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Reimagining Higher Education: The Societal Impact of AI, AR, and Virtual Simulations on Critical Thinking and Problem-Solving

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Abstract
While societies pursue a swift digital transformation, the higher education system finds itself increasingly challenged to nurture and foster the capacity to think critically, reflectively, and to solve problems—an ensemble of capacities that one might consider essential for working one's way through these complex global issues. This study explored how emerging technologies—specifically Artificial Intelligence (AI), Augmented Reality (AR), and Virtual Simulations—were perceived and experienced by students and educators in fostering critical thinking and problem-solving skills within higher education. Anchored in the interpretivist paradigm, the research employed a qualitative methodology, using semi-structured interviews and content analysis to gather in-depth insights into the participants' lived experiences. The study also explored how such technologies contribute to broader societal goals, including digital inclusion, equitable learning experiences, and preparation for participatory citizenship in a knowledge-based economy. Data were collected from faculty members and students across multiple academic disciplines in selected higher education institutions. Thematic analysis of interview transcripts and content analysis revealed nuanced understandings of how immersive technologies contributed to cognitive engagement, collaborative inquiry, and reflective problem-solving. Grounded in constructivist and experiential learning theories, the study highlighted the contextual and relational dynamics that influence technology adoption and its pedagogical impact. The findings provided rich, descriptive accounts that can inform educational practice, professional development, and policy-making related to innovative, technology-enhanced learning environments in higher education. These insights offer implications not only for educational innovation but also for public policy, institutional planning, and the ethical integration of emerging technologies in shaping more inclusive, resilient, and future-ready societies.

Keywords: Interpretivism, Emerging Technologies, Qualitative Research, Critical Thinking, Problem-Solving, Higher Education, Artificial Intelligence (AI), Augmented Reality (AR), Virtual Simulations, Thematic Analysis, Constructivist Learning, Experiential Education, Technology Integration

I Introduction

The quickly changing world of higher education makes critical thinking and problem solving even more essential for preparing students to navigate the real world and the elaborate, even immeasurable, problems that lie within it (Facione et al., 2020). The cognitive abilities that the learners possess allow them to dissect information, appraise options, and come up with creative answers, which is an increasing requirement in the professions and in society (Eyre et al., 2024). Nevertheless, the conventional teaching methods, frequently derived from lectures and insisting on the memorization of facts, have come under fire for their too-limited success in stimulating the aforementioned skills that are of such high value (Putriani & Purnomo, 2025). Methods of this kind generally favor delivering content rather than fostering active engagement, which leaves unaddressed the vital need for developing the abilities of our students to think critically and to solve problems collaboratively (Dede, 2013). Conventional methods, by emphasizing passive content absorption, often fail to address systemic inequities in education, particularly in resource-constrained settings, thus widening the digital divide and excluding marginalized students from developing essential 21st-century skills.

While universities and colleges work to meet the demands of the 21st century, they must explore new and innovative ways of teaching to enhance the development of our students' cognitive skills. There are too many cognitive skill gaps, and we need to bridge them if we hope to truly educate our students. In today's interconnected world, critical thinking and problem-solving are not only academic competencies but also essential societal skills, enabling individuals to navigate ethical dilemmas, civic responsibilities, and workforce complexities across diverse global contexts.

New technologies that are coming up, such as Artificial Intelligence (AI), Augmented Reality (AR), and virtual simulations, hold game-changing prospects for overcoming these limitations. These tools establish vibrant, interactive learning spaces where dynamic learning takes place. The best distance education is characterized by hallmark collaboration between learners. There is potential for this in what they offer. They advance distance education closer to the type of interaction that is its potential (Dunleavy & Dede, 2013). Combining these technologies allows teachers to transcend the limits of traditional teaching. Learning environments can then be created by them that move students from lower-order thinking to higher-order thinking. Artificial Intelligence (AI), Augmented Reality (AR), and virtual simulations are changing how we teach and learn. They are making education more personalized and immersive, and they are allowing for an educational experientially rich in ways beyond what we have traditionally known. Providing good feedback and feed forward is a hallmark of good instruction. In AI, our tools include intelligent tutoring systems and adaptive learning platforms that provide not only good feedback but also good feed forward that is tailored to the learning needs of the student. The AI in these tutoring systems is much too complex and too advanced to be described in this space; suffice it to say that these systems are capable of processing a lot of information about student performance to issue recommendations about the next steps a student should take (Bond et al., 2020). These technologies are not only reshaping how knowledge is constructed but are also redefining learners' roles as active, critical participants in society. By enabling participatory, student-centered experiences, they contribute to a more inclusive, justice-oriented, and digitally literate citizenry.

