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Shaping the Future of Learning: Students' Perceptions of Artificial Intelligence in Pakistan's Educational Ecosystem

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Abstract

In the era of rapid technological transformation, Artificial Intelligence (AI) has become an integral component of academia, reshaping how students learn, engage, and prepare for future opportunities. As higher education adapts to the digital shift, understanding students' perceptions of AI in education becomes increasingly important. This qualitative study explores undergraduate students' perceptions of the role of AI in transforming the learning ecosystem and teaching practices in Pakistan's higher education context. Twenty-one semi-structured interviews were conducted with final-year undergraduate students from STEAM disciplines using purposive and snowball sampling techniques. All interviews were transcribed and analyzed through Reflexive Thematic Analysis. The findings highlight that students view AI as a transformative force enhancing learning efficiency, accessibility, and engagement, while also calling for institutional guidelines and digital literacy training to ensure its ethical and equitable use. The study concludes by proposing a framework for integrating AI to strengthen learning ecosystem pedagogical practices and prepare learners for the evolving job market.

Keywords: Artificial Intelligence; Educational landscape; Upskilling and reskilling; Continuous Learning; Thematic Analysis.

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1. Introduction

In today's educational landscape, Artificial Intelligence (AI) is continuously transforming the way knowledge is delivered, accessed, and experienced. Since the time of its emergence, AI has been reshaping the educational environment by enabling personalized learning experiences of students and improving the administrative efficiency of educators [1,2]. As a transformative digital technology, AI is poised to revolutionize how people work and interact globally [3,4].

Many countries have integrated AI into various programs, equipping students with essential digital and problem-solving skills [5,6]. In contrast, Pakistan faces significant challenges in integrating AI into its education system, primarily due to weak technological infrastructure [7], limited awareness of AI among educators and students, and a shortage of skilled professionals capable of implementing and supporting AI-driven initiatives [8]. To maintain relevance in a technologically competitive landscape, Pakistani universities must consistently adopt innovative teaching and learning methods [8,2].

2. Literature Review

In the field of higher education, Artificial Intelligence (AI) has become a transformative force, changing academic procedures. AI refers to advanced digital systems that mimic human cognitive functions by analyzing vast amounts of data, identifying patterns, and making informed decisions based on these insights [9,10,11]. While various definitions of Artificial Intelligence emphasize its ability to simulate human cognitive processes, its implications extend far beyond technology and into domains such as education. AI is rapidly becoming an essential tool across multiple domains of society, and its role within educational institutions is particularly critical Reference [12]. AI applications or tools are not merely supplementary but essential for transforming modern academic institutions into dynamic centers of learning, innovation, and sustainability [13,14].

Emerging studies show that AI tools, especially those with natural language processing capabilities like ChatGPT, are increasingly influencing global educational practices by enabling personalized learning, instant feedback, and real-time academic support. In terms of AI-driven applications or tools such as ChatGPT, Grammarly, Photomath, and Canva, they have introduced innovative approaches to learning and problem-solving. Platforms like ChatGPT offer continuous academic support, helping students comprehend complex subjects and enhance their writing abilities [15,16]. Additionally, techniques such as machine learning, natural language processing, and adaptive algorithms now support personalized learning paths tailored to individual learners' strengths, challenges, and preferences. Globally, platforms powered by AI are already being used for tasks such as grading, tutoring, and designing interactive learning experiences [17,18]. Unlike conventional models that apply the same instruction to all learners, AI-based adaptive systems adjust teaching strategies dynamically to meet the individual needs of students [19,20]. Governments and institutions are increasingly investing in AI integration to support scalable, responsive, and high-impact education systems. As these technologies mature, they promise not only to revolutionize educational delivery and evaluation but also to shape the future of how society learns and adapts Reference [21,22].

