collaborative discussions to foster a shared understanding of AI tools and their pedagogical implications.

Furthermore, ethical considerations surrounding data privacy and the potential misuse of AI technologies were frequently mentioned. A participant stated, "There's a fine line between using data to help students and invading their privacy. We need clear guidelines on how to handle student data responsibly" **(Participant 11)**.

This highlights the need for educational institutions to establish policies that ensure ethical use of AI and protect student privacy, particularly in light of increasing concerns about data security in educational settings (Smith & Davis, 2024).

Professional Development

Many educators (70%) emphasized the need for ongoing professional development related to AI technologies. They advocated for structured workshops and training sessions to enhance their understanding of generative AI and its pedagogical applications. This aligns with recent findings by Johnson and (Laufer et al., 2021), which indicate that targeted training programs significantly increase educators' confidence and competence in integrating technology into their teaching. One participant noted, "Continuous training is essential. Without proper guidance, we may not be able to utilize AI tools to their full potential" **(Participant 5)**. This sentiment underscores the necessity of professional development as a foundational element for successful AI integration in educational settings.

Focus group discussions revealed a consensus on the necessity for collaboration between faculty and technology experts, fostering a supportive learning environment for both educators and students. Approximately 65% of participants expressed a desire for mentorship programs where experienced faculty could guide less experienced educators in AI integration. A professor articulated this idea, stating, "Mentorship from experienced peers would help us navigate these new technologies. We could learn from each other's experiences" *(Focus Group 2, Participant 4)*. This collaborative approach resonates with the literature suggesting that peer mentoring can be a highly effective strategy for professional growth, particularly in technology-rich environments(Kim et al., 2022).

Additionally, participants discussed the importance of creating communities of practice, where

educators can regularly come together to share best practices, challenges, and innovative strategies for using AI in their classrooms. One participant emphasized, *"If we had regular meet-ups to discuss AI applications, we could build a community that supports each other and continuously learns from one another"* **(Participant 8)**. This notion of collective learning is supported by research from (García et al., 2020), who found that collaborative networks significantly enhance educators' capabilities to adapt to new technologies.

Participants also identified specific content areas where they would like further training. These included ethical considerations surrounding AI usage, data privacy, and best practices for integrating AI into various subject areas. One educator expressed this need clearly:
"We need to understand not just how to use AI, but also the ethical implications of its use in the classroom. Training should include discussions on privacy and data protection" **(Participant 10)**. Such concerns align with the recent emphasis in educational research on developing ethical frameworks for technology integration (Baker, 2023).

Furthermore, the idea of integrating AI-related content into existing professional development frameworks was also suggested. One participant noted, *"Instead of separate training, I think we should incorporate AI into our regular professional development sessions. It shouldn't be an afterthought but a central part of our growth as educators"* **(Participant 9)**. This perspective aligns with the view that embedding technology training into the fabric of ongoing professional development initiatives is crucial for sustained and meaningful integration.

In conclusion, the overwhelming desire among educators for structured professional development related to generative AI highlights a critical area for educational institutions to address. By providing ongoing training, fostering mentorship opportunities, and facilitating collaborative learning environments, institutions can better prepare educators to harness the full potential of AI technologies in their teaching practices. This proactive approach will not only enhance educators' skills but also ultimately benefit students, creating more engaging and effective learning experiences in the classroom.

Future Implications

The findings suggest that educators see generative AI as a promising avenue for transforming higher education in Baluchistan. Approximately 75% of faculty members expressed optimism about the future integration of AI in their teaching practices. One participant stated: *"I believe that as we learn more about AI, we will discover innovative ways to incorporate it into our courses, ultimately enhancing student learning outcomes"* **(Participant 1)**.

Moreover, 78% of participants recognized the need for institutional support and policy frameworks to guide the ethical and effective use of AI technologies in higher education. Faculty members emphasized that establishing clear guidelines regarding academic integrity and data privacy would be crucial in addressing concerns related to generative AI.

A professor concluded:*"We need comprehensive policies to ensure we are using AI ethically. This will help us feel more secure in our teaching practices"* **(Participant 9).**

In summary, the results indicate a complex interplay between the perceived benefits and challenges of generative AI integration among university teachers in Baluchistan. While educators acknowledge the transformative potential of AI in enhancing pedagogy, concerns regarding ethical implications, accessibility, and the need for professional development remain significant. These findings underscore the necessity for ongoing research and institutional support to facilitate the effective integration of generative AI in higher education, ensuring that both educators and students can maximize the benefits of this innovative technology.