Learning is augmented by AR, which is enhanced by overlaying digital information onto the physical world. It enables contextual exploration and visualization of abstract concepts, which can deepen critical engagement in teaching (Bower et al., 2014). Simulations running in virtual environments, on the other hand, allow students to work in wholesome, entirely secure settings where they can carry out various tasks, engage in all manner of decision-making, and ponder the consequences of their actions. Such settings and exercises form the best possible vessels for the development of the rudiments of real and effective problem-solving (Merchant et al., 2014). Constructivist and experiential learning theories contend that learners need to be actively engaged in the process and should constantly reflect on what they are learning (Kolb, 2014; Shabani et al., 2010). Nevertheless, how they are seen and felt by students and educators greatly affects their efficacy. That's because the contextual factors around their use influence what integration into settings of higher education actually looks like. Understanding how such tools are perceived and utilized can inform not just educational innovation but also broader societal efforts to democratize learning, bridge digital divides, and prepare socially responsible, critically engaged citizens.

This research aims to investigate the perceptions and lived realities of students and teachers who use AI, AR, and virtual simulations in their learning and teaching. These technologies are hailed as potentially powerful tools for fostering not just the basic skills of computation and memorization but also the higher-order processes of critical thinking and problem solving. Because the technologies are being used in education right now, it's important to learn what effects (if any) they are having on students' cognitive engagement and on teachers' professional practice.

II Research Questions

This study is guided by the following research question:

How do students and educators perceive the role of emerging technologies (AI, AR, and virtual simulations) in developing critical thinking and problem-solving skills in higher education?

The study aims to make a contribution to the increasing amount of literature on technology integration in education. It also attempts to provide useful insights for people who have an interest in emerging technologies and how these can be used to enhance cognitive skill development.

III. Conceptual Framework

This research occupies a conceptual framework that integrates the interpretive paradigm, constructivist and experiential learning theories, and prior qualitative research on technology integration in higher education. This framework provides a way to look at the coming together of two areas of our society: education and technology. It also focuses the study on the events that are part of the relationship perceived by both students and teachers, which is part of the use of the emerging technologies with which we are now familiar. Drawing from the social construction of technology (SCOT) perspective, the framework also considers how meaning-making around AI, AR, and virtual simulations emerges through users' interactions within specific social and institutional contexts, reflecting broader societal narratives of innovation, inclusion, and digital transformation. This study is significant for our society today and for all tomorrows. Its potential is evident in two ways. First, the interpretivist paradigm undergirds this study, directing our attention to the understanding that is constructed with, and by, participants in the lived experiences that they have co-constructed (Tamayo et al., 2020). Unlike a positivist approach that seeks objective truths, interpretivism acknowledges that people perceive new technologies in light of their personal, social, and institutional contexts (Guba & Lincoln, 1994).

Through the interpretivist lens, within this research, we can understand how students and educators come to an understanding of highly technical pedagogical tools like AI, AR, and virtual simulations. This research covers how a diverse group of subjects engages with these tools. It also takes into account the many ways in which subjects can come to an interpretation of the tools and the technical vista these tools offer them. The lived experiences of participants arise from one-on-one and group conversations in semi-structured interviews, along with content analysis. This paradigm also situates learning within broader cultural, institutional, and social systems, acknowledging that perceptions of technology are influenced not only by pedagogical settings but also by societal structures such as access, equity, and digital literacy. By linking pedagogical experiences with broader social forces, this framework underscores the need for context-sensitive technology integration strategies that not only support cognitive skill development but also contribute to more equitable, participatory, and resilient learning ecosystems.

IV Theoretical Foundations

This study is based on theories of constructivist and experiential learning. These theories provide perspectives on how developing, or emergent, technologies might foster the kinds of thinking, critical and otherwise, and problem-solving skills that would be needed, for example, by a robotic engineer. These theories spotlight active, learner-centered processes that mesh with the interactive and immersive nature of AI, AR, and virtual simulations. At their core, constructivist learning theories tell us that learners construct knowledge and understanding through active engagement with their environments. This basic premise makes constructivism an ideal theoretical framework for the study of modern technologies, interactive tools, and their uses in learning contexts. When we consider "emerging technologies" as tools, we frame them within the context of whether they enable or disable learners in the quest for knowledge construction. In this sense, the immersive and interactive nature of AI, AR, and virtual simulations serves the specific purpose of promoting the kind of complex problem-solving that all these tools supposedly facilitate (Jonassen, 2011). Constructivist approaches do not operate in isolation from broader social realities. In the context of higher education, they intersect with societal challenges such as unequal access to digital tools, underrepresentation in STEM, and the need for inclusive learning environments that prepare students to be active, socially responsible citizens.