As AI technologies have rapidly transformed education across the globe, a stark divide persists between developed and developing countries in their ability to effectively harness these advancements. Most developing nations, including Pakistan, face significant barriers that hinder their ability to capitalize on the opportunities that AI presents [23]. The Government AI Readiness Index 2021 highlights this disparity by revealing that many lower-income countries lack the foundational infrastructure, resources, and policy frameworks needed to support AI adoption [24]. Pakistan's higher education system continues to face structural barriers such as inadequate infrastructure, limited faculty training, and ethical concerns related to data privacy, academic misconduct, and digital equity [25,26,27]. Student attitudes toward AI are equally important, as positive perceptions can enhance motivation, collaboration, and academic confidence [28]. However, these attitudes are shaped by exposure, accessibility, and institutional support. The absence of clear policies or curriculum frameworks introducing AI concepts restricts students' understanding of its educational potential [29].

UNESCO and the World Economic Forum (WEF) highlight the importance of embedding AI literacy in education, as the global expansion of AI is reshaping industries, generating new types of employment, and redefining the skillsets needed in the workforce [30,31]. In Pakistan, however, the understanding of AI remains relatively low. Given the WEF's projection of 97 million emerging roles that will demand AI literacy, incorporating AI education into Pakistan's curricula is essential for aligning education with global labour market demands [32]. The Higher Education Commission's (HEC) Undergraduate Education Policy emphasizes the development of 21st-century competencies, including communication, ICT proficiency, quantitative reasoning, and creativity, yet it does not currently include AI literacy as a core component [33]. This study aims to examine how students in Pakistan view the role of Artificial Intelligence (AI) within the educational landscape, With AI becoming an integral part of global education through applications like adaptive learning systems, intelligent tutoring programs, and automated evaluation tools, it is essential to investigate how learners in Pakistan perceive, interact with, and adapt to these emerging technologies within their specific academic environments.

3. Method

AI is reshaping both personal and professional spheres, with effects that are expected to be long-lasting. This makes it essential to examine AI's role in education to better equip students with skills and prepare them for the future world of work. Keeping in view Sustainable Development Goal 4 (Quality Education), this study focuses on gaining a deeper understanding of how students perceive the role of AI in shaping the educational landscape within Pakistan's evolving learning ecosystem. The research is guided by one overarching research question and three supporting sub-questions.

Central Research Question:

1. How do undergraduate students perceive the role of AI in education?

Sub-Questions:

1. What are the perceptions of the students regarding AI?
2. How do undergraduate students perceive the impact of AI on education or the learning ecosystem?

3. What are students' perceptions of acquiring AI-related skills?

The data for this study were mainly collected through semi-structured interviews, with additional information from reflexive journals and secondary sources such as recent WEF reports (2023-2025), the HEC Undergraduate Education Policy [33], and the draft of the National Artificial Intelligence Policy [34,35]. Semi-structured interviews were conducted with n=21 participants due to low and slow participation rate [36]. Each interview lasted at least forty minutes and was conducted in accordance with ethical principles of qualitative research [37]. The participants consisted of undergraduate students (11 male, 10 female) from STEAM disciplines (see Table 1).

Table 1: Demographics of the Participants

Gender	No. of Participants	Age Range	Educational Background
Male	11	22-24	STEAM/STEM
Female	10	22-23	STEAM/STEM

The data were collected using purposive sampling and snowball sampling techniques in a nested sampling scheme Reference [38,39]. Purposive sampling was employed to gather data from students who met the inclusion criteria: they were enrolled in STEAM fields as final-year students of HEIs in Pakistan, had used AI in their student life, and resided in urban cities in Pakistan. The study followed the ethical standards outlined in the qualitative research guidelines [40]. To uphold rigor and credibility, a dual strategy was implemented: first, the Instrument for Theoretical Saturation Evaluation Tool was used [41,42]. Second, to maintain trustworthiness, procedures such as member checking, peer debriefing, and expert validation were adopted and recorded in a systematically maintained audit trail [43].