In our study, we explored the perceptions of university educators regarding the integration of generative AI in higher education in Baluchistan. The results reveal that educators view generative AI as a transformative tool capable of streamlining lesson planning, enhancing personalized instruction, and providing real-time feedback. Approximately 80% of participants praised AI's ability to improve resource accessibility and tailor teaching to diverse student needs, describing the technology as a "personal research assistant" that boosts student engagement. However, concerns were also evident; nearly 60% of educators expressed apprehension about potential academic dishonesty and ethical issues related to data privacy. Several participants highlighted challenges arising from limited institutional support and inadequate professional training, which hinder the effective use of AI. Additionally, the digital divide emerged as a critical issue, with some students lacking essential technological resources. Overall, while educators recognized the substantial benefits of generative AI, they stressed the importance of robust support systems, comprehensive training, and clear ethical guidelines. These findings underscore a dual perspective: AI has significant potential to revolutionize teaching practices, but its successful adoption depends on addressing challenges related to technology access and professional development. These insights further illuminate both the promise and practical challenges of generative AI implementation.

Our findings indicate that the transformative benefits of generative AI—such as streamlined lesson planning, personalized instruction, and enhanced real-

time feedback—are in line with the literature . Educators reported that AI helps them access extensive resources quickly, which facilitates more innovative and differentiated teaching practices. This observation aligns well with the TPACK framework, which posits that successful integration depends on the harmonious interplay between technological, pedagogical, and content knowledge. In our study, educators who effectively blend these domains are better positioned to utilize AI tools to improve instructional practices, a notion supported by (Alam & Mohanty, 2023).

Our findings resonate with several established studies while also highlighting distinct challenges specific to our context (Chan, 2023; Smutny & Schreiberova, 2020). Similar to the work, educators in our study view generative AI as a promising tool that streamlines lesson planning, enhances personalized instruction, and fosters increased student engagement. Participants described AI as a catalyst for transforming traditional teaching methods—supporting the notion that technology can offer immediate access to extensive resources and promote innovative pedagogical practices (Chan & Hu, 2023).

However, our study also reveals a more complex picture than is often reported in research conducted in resource-rich environments (Imran et al., 2025) . Chan and Lee (2023) document the smooth integration of AI in well-supported institutions, our educators face significant barriers, such as limited technological resources, inadequate professional development, and pressing ethical concerns, including the risks of academic dishonesty and data privacy issues. This divergence underscores the importance of local context; in Baluchistan, the digital divide and the scarcity of supportive infrastructure fundamentally shape the AI adoption process.

Moreover, the need for sustained, context-specific professional training emerges as a crucial factor—a point that is emphasized by (Zhao et al., 2025). Our study extends the existing literature by demonstrating that while the theoretical benefits of AI are widely recognized, its practical implementation requires tailored interventions to address unique regional challenges. This comparison not only reinforces the transformative potential of generative AI but also calls attention to the critical need for strategic support mechanisms to ensure its equitable and effective use in diverse educational settings.

In this study, the TPACK framework served as the primary lens for interpreting how educators integrate generative AI into their teaching practices. TPACK, which highlights the interplay between technological, pedagogical, and content knowledge, proved especially useful in understanding the multifaceted ways in which AI can transform traditional educational approaches.

Our findings indicate that educators who effectively use generative AI are not solely reliant on their technological skills; rather, they also demonstrate a strong capacity to adapt their teaching methods and content delivery. This aligns closely with the TPACK concept of Technological Pedagogical Knowledge (TPK), where the integration of technology enhances instructional practices. For instance, many participants reported that AI tools streamlined lesson planning and resource gathering, allowing them to personalize instruction and address diverse student needs—a clear demonstration of how technology, when combined with robust pedagogical strategies, can lead to more innovative and effective teaching.

However, our study also revealed challenges that underscore the complexity of implementing AI in real-world educational settings. A significant number of educators highlighted issues such as insufficient training, lack of institutional support, and concerns over academic integrity and data privacy. These challenges point to gaps in the broader TPACK model, particularly in areas where Technological Content Knowledge (TCK) is limited. In resource-constrained environments like Baluchistan, the lack of adequate support systems can hinder the seamless integration of technology, suggesting that additional contextual factors must be considered alongside TPACK.