The theory of learning through experience, as expressed by Kolb (2014), underscores learning as a repetitive, circular pattern where one moves from having a concrete experience to making reflective observations about it, moving next to the more abstract, conceptual level of understanding, and finally to active experimentation with new ideas or new ways of doing things. Experiential learning also supports the development of civic competencies, as students are encouraged to engage in authentic, real-world scenarios that require ethical reasoning, collaboration, and reflection—skills vital for participating meaningfully in democratic and pluralistic societies. The study framework is particularly relevant when it comes to exploring the virtual side of AR and VR within the not-so-distant AR and VR structure. We know we are at the starting edge of AR and VR structures in education. In this regard, immersive is one of the three principal components of a virtual experience. For example, virtual reality in the worlds of medical or engineering education, students can virtually complete the work of a doctor or an engineer, experimenting in decision-making, reflecting on outcomes, and refining the logic and problem-solving structures of their work in real time. Virtual worlds allow students to engage in all of these things not in real time (Merchant et al., 2014). The research demonstrates the importance of reflective practice and iterative learning in the development of critical thinking and problem-solving skills, and it recognizes how those components are rooted in experiential learning theory. It emphasizes the significance of those components for student outcomes and underscores the opportunities provided by using emerging technologies to attain those outcomes.

The prior qualitative research on technology integration in higher education forms the basis of this study. It offers a few glimpses into the opportunities and, sometimes, the audacious challenges that modern technologies present to the goals of enhancing any and all learning outcomes. While existing studies provide insight into educational outcomes, few explicitly address how emerging technologies mediate social inclusion, empower underrepresented learners, or contribute to societal transformation in education. This study builds on those gaps by exploring lived experiences through a societal lens. One way this research (Bower et al., 2014) has fetched some very relevant insights is about what the interactive nature of AR means in a disciplines like STEM (Science, Technology, Engineering, Mathematics), yielding not only spatial cognition but also something resembling a critical engagement with material that a few other pedagogy pundits express isn't as present when ideas are simply "looked at" in the same way previous technologies invited students to do. Another way this research has yielded some very useful insights is with regards to the AR's promises and the perceptions extant among the students and instructors that have used it. In the same vein, (Zawacki-Richter et al., 2019) undertook a systematic review of the use of AI in higher education. They found that tools powered by AI, like intelligent tutoring systems, have the potential to promote far more analytical thinking than is common with current teaching practices. Meanwhile, qualitative studies of the virtual simulations—used as the primary AI adjunct in this study—have found them to be fantastic tools for fostering far more analytical, problem-solving thinking in our students than was common before we had them. For virtual

simulations to be educationally effective, they have to be closely aligned with the kind of curriculum we're already using.
Even though a burgeoning body of studies exists on the integration of various technologies into higher education, there is still a noticeable dearth of understanding about the real-world, lived experiences of both students and educators with the latest technologies, like artificial intelligence and augmented reality, suitable for use by the modern higher education institution. When the literature does dip a toe into the qualitative pool, it tends to rely on the same old, same old "perception" and "experience" metrics to tell one group from another—exactly what this study sought to avoid (Selwyn et al., 2016). While investigations like those by Zawacki-Richter et al. (2019) and Bower et al. (2014) offer somewhat valuable insights, they often and usually lack a deep exploration of the relational and situational dynamics that ostensibly form around the adoption of technology and its pedagogical impact. This study addresses that gap using an interpretivist approach to render somewhat rich, somewhat descriptive accounts of how students and educators across multiple disciplines experience these technologies and live their lives fostering critical thinking and problem-solving skills.

V. Methodology

This investigation uses a qualitative methodology to look into the emerging technologies' perceptions and experiences of the students and educators who use them. The technologies under examination are Artificial Intelligence, Augmented Reality, and virtual simulations. The technologies are in their formative stages, so they don't yet have a long history of application in academia. Thus, the study isn't about the application of pedagogical theories within a long-established substrate of practice. Rather, it's an exploratory interrogation of the pedagogical potential of technologies not yet fully integrated into practice.
This study takes a qualitative case study approach to provide in-depth understanding of the contextual and relational dynamics of technology integration in higher education (Schoch, 2020). Exploring the subjective experiences of participants in specific institutional and disciplinary contexts is what this design is particularly suitable for. It aligns with the interpretivist emphasis on meaning-making (Creswell & Poth, 2018). The study's concentration on several instances designated as particular institutions of higher learning with a range of academic disciplines affords a nice opportunity to really dig into how these technologies are perceived and experienced across such diverse settings (Kelliher, 2011). This design bolsters the study's aim of revealing subtle insights about the nascent role of new technologies in nurturing critical thinking and problem-solving skills. It also serves to answer the question, "What is the emerging role of new technologies in the development of those basic skills? The research was carried out in those higher education institutions that have adopted the use of emerging technologies to teach and facilitate learning. These institutions were a mix of public and private universities in Pakistan. Only those disciplines were selected that represent the range of contexts in which one might apply a technology like AR, AI, or virtual simulation (Merriam & Tisdell, 2016). This approach is particularly valuable for uncovering how broader societal dynamics—such as technological access, institutional support, and sociocultural expectations—shape the integration of emerging technologies in education.
We used purposive sampling to hone in on the right people for our study. Specifically, we sampled individuals with pertinent knowledge and experience, those who have actually used the technologies of interest (AI, AR, or virtual simulation) in educational contexts. Our participants were a mix of students (undergraduate and graduate) and faculty from disciplinary areas that make use of the selected technologies in their teaching and research. Altogether, we interviewed about 30 people across our research sites. That's not a large number by any means, but we expected to achieve "data saturation" with this cohort (Guest et al., 2006). Selection of participants was based on enrollment or employment in key educational roles. Students were picked, first and foremost, because they were enrolled in courses that also happen to integrate the kinds of technologies the