4.Analysis

The collected data were analyzed to identify patterns and themes within the data using Reflexive Thematic Analysis (RTA) [44,45,46]. The analysis involved six steps: Familiarization with the data, Coding, Generating Initial Themes, Reviewing and Developing Themes, Refining, Defining, and Naming Themes, and writing up. In the familiarization stage, interviews were repeatedly read, listened to, and transcripts were reviewed multiple times. During this stage, the initial coding process started as per qualitative tradition [46]. In the Coding stage, the data were coded. As RTA is a reflexive process, codes were constantly refined, deleted, renamed, and grouped into subthemes. These codes were then grouped into broader themes that capture meaningful patterns Reference [46]. Next, the themes were reviewed to ensure coherence and alignment with the data. Once refined, each theme was clearly defined and given a descriptive name that reflects the content and significance of the data. The final step involves writing up the findings and synthesizing the themes into a coherent, detailed narrative. A thematic map (see Figure 1 below) was constructed to visualize the underlying patterns within the data.

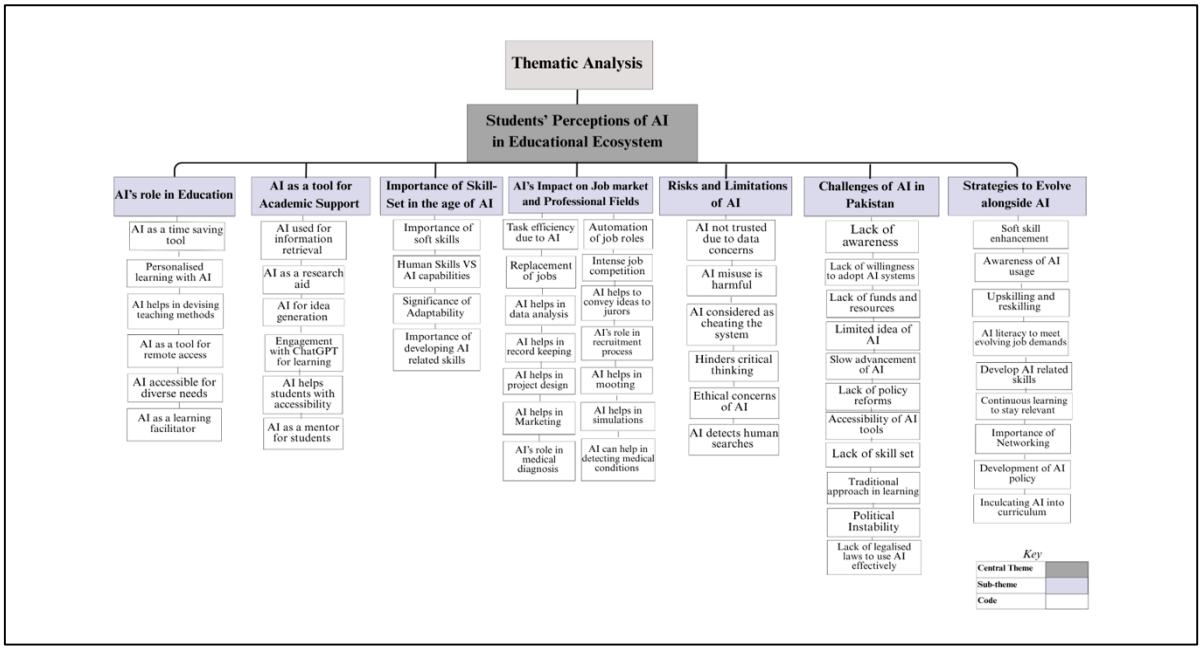

Figure 1: Thematic Map

5. Findings of the study

After a thorough analysis process, six key findings were identified from the data, as detailed below.