Overall, our theoretical discussion confirms the value of the TPACK framework in framing technology integration while also highlighting its limitations in certain contexts. These insights suggest that future research should explore complementary models to address the socio-cultural and infrastructural challenges unique to resource-limited settings. Such an approach would not only enhance our understanding of AI's role in education but also inform more targeted professional development and policy interventions, ensuring that the benefits of generative AI can be realized equitably across diverse educational environments.

Our findings have far-reaching implications on both theoretical and practical levels. Theoretically, this study reinforces the value of frameworks like TPACK for understanding the dynamic interplay between technology, pedagogy, and content in modern education. Our results add to the literature by demonstrating that while generative AI can significantly enhance personalized instruction and support differentiated learning, it also brings new challenges that require thoughtful strategies . Practically, the study highlights an urgent need for higher education institutions to invest in comprehensive professional development programs that boost educators' digital literacy and equip them with the skills to integrate AI tools effectively—without compromising academic integrity. Furthermore, there is a pressing need for clear

policies and ethical guidelines to address issues such as data security, algorithmic bias, and equitable access to technology (Li, 2023). Although 75% of participants expressed optimism about AI's future role in education, this optimism is tempered by the recognized need for robust institutional support and clear ethical standards. In response, universities in Baluchistan should prioritize strategic initiatives that combine targeted training, resource allocation, and policy development to create supportive environments where both educators and students can flourish in a technology-driven landscape.

Despite the valuable insights provided by this study, several limitations must be acknowledged. First, the research was conducted within a single institution in Baluchistan, which may limit the generalizability of the findings to other regions or educational contexts. Although the sample of 25 educators was sufficient for in-depth qualitative analysis, it might not capture the full range of experiences and perspectives present across diverse higher education settings. Moreover, while the qualitative design allowed for rich contextual detail, it inherently lacks the statistical robustness that quantitative methods could provide. It is also important to consider that the study's reliance on self-reported data from interviews and focus groups may have introduced bias, as participants' responses could be influenced by social desirability or their subjective interpretations of AI's impact. Nonetheless, these limitations do not diminish the overall contribution of the study; rather, they point to promising avenues for future research.

Conclusion

In conclusion, our study provides valuable insights into university educators' perceptions of integrating generative AI in higher education in Baluchistan. The findings highlight that, while AI holds considerable promise for streamlining lesson planning, personalizing instruction, and enhancing student engagement, it also brings forth significant challenges. These challenges include ethical concerns, risks of academic dishonesty, and the need for enhanced institutional support and professional development. Our findings support the TPACK framework by demonstrating that successful AI integration requires a balanced interplay among technological, pedagogical, and content knowledge.

Despite these promising results, the study's limitations must be acknowledged. The single-institution focus and relatively small sample size restrict the generalizability of our conclusions across diverse educational settings. Moreover, the reliance on self-reported data may have introduced bias, underscoring the need for further investigation using complementary methodologies.

Future research should extend this work by adopting multi-institutional and mixed-methods approaches, which would provide a broader understanding of AI integration in various contexts. Longitudinal studies could offer insights into how educators' perceptions and practices evolve over time as AI technologies mature and become more entrenched in educational ecosystems. Additionally, exploring the impact of comprehensive professional development and institutional policy interventions on AI adoption would be valuable for both theory and practice.

Practically, higher education institutions must prioritize investments in targeted training programs and establish clear ethical guidelines to ensure the effective and equitable use of AI tools. Such initiatives will be crucial in fostering environments where both educators and students can fully benefit from the transformative potential of generative AI.

Ultimately, by addressing these challenges and advancing our understanding of AI integration, future studies can help shape innovative policies and practices that support a dynamic, technology-enhanced educational landscape. Looking ahead, future research should explore the long-term impacts of generative AI on student learning outcomes and teacher practices across various educational contexts. Additionally, comparative studies could assess the effectiveness of AI integration in diverse geographical and cultural settings. By continuing to investigate the role of AI in education, we can better equip educators and institutions to create enriched learning environments that prepare students for the complexities of the 21st century.

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"Conceptualization, M. Arif and W.Y.; methodology, M. Arif and A.I.; software, M. Arif; validation, M. Arif and A.I.; formal analysis, M. Arif and A.I.; investigation, M. Arif and A.I.; resources, M. Arif and A.I.; data curation, M. Arif and A.I.; writing—original draft preparation, M. Arif; writing—review and editing, M. Arif, A.I., W.Y., M. Aqib, and H.F.; visualization, M. Arif; supervision, M. Arif and W.Y.; project administration, M. Arif. All authors have read and agreed to the published version of the manuscript. "

Conflicts of Interest
The authors declare no conflict of interest.

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