study is interested in. Meanwhile, the faculty members chosen had a demonstrated track record of serving up rich, relevant, technology-enhanced instruction. Care was taken to include participants from both well-resourced and under-resourced institutions, ensuring that the study reflects a diversity of experiences related to digital inclusion, institutional disparities, and access to emerging technologies.

The primary data collection method was semi-structured interviews, which enabled an in-depth exploration of participants' perceptions and experiences with new technologies. The interviews were conducted with both faculty and students, using an interview guide with open-ended questions to elicit detailed responses, with plenty of room to probe emergent themes (Kvale & Brinkmann, 2015). The participants' experience with AI, AR, and virtual simulations was the main focus of the questions. Their experience gave rise to perceptions that helped the researchers understand the impact of these technologies on not just critical thinking but also problem-solving. Additionally, the researchers were excited to learn more about the contextual use of these technologies. They hoped to yield more nuance around understanding when and where (or if) these technologies were impactful. Interviews, lasting approximately 45–60 minutes, were audio-recorded with participants' consent and conducted either in person or via secure online platforms to accommodate participants' preferences and logistical constraints.

Focus group discussions were conducted, as feasible, to complement the data from interviews. The focus group discussions were conducted to allow the capturing of more collective perspectives and to enhance participant interactivity as compared to that achieved in the interview. We used these techniques for gathering data. The richer and detailed our data was, the more useful it was for us. We held focus groups with 6 to 8 students in each session. (Not all students expressed a desire to appear in the focus group, so the number we held was limited.) We organized the focus groups by discipline and used them to explore not only shared experiences but also the differing viewpoints of students on technology integration (Krueger & Casey, 2015). These discussions, lasting approximately 60–90 minutes, were facilitated using a semi-structured guide and audio-recorded for analysis. Focus groups were implemented selectively, depending on participant availability and institutional logistics, to enrich the dataset with collaborative insights. These methods also aligned with participatory knowledge-building, as they center the voices of students and educators in a way that reveals power relations, agency, and contextual constraints in digital learning environments.

To intersect the information gleaned from interviews and focus groups, the study also gathered data through content analysis. These were materials such as reflective journals or project submissions that students created as part of their coursework. The main artifacts were digital outputs (e.g., AR designs, simulation logs) that one would naturally expect to find in the portfolios of students with digital bent. They provided excellent, albeit unsurprising, evidence of educational institution's stated intention to make students proficient in the use of emerging technologies. They also furnished the otherwise much-hoped-for evidence that technology was having an impact on critical thinking and problem-solving, that was, the kind of thinking and problem-solving one would hope for when encountering artifacts allowed by these kinds of technologies (Bazeley, 2013). Artifacts were collected with the consent of participants and anonymized to ensure privacy. Their inclusion vastly improved the study's ability to provide context for participants' narratives and offers something of a deep dive into the understanding of processes involving technology and learning.

Obtaining informed consent from participants was the first ethical step in this study. The researchers revealed the purpose of the study, the procedures that would be followed, and any risks that might be involved. Participants were given time to read the consent form and to ask questions before signing. Study participants understood they could choose to leave the study at any time and for any reason without fear of incurring any consequences. All materials that could identify someone, including interview recordings, transcripts, and content analysis, were made unidentifiable to ensure confidentiality. Here, the approach was to use pseudonyms. These materials were kept securely and were guarded by passwords known only to the research team. Any identifiable data were known only to the research team, and all such data were destroyed after the study, by ethical guidelines laid out by our institution. Apart from safeguarding individuals, this study's ethical obligations extended to something with a far broader reach, especially when one considers the potential impacts on funding and policy decisions. This is about representing technology use in a fair, responsible, and comprehensible manner.

VI Data Analysis

Thematic analysis was used to identify patterns and themes in the qualitative data. This was done by following the six-phase process outlined by Braun and Clarke (2006). To begin with, transcripts of interviews and focus groups are rendered word for word and checked for correctness. The first coding pass entails attaching labels that describe, in general terms, what is happening in the data segments and what participants are saying about their experiences with new technologies. We then group the codes into initial themes and refine the themes through several rounds of review so that we can be sure they are coherent and relevant to the research question. This process entails constant comparison to detect patterns across types of cases and categories of participants, assuring us that the themes we identify truly represent the richness of the data (Saldaña, 2015). Qualitative data analysis software (e.g., NVivo) assists with this analysis by managing and organizing codes and themes. Analytic memos were maintained throughout to document interpretive decisions, with particular attention to how societal narratives—such as digital transformation, innovation culture, and learner empowerment—emerged through participants' lived experiences. Themes were examined not only in terms of cognitive engagement but also through the lens of social and institutional factors, such as access to technology, pedagogical autonomy, and cultural attitudes toward innovation, to explore how societal conditions shape learning experiences.