Finding 1#, AI is redefining the educational scenario by assisting teachers as a time-saving resource, support for academic tasks, and in developing personalized learning for students. Regarding the assistance of AI for teachers, a participant said, *"AI is a great tool …It has automated administrative tasks and it provides intelligent tutoring systems, so it enables students as well as teachers. It allows students to learn at their own pace and for teachers, it is a great tool. So that they can devise new teaching methods" (Interview#3, lines 23-27).* Additionally, talking about the significance and benefits of AI in education, another participant stated, "…*For educators, it acts as a powerful tool to support them and optimize the learning process" (Interview,3, lines 23-27).* In terms of personalised learning, a student shared*, "AI helps us a lot with good assistance with all the problems. I think AI also provides a very personalized learning for everybody" (Pilot Interview, lines 60-62).* Another added, *"I think it has the potential to revolutionize education by providing different personalized learning experiences for students… helping them to instantly get solutions to their problems" (Interview 10, lines 18-20).*

The finding implies that AI is transforming the dynamics of education by supporting teachers in enabling personalized learning, fostering deeper conceptual understanding, and promoting interactive teaching practices. This transformation calls for governments and policymakers to take proactive measures by developing comprehensive AI-integrated policies, investing in digital infrastructure, ensuring equitable access to AI tools, and providing capacity-building programs for educators to effectively harness AI's potential within the education system.

Finding 2# AI is an established academic tool that assists in various aspects and changes the learning dynamics

for students, from understanding concepts, managing workload, and developing study efficiency, while also complementing traditional teaching methods. In terms of academic support, a student stated, *"AI is very helpful. In many topics where we need data or when we have to solve different questions, it provides answers that we might not be able to find on our own through research" (Interview, lines 23–25).* Another participant stated that *"I always go to ChatGPT, Gemini, or Claude, I prepare for my papers using these tools because they provide precise and to-the-point answers. This helps save a lot of time. And even if I want to study a new skill, with AI tools, you just go there, explain your background, what you want to learn, and your timeline, and it gives you the entire roadmap along with the resources" (Interview #1, lines 23–26).*

Similarly, a student stated that, *"For students, it enhances accessibility for those who are disabled and cannot travel to the university for classes" (Interview 3 lines 25-26).* Another student added, "*if you are talking about people who can't see or people who can't read, there are a lot of text-to-speech or speak-to-text AI platforms that can help them in daily routines" (Pilot Interview, lines 72-74).* The finding implies that AI can enhance traditional teaching by assisting in academic tasks such as personalized feedback, accessibility, and adaptive learning support. However, to ensure students benefit meaningfully, governments and policymakers should focus on creating structured frameworks that promote ethical and effective AI use in learning environments.

Finding 3# Students emphasized the importance of evolving skill sets such as digital literacy, adaptability, creativity, and problem-solving, to remain competitive and prepared in an AI-driven learning and work environment. For instance, a student stated, *"The skills that are required to work in the AI influenced industry can be divided into two parts, first is the technical skills that a person requires and the other one is the soft skills, the technical skills I think a person working in this field has to be good in data analysis, machine learning, programming and you should be good at problem solving as well, other than that you should be adaptable, so that you can easily be accommodated in the newly introduced technologies. Often, more in soft skills, one should be good at explaining the problem that he's facing" (Interview# 3, line 34-39).* The findings imply that adapting to a job market that is continuously evolving due to AI requires students to develop both soft skills and AI literacy. As AI is also data and is operated through data to interpret that data, soft skills are required by future workers.

Finding 4 # Students recognized AI as transformative in shaping the job market and the professional fields. A student shared,*" I think a lot of new types of jobs will be created. For example, if you look back 5 to 6 years, or even 10 years ago, you wouldn't really find roles like AI engineers or machine learning engineers. But now, those roles have become very common. And even within those fields, people are now hiring for very specific and niche areas; Take prompt engineering, for instance. What is prompt engineering? It's basically about designing and structuring inputs for a chatbot how you frame a prompt so that the AI gives you the desired response. In other words, it's a specialized skill where you train the AI through carefully crafted prompts to produce effective and accurate outputs" (Pilot Interview, lines 238-244).*

Similarly, another student stated, *"Artificial Intelligence is proving to be very useful. Through AI, we can create many scenarios where it feels like you're working with a patient, and your communication skills improve through that process. I would say that many simulations are now being developed virtually through AI. For example, in my degree, which involves a lot of practical work, it's often very difficult to get real interaction with patients. In*

such cases, AI helps a lot by allowing you to create realistic scenarios, like working with a patient, which in turn helps you improve your communication skills. These simulations allow you to enhance your practical skills, especially in the context of fields like BDS" (Interview#14, lines 32-41).