Content Analysis is examined with content analysis, which complements the thematic analysis of data from interviews and focus groups. This approach consisted of coding and categorizing artifacts systematically to expose the patterns in how students use AI, AR, and virtual simulations. This digital platform's purpose was to stimulate student thinking through the medium of its website. The website is simple in its design but achieves complexity in the way it navigates students through several substantial ideas and serious dilemmas (Krippendorff, 2018). Metacognitive processes, how students think about their learning and the tasks they have to perform, can be analyzed in reflective journals. These processes can be analyzed for evidence. The kind of problem-solving strategies that students employ can also be analyzed when they project the kinds of problems they might have in trying to carry out the tasks they have to do. Together, the thematic and content analyses yield a rich understanding of the pedagogical effects of technology. Bringing together these two data sources boosts the researchers' trust in the outcomes of their investigations and helps craft an ever-more-valid portrait of the world of edtech (Bazeley, 2013). This study's rigor and the validity of its findings are enhanced by the twofold method that was used. We achieved a far deeper understanding of the structural inequalities, institutional contexts, and professional cultures that affect the use of the very technologies that are supposed to help achieve educational equity by illuminating the content of a set of interviews and focus-group sessions.

VII. Findings

This qualitative case study conveys the point of view and the lived experiences of students and educators regarding three specific emerging technologies—artificial intelligence, augmented reality, and virtual simulations—that are being used to try to facilitate the development of critical thinking and problem-solving skills in higher education. This was a descriptive, narrative study. Semi-structured interviews, focus group conversations, and content analysis were examined using thematic analysis. From the two viewpoints of students and educators, several key themes emerged. These themes, underscored by insights from various participants and a few well-placed quotes, pointed to the more nuanced ways in which these technologies are influencing cognitive engagement, collaborative inquiry, and reflective practice. We conducted student interviews and organized our findings into themes. We also used themes from faculty interviews, participant-to-participant insights, and compelling quotes and narratives from our participants to tell the story of the integrated technology phenomenon. Altogether, this work provides a pretty clear picture of the perceptions of students and faculty toward this educational happening.

Perceptions of Engagement, Learning Depth, and Problem-Solving

Across many disciplines, students said that AI, AR, and virtual simulations boosted their interest in, and understanding of, course content. They also said that their capabilities as problem solvers were strengthened somehow by their use of these new technologies. One of the big reasons, students felt, was that the technologies offer new opportunities for interactivity, with students often describing working with them as a kind of play. This quality of play was evident in descriptions by engineering students of how they worked with AR simulations of mechanical systems (doing what amounts to cartoon physics with virtual 3D components). Another motif was personalized learning via AI, wherein pupils held in high esteem adaptive pedagogical platforms that were capable of molding problem sets to their precise skill levels, thus allowing them to attempt, at a self-determined pace, problem tasks that were, across the board, of an increasingly challenging nature. A third problem-solving theme in simulated environments emerged from student experiences with virtual simulations, particularly in health sciences, where they practiced clinical decision-making in risk-free settings.

It was observed that the simulations fostered important behaviors in the area for the development of the outcomes we desire for students. The simulations stimulate the engagement of students in the large-scale systems necessary for understanding the problems at high levels of cognition - critical thinking, problem-solving, and evaluation. They also force students to repeatedly attempt to understand and engage with the problems in a number of different ways, re-engaging them with the content in a way that is necessary for retention. Some students pointed out that technical problems and steep learning curves were barriers to becoming engaged, suggesting that technology was only as effective as its usability and that the institutions had to support its use

Challenges, Pedagogical Strategies, and Reflections on Technology Use

Faculty interviews shed light on the complicated mix of enthusiasm and integration problems faculty have when they try to adopt emerging technologies into their instructional practices. One salient theme from these interviews was technological and pedagogical challenges. Faculty raised concerns and issued complaints about things they would expect, such as inadequate training, a technology infrastructure that is sometimes unreliable, and, most notably, insufficient time to plan what often becomes a reimagining of a course when emerging technologies are infused. Even with significant effort invested in trying to align objectives and assessments, many faculty across disciplines found that AR tools were simply too demanding of their time and pedagogical energy, which is a crummy thing to admit since the tools seem so promising at face value. STEM-field faculty, for instance, employ simulations to replicate actual engineering problems, compelling students to apply theoretical knowledge to real-world practicalities. A third theme, reflective adaptation, underscored the faculty's continued work to improve and hone their use of technology, which was based on student feedback and their observations. Numerous individuals indicated that even though technologies can amplify student engagement, they don't automatically yield measurable gains in critical thinking. When they do lead to those results, it seems not to be an accident but by design and with a hefty dose of scaffolding. The result speaks to an intentional alignment with certain learning principles, principally those articulated since the 1990s in what has been termed the "Constructivist" or "Experiential Learning" school.

Shared Experiences and Contrasting Views

When the Interview and focus group discussions with students and faculty were examined together, interesting similarities and differences emerged. Both groups appreciate the immersive learning opportunities that AI, AR, and virtual simulations provide. They value the new dimensions of interactivity and hands-on experiences that these technologies can offer. Especially in the health sciences, both students and faculty treasure the fidelity of the simulations and the lifelike practice they afford. But that's where the shared experience seems to stop. Faculty members seem to have a somewhat different view of the technologies. For them, the use of advanced technologies like simulators raises questions of access, fit, and, above all, training. Another cross-cutting theme was contextual influences, where institutional factors, such as access to training or reliable hardware, shaped the success of technology integration. Students in well-resourced institutions reported more positive experiences compared to those in under-funded settings, while faculty across sites emphasized the need for institutional support to maximize technology’s pedagogical potential. These insights underscore the importance of aligning technology use with institutional and disciplinary contexts to enhance cognitive skill development.

Use of Verbatim Excerpts to Convey Meaning and Depth

To communicate how deep and authentic the participants' experiences are, the following verbatim quotes and narratives illustrate the main ideas and themes that emerged from the focus group discussions. A student in a computer science program shared: "The AI tutor was like having a personal guide—it kept pushing me to think deeper about coding problems, asking me why I chose a certain approach. It made me question my assumptions." This quote reflects the theme of personalized learning through AI and of AI's role in the ecosystem in which a student is attempting to learn. A nursing faculty member described in a narrative their experience with virtual simulations. "Watching students navigate patient scenarios in the simulation lab was eye-opening. They had to make quick decisions, reflect on errors, and try again—it’s a powerful way to build problem-solving skills." Simulated environments have the value of providing a setting where the clinical judgments of students can be observed and practiced. In contrast, a faculty member from the humanities pointed out a problem: "The idea of AR is fantastic, but it’s a tough fit when it comes to using it for dissecting texts. I can't justify the hours it would take to move from a standard digital-format lit analysis to one that uses AR. If I could just pay someone to do that for me, I would!" This quote captures a theme of technological and pedagogical challenges. A student's reflective journal provided more detailed information. It revealed the following through content analysis: "Using AR to explore historical sites felt like stepping into the past—it made me think critically about how context shapes events." Together, these excerpts afford a clear glimpse into the consequences of new technologies for the next generation. They articulate the findings in ways that resonate with the lived experiences of the participants.

V. Discussion

This research investigated how students and educators view and experience the use of new technologies, Artificial Intelligence (AI), Augmented Reality (AR), and virtual simulations. Their views are a crucial new layer of understanding as we forge ahead with the use of these technologies to foster, in our higher education students, the kinds of critical and creative thinking and problem-solving skills we know they must have to be successful. This thematic analysis of interviews, focus groups, and content analysis provided a detailed account of the influence of these technologies on cognitive engagement and pedagogical practice. The emergent themes were interpreted using the lenses of constructivist and experiential learning theories. In this regard, frameworks of constructivist and experiential learning not only inform cognitive development but also promote the formation of democratic capacities (i.e., reflective judgment, civic reasoning, and collaborative problem-solving skills) that are essential for participation in knowledge societies. We assessed the outcomes for structuring educational experiences in which technology is either successfully or unsuccessfully employed. When it comes to framing and, we might add, valuing, the research we undertake, interpretivism is our chosen perspective. This is because of (1) its fit with the context (the lived experiences of research participants) that we wish to capture and (2) the emphasis interpretivism places on understanding the particular meanings that research participants give to their actions and the world around them. Our research conversation contributes to the growing nationwide discourse around the integration of technology into the higher educational system. This conversation contributes to the growing discourse surrounding the integration of technology into the higher education system and yields several actionable recommendations for educators, institutions, and policymakers. Teachers must also think about how their design decisions create inclusive learning cultures, where everyone has the equal opportunity to learn, to think, and to participate with technology. They must ask: Do the designs push marginalized groups toward greater inclusion and participation, with technology as an enabler? Or do the designs serve oppositely, with technology as a barrier?