A mechatronics student emphasized how AI helps them in project design, as stated**,** *"I remember when we got introduced to ChatGPT and how it helped us write our reports; it helped us focus on the actual design of our projects. So, for example, we had a project where I had to design a PCB, which is a printed circuit board to the small electrical board and the fact that I was allowed to put all my time into designing that board, and I could do that in 1 day with ChatGPT" (Interview#4, lines 21-26).* The implication is that students need to be equipped for the AI-driven job market and future professions by gaining insight into evolving industry trends and recognizing shifts in employment demands, enabling them to adapt and succeed alongside AI advancements.

Finding 5# Students expressed critical concerns regarding AI's risks and limitations, particularly related to ethics, misinformation, plagiarism, reduced critical thinking, and data privacy, which could hinder its responsible use in education such as stated by a student, *"You're basically like skipping your critical thinking part and just making AI to the work" (Interview#21, line, 427-429).* One of the issues is the lack of awareness among students towards AI ethics. As stated by a student, *"if we talk about AI ethics, I feel that this shouldn't be brought into academics. A person has their own capabilities, their own critical thinking and these ideas and thoughts they're ours. So, if the idea is yours and the critical thinking is yours, then you should have the ability to express that idea yourself, rather than relying on any tool... That's why I believe it shouldn't be introduced in academics, because it's leading students toward distractions, the mind, and the brain are being affected" (Interview# 8, lines 191-198).* These limitations underscore the importance of AI-focused ethical guidelines and AI-aligned policy reforms to educate students not just on how to use AI, but also on how to engage with it responsibly and thoughtfully within both educational and work settings. A robust national policy on equity, integrity, and data security is essential to prevent AI from deepening existing social and educational divides.

Findings 6# AI integration in Pakistan requires addressing multiple contextual challenges, criticizing the absence of a coherent government policy on AI in education and workforce development. For instance, a student stated regarding the lack of awareness of AI, *"Students here have absolutely no idea what they're doing. They only know that when they get a question or a problem, they have to pop it into AI, take whatever solution or answer AI gives them, pop it into the assignment section, and submit it. That's it. That's the only thing I can say about Pakistan" (Interview#15, lines 170-73).* Another student highlighted the lack of policy reforms, *"Obviously, Pakistan right now, inculcating AI… is also a necessity. I think it should be done. But for countries like Pakistan, it is a luxury right now…whereas they can't allocate that much funds or budget to inculcate digital things. So right now, Pakistan is in a bit of the shuffle" (Interview#19, lines 317-320).* The challenges imply that the limited access and uneven infrastructure development call for inclusive and balanced approaches, for which there is a need for AI-aligned policy making, AI-focused ethical guidelines, and mainly the awareness of AI at all levels, from students to teachers, to organizations, as there is a growing demand for AI literacy and responsible use of AI technologies.