How Findings Align with Constructivist and Experiential Learning Principles

The themes identified boosted engagement in various ways, by making it interactive, by personalizing the learning experience through AI, by setting up problem-solving in simulated environments, and by encouraging reflective adaptation. The principles of constructivist and experiential learning closely match the themes of this evaluation. Constructivist learning theory, active knowledge construction through social interaction and exploration, forms the theoretical backbone for many educational programs and environments (Vygotsky, 1978). The theory is reflected in students' descriptions of AR and virtual simulations as tools that make abstract concepts more concrete and as forms of collaboration that push them toward more meaningful inquiry. For example, engineering students using AR to visualize mechanical systems engaged in hypothesis testing and peer discussion, mirroring the constructivist emphasis on co-constructed knowledge (Jonassen, 1999). Experiential learning theory (Kolb, 2014) is also evident in virtual simulations. This is especially true for health sciences students. They are using the virtual simulations to practice clinical decision-making and to reflect on those decisions in an outcome-based manner. The use of AI-driven analytics in the virtual simulation world serves a dual purpose. First, it helps the faculty tailor the virtual experience to each individual student. Second, it allows the very constructivist nature of the virtual world to serve a purpose that it was designed for to act as a scaffold for navigating through an individualized learning path.

Designing Meaningful, Student-Centered Tech-Enhanced Learning Experiences

The findings have major ramifications for crafting pedagogical practices that harness AI, AR, and virtual simulations to nurture cognitive skills. Educators should make student-centered design a top priority, integrating tech in a way that meshes with not just learning objectives but also with the sort of authentic engagement that makes active learning, well, active. For instance, using virtual simulations in nursing education demonstrates the value of authentic, scenario-based tasks that promote problem-solving through trial and error. It is also important for faculty to include reflective components, such as writing in journals or having debriefing sessions, to support the development of students' metacognitive processes. The importance of reflecting in some way on simulated outcomes was a theme in the students' narratives. Alongside these applications in non-adaptive tools, AI-driven engines are being put to work to create adaptive learning experiences, tailoring challenges to individual student needs. This is seen quite clearly in the student feedback we get on our personalized problem sets. Programs meant for the development of faculty should hone in on endowing those faculty members with the skill set to design and implement effectively the technologies in question. When doing so, they should emphasize the alignment of said design and implementation with not only constructivist principles but also those of experience-based learning. These strategies allow educators to create significant learning environments that are enhanced by technology.

Institutional, Cultural, or Technical Factors Affecting Implementation

The research pinpointed a number of obstacles and facilitators that affect the effective assimilation of new technologies into higher education. Barriers at the institutional level, such as a lack of funding for technological infrastructure or inadequate training, were often mentioned by faculty, especially those from under-resourced institutions. These concerns mirror the results of previous research, which found that insufficient support at the level of the institution critically undermines faculty members' attempts to implement innovative technologies in their teaching (Selwyn, 2016). Unreliable software or steep learning curves are also hinders of engagement when it comes to technical challenges, with students experiencing glitches in the AR tools. Resistance to change, a cultural factor, constituted an additional obstacle, especially for pedagogies that had traditionally been the province of faculty in the humanities, where technology's relevance was less apparent. It was the long-standing and, in some cases, strongly held belief of many faculty members that good teaching consisted of little more than what could be obtained from a top-notch textbook and a blackboard. On the other hand, enablers included strong institutional support, which afforded access to training and technical help that made faculty feel more confident and students more engaged. Collaborative cultures in institutions that encouraged trying out the technology were also supporting adoption, especially in STEM fields and health sciences, where we saw established protocols for tech integration. These findings point out the necessity for institutions to invest in structures, to offer continual professional growth, and to create an atmosphere of innovation in order to maximize the teaching benefits of new technologies.

Value of Capturing Lived Experiences and Contextual Understanding

The approach of interpretivism was invaluable in capturing the lived experiences and contextual nuances of technology integration. It aligned perfectly with the study's aim, which was to explore not just the what, but also the why and how of technology integration, subjective perceptions that usually prove quite elusive (Creswell & Poth, 2018). The study centered on the voices of participants, obtained through semi-structured interviews, focus groups, and analysis of artifacts. One might refer to these as the special, context-dependent observations that provide researchers an "edge" in terms of understanding the emotional and relational dynamics of technology use. These are insights that would remain concealed if the researchers depended solely on numbers to tell them what was happening. For example, narratives from students about feeling 'immersed' in AR environments or reflections from faculty about adapting pedagogies revealed the personal and situational factors shaping technology's impact. This strategy also underscored the variety of experiences among the different disciplines and institutions, pointing out the significance of context when it comes to comprehending pedagogical results. Thematic analysis both allowed and required a systematic, yet flexible, exploration of the meanings participants had made. This ensured that the findings were firmly grounded in the realities of the participants (Braun & Clarke, 2006). The interpretivist approach focuses on generalizability and provides a robust foundation for the practice of informing educational policy.

VI. Conclusion

This study focused on the foray of the contemporary technologies into higher education and how they were perceived through the lived experiences of teachers and students. The understanding of the integration of what are being labeled as "emerging technologies", Artificial Intelligence (AI), Augmented Reality (AR), and virtual simulations into contemporary educational practices, and the promised boosts to critical thinking and problem solving ostensibly to come from such practices, formed the core of this study. The pressing societal need equips individuals with cognitive and ethical competencies necessary for today's increasingly digital and interconnected world. This qualitative case study situates its research in the interpretivist paradigm. It focuses on the technologies available in one local context, which profoundly shape not only the quality and kinds of cognitive engagement that students experience but also the very pedagogical practices of the teachers who design, deliver, and assess that engagement. However, realizing the full potential of these technologies requires addressing systemic barriers, such as unequal access to digital tools, gaps in faculty development, and institutional disparities that perpetuate educational and social inequities. This conclusion encapsulates the major insights, delineates the study's contributions to educational research, and offers advice to practitioners, educators, and institution administrators alike on how to better foster technology-enhanced learning. Additionally, it makes several suggestions for future research that could use this study not only as a springboard but also as a rudder for better understanding and thus better technology-enhanced learning.

The results showed that student engagement has increased, the learning curve has sharpened, and problem-solving skills have been fortified due to AI, AR, and virtual simulations, stemming from interactive, personalized, and hands-on learning environments. Students did not hold back when expressing the virtues of AR's interactivity, AI's personalized feedback, and the virtual simulations' no-risk environments in promoting not only critical but also team-based and iterative problem-solving. These technologies are manifesting the principles of constructivist and experiential learning (Vygotsky, 1978; Kolb, 2014). The technologies themselves held promise, but several challenges had to be tackled. These included technical limitations, insufficient training, and the necessary redesign of the spectrum of courses, so that the courses could truly utilize this powerful spectrum of technologies. We found that these were all surmountable obstacles, and more or less reflective of any change in the educational environment. Insights gained from cross-participant interactions highlighted the significance of support from educational institutions and the importance of contextual factors in determining the extent of technology's impact. Varied experiences among different educational institutions arise from disparities in resources. The transformative potential of emerging technologies in higher education, when thoughtfully integrated, was emphasized in our findings. This study contributes to the growing body of literature on technology integration in higher education by providing nuanced, qualitative insights into the lived experiences of students and educators. Unlike quantitative studies that focus on measurable outcomes, this research's interpretivist approach captures the subjective and contextual dimensions of technology use, addressing a gap in the literature for deeper, participant-driven perspectives (Selwyn, 2016). By grounding the findings in constructivist and experiential learning theories, the study offers a theoretically informed understanding of how AI, AR, and virtual simulations foster critical thinking and problem-solving skills. The cross-disciplinary and multi-institutional perspective further enriches the discourse by highlighting variations in technology adoption across STEM, health sciences, and humanities contexts. These contributions provide a foundation for educators, researchers, and policymakers to design and evaluate technology-enhanced learning environments that prioritize cognitive skill development and contextual relevance. This research emphasizes the importance of innovative forms of education in producing a fairer and more inclusive society. More importantly, this study sets out not to merely define the what and the how of colleges and universities integrating artificial intelligence, augmented reality, and virtual simulations into the educational experience. It also attempts to address the less commonly asked question of why.

Recommendations

- Instructors must use virtual simulations, as well as AI-driven tools, to create the kinds of hands-on, interactive, and student-centered learning experiences that promote critical thinking and the kind of problem-solving we want to see in our students. In this case, virtual simulations combined with debriefing sessions lead to reflective practice. A tool driven by AI should provide the skeleton for the kinds of formative assessments and personalized feedback that ought to happen in real time during the learning process.

- Higher education institutions should invest in infrastructure, training, and support systems to facilitate the integration of emerging technologies. Providing robust technical support and access to reliable hardware and software can mitigate barriers such as technical glitches, as reported by participants. Institutions should also prioritize professional development programs that equip faculty with the skills to design technology-enhanced curricula, addressing challenges noted in humanities disciplines. Furthermore, institutions should support qualitative research initiatives to explore the contextual and relational dynamics of technology adoption, ensuring that policies and resources are informed by the lived experiences of students and educators. Such support can foster a culture of innovation and enhance the pedagogical impact of technologies across diverse academic settings.
- Policymakers and institutions should integrate emerging technologies not only for academic enhancement but also as tools for digital citizenship, social inclusion, and educational equity across diverse communities.
- Future research should build on this study's findings by conducting longitudinal qualitative studies to examine the sustained impact of AI, AR, and virtual simulations on critical thinking and problem-solving skills. Longitudinal approaches can capture how perceptions and practices evolve over time, providing deeper insights into the long-term efficacy of these technologies. Additionally, research should explore technology integration across a broader range of institutional and cultural contexts, including under-resourced or non-Western higher education settings, to enhance the transferability of findings. Further investigation into the role of specific pedagogical strategies, such as scaffolding or collaborative learning designs, could clarify how to maximize technology's benefits. Finally, studies that integrate student and faculty co-design of technology-enhanced learning experiences could offer innovative perspectives on aligning technologies with learner needs, advancing the field of educational technology research.

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