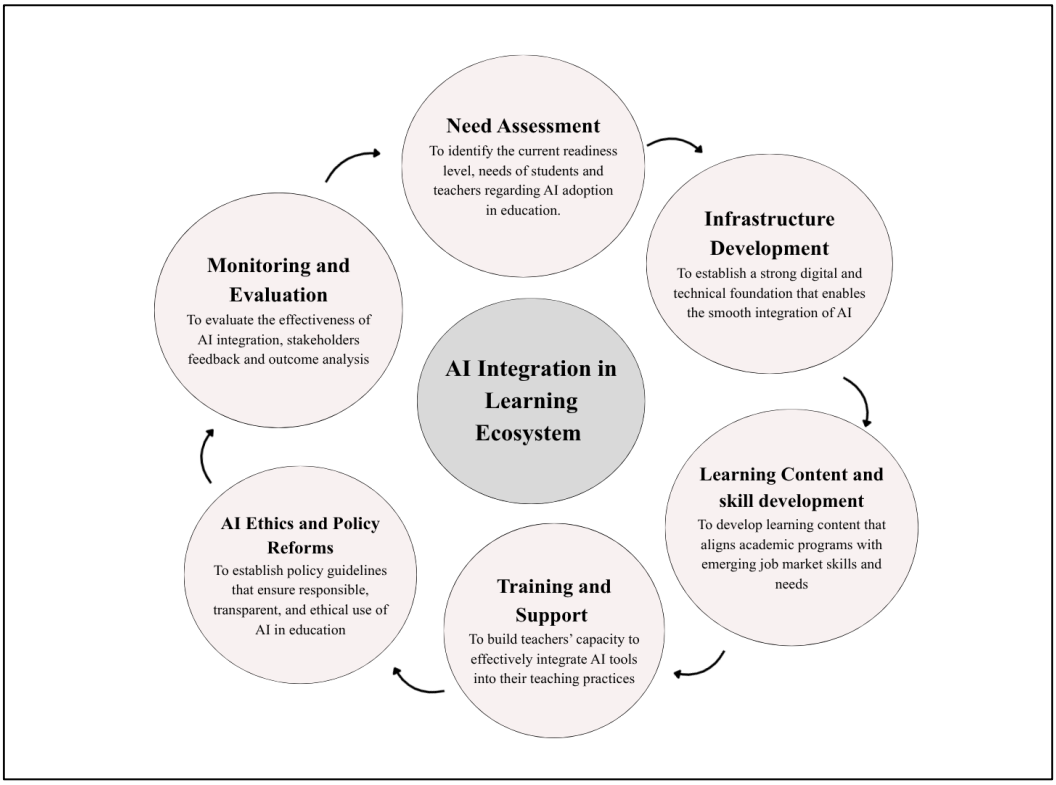

Figure 2: Framework for Student-centered AI Integration in the Learning Ecosystem

In the context of AI, a learning ecosystem can be understood as a broad and interconnected framework that brings together people, content, technology, data, tools, strategies, and governance to shape and enhance the overall learning experience. Rather than focusing on individual elements in isolation, it takes a holistic approach to how learners gain knowledge. AI contributes by suggesting tailored learning content based on real-time performance, creating modular learning units and fostering skill development through simulations and assessments. This transforms learning from rigid, one-size-fits-all courses into responsive and contextual pathways suited to organizational or platform needs.

In the figure above, the integration of Artificial Intelligence (AI) in education focuses on a systematic, cyclical process that begins with understanding the foundational needs. The needs assessment phase serves as the cornerstone, identifying existing gaps, readiness levels in adopting AI-based tools and practices. It examines students' understanding of technical and non-technical skills, learning preferences, and exposure to technology while also evaluating teachers' confidence, pedagogical awareness, and familiarity with AI-driven instructional practices. Building upon this foundation, infrastructure development becomes essential to create an enabling digital environment. This involves establishing technological frameworks such as reliable internet connectivity and cloud systems, while ensuring equitable access to hardware and platforms capable of supporting AI applications.

Complementing this, learning content and skill development focus on creating AI-driven educational materials that bridge academic learning and real-world application. Through adaptive modules, project-based learning, and simulations, students can develop both technical and non-technical skills that align with evolving labor market

demands. However, the success of AI integration heavily relies on educators, making teacher training and support a pivotal phase. Continuous professional development programs are essential to enhance teachers' technological proficiency and adaptability in using AI for personalized instruction and assessment. Equally critical is the AI ethics and policy reforms, which ensure in developing policies or guidelines that safeguard data privacy, prevent algorithmic bias and ensure equitable access to AI resources. Finally, monitoring and evaluation ensure that AI integration remains dynamic and impactful. Through regular evaluation, stakeholder feedback, and learning outcomes, institutions can assess progress and identify areas for refinement. This ongoing feedback loop promotes innovation, encourages adaptive learning, and keeps AI integration aligned with emerging technologies and educational priorities. In short, an AI-integrated framework is essential for creating adaptive, personalized, and future-ready learning environments that align education with labour market needs while building critical skills for career success of the students for an AI-driven labour market. By aligning academia, industry, skills, and training with AI advancements, this framework supports diverse groups of educators, workers, employers, and policymakers to work alongside AI for the country's economic development.

6. Discussion

In an era where Artificial Intelligence is redefining education and employability, understanding how students in Pakistan perceive the role of AI in the learning ecosystem has become vital. This study explored these perceptions through the lens of Career Construction Theory [47] and the Technology Acceptance Model [48], offering an integrated framework to interpret both their readiness and technological engagement in an AI-driven educational landscape. This interaction between adaptability and technological acceptance is especially significant in developing contexts such as Pakistan, where disparities in AI literacy, access, and institutional support persist. While many students exhibit curiosity and career concern, infrastructural and educational limitations constrain their ability to leverage AI effectively.

The findings resonate with prior studies emphasizing the uneven integration of technology in Pakistan's higher education system [49,50]. Despite initiatives such as the Digital Pakistan Policy [51], participants consistently highlighted the gap between national digital goals and their implementation within universities. A recurring theme was the transformative potential of AI in learning. Participants described using AI tools for conceptual clarity, idea generation, and organization of academic work, aligning with previous research showing that students frequently use ChatGPT for content creation, summarization, and proofreading [52,53,54]. Global reports also affirm that AI personalizes learning, enhances engagement, and improves digital competencies [55,56]. However, findings suggest that while AI can supplement human instruction, especially in resource-limited settings, it cannot replace mentorship or the ethical guidance educators provide [57].

At the same time, participants cautioned against the over-reliance on AI, expressing concern that excessive dependence on such tools could undermine critical thinking and problem-solving abilities. This aligns with the concept of "cognitive outsourcing," where students' intellectual effort diminishes as AI assumes greater responsibility for cognitive tasks [58,59]. Ethical awareness around AI use remains underdeveloped, with limited institutional frameworks guiding responsible practices. Scholars have similarly warned about bias, data privacy, and transparency issues in AI systems [60,61]. These ethical gaps underscore the need for policies that embed

digital literacy, data ethics, and critical evaluation within university curricula [61,62].

From a national perspective, the study highlights the mismatch between university education and industry needs. Curricula remain outdated, emphasizing rote learning over critical thinking, creativity, and digital competence. This gap hinders graduates from meeting the demands of AI-driven workplaces. Although frameworks such as the Undergraduate Education Policy (UEP, 2020; revised 2023) aim to promote competency-based learning, they lack concrete mechanisms for AI integration or faculty development. The UNDP [59] and World Bank [62] similarly report that Pakistan's digital transformation requires significant investment in teacher training, infrastructure, and equitable internet access.

7. Limitations and Recommendations

This study represents an early effort to explore undergraduate students' perceptions of AI in Pakistan's educational ecosystem. There were two limitations of the study. Firstly, the research was geographically restricted; hence, the experiences of students in underdeveloped regions with weaker digital infrastructure were not captured. Second, the scope was limited to students, excluding the perspectives of faculty, administrators, policymakers, and industry stakeholders. These factors limit the generalizability of the findings. To address these gaps, future research should adopt a mixed-methods approach that includes multiple stakeholders' perspectives across diverse regions of Pakistan.

8. Conclusion

This qualitative study examined undergraduate students' perceptions of Artificial Intelligence in higher education. The findings indicated that students view AI as a transformative force that enhances learning experiences, offers personalized instruction, improves accessibility, and boosts academic performance. Participants recognized AI's role in providing instant feedback, assisting with research and assignments, and supporting adaptive learning environments, positioning it as a key catalyst in modern education. However, the study highlighted that fully realizing AI's potential requires collaboration among stakeholders, including the government, the Higher Education Commission (HEC), and higher education institutions (HEIs). Students emphasized the need for developing AI-integrated infrastructure, ensuring equitable access to digital tools, and enhancing faculty capacity through professional development and AI literacy initiatives. With these efforts, higher education can evolve into a dynamic system that equips learners with essential digital and human-centered skills for success in the 21st century.

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