Generative AI for Bridging the Digital Divide in SADC Higher Education: A Quantitative Study on Student Perspectives.

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Abstract
Generative Artificial Intelligence (GenAI) has rapidly transformed higher education by enabling content creation, personalized learning, and academic support. While adoption has advanced in developed contexts, its use in emerging regions remains underexamined. This study investigated student engagement with GenAI specifically ChatGPT, Gemini, and Claude across higher education institutions in the Southern African Development Community (SADC). Using Activity Theory as the analytical lens, a quantitative survey was conducted with 908 students from diverse academic levels and disciplines. The findings revealed high awareness, with 73% of respondents actively employing GenAI for academic writing, conceptual clarification, and the generation of study materials. Despite positive perceptions of usefulness, significant gaps were identified, including insufficient ethical guidance, digital literacy challenges, inconsistent institutional policies, and faculty resistance. These shortcomings hindered responsible and equitable integration. The study underscores the necessity of context-sensitive strategies to support ethical, inclusive, and pedagogically sound adoption of GenAI in higher education. The results provide practical insights for policymakers, institutions, and educators seeking to harness AI responsibly within resource-constrained environments.

Keywords: ***Generative AI, Higher Education, SADC, Student Engagement, AI Ethics, Educational Innovation, Policy Integration***

I. Introduction

Artificial Intelligence (AI) refers to the simulation of human intelligence by computer systems through processes such as learning, reasoning, and self-correction [1]. While classical AI research emphasized problem-solving and reasoning [1], recent applied studies demonstrate its growing role in solving practical challenges in domains such as agriculture and education [2], [3]. Within this field, Generative Artificial Intelligence (GenAI) represents a transformative subset that produces original content—text, images, audio, or code—based on large-scale data models [4]. Tools such as ChatGPT, Gemini, Claude, and DeepSeek have emerged as widely accessible platforms that enable real-time content generation, personalized learning, and multilingual communication [5], [6].

In higher education, GenAI has shown potential to enhance learning by simplifying complex topics, improving academic writing, and delivering immediate feedback to students. Zhai [7] argued that the rise of large language models (LLMs) has already reshaped instructional practices, creating opportunities for adaptive and self-directed learning. While such tools are now deeply embedded in teaching and learning processes across developed regions, their uptake in emerging contexts, particularly in the Southern African Development Community (SADC), remains inconsistent.

The SADC region comprises 16 member states with wide disparities in economic resources, digital infrastructure, and linguistic diversity [8]. Higher education systems face persistent challenges, including limited connectivity, underfunded institutions, and inadequate faculty training, which restrict equitable access to digital technologies [9]. Consequently, integrating GenAI in this context

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presents both an opportunity for pedagogical innovation and a challenge for ensuring ethical and inclusive adoption. Concerns regarding academic integrity, data literacy, and the risk of widening the digital divide are particularly salient.

Despite a growing body of global literature on GenAI in higher education, most empirical evidence originates from technologically advanced regions, limiting its relevance to under-resourced contexts. Research remains scarce on how students in the SADC region engage with these tools, what academic tasks they prioritize, and how they perceive the benefits and risks of GenAI adoption. Unchecked use may lead to dependence on AI-generated content, erosion of critical thinking, and academic dishonesty, raising urgent questions about policy and governance.

This study addresses these gaps by examining student engagement with GenAI in SADC higher education institutions. The objectives are fourfold: (i) to assess students' awareness and frequency of GenAI use; (ii) to identify academic tasks for which GenAI tools are employed; (iii) to explore perceived benefits and challenges, including ethical concerns and institutional support; and (iv) to analyze students' perspectives on the future integration of GenAI within higher education in the region. By applying Activity Theory as the analytical framework, this study situates student practices within broader institutional and socio-cultural contexts, offering insights to guide policy and pedagogical strategies.

II. Literature Review

The integration of Generative Artificial Intelligence (GenAI) in higher education has accelerated globally, with research highlighting its pedagogical, ethical, and institutional implications. Scholars have examined its potential to enhance personalized learning, academic performance, and student engagement [4], [10], [11]. However, limited evidence exists on its adoption in low- and middle-income regions, including the Southern African Development Community (SADC), where issues of equity, infrastructure, and governance shape its trajectory.

A. Adoption Patterns

Evidence from technologically advanced contexts shows rapid uptake of GenAI tools among students. A 2025 survey by the Higher Education Policy Institute (HEPI) reported that 92% of UK undergraduates had used GenAI, with 88% applying it to assignments, a significant increase from the previous year [11]. In contrast, adoption patterns in Africa have been shaped by socio-cultural and infrastructural contexts. Essien et al. [12] found that Nigerian university students primarily used ChatGPT for brainstorming, summarizing, and retrieving references, but peer norms, faculty attitudes, and digital infrastructure strongly mediated usage. Similarly, Chan [10] emphasized that the effectiveness of GenAI integration depends heavily on contextual factors such as access, acceptance, and cultural perceptions.

B. Academic Benefits

Studies consistently report positive academic outcomes associated with GenAI. Udeh [4] documented that adaptive, GenAI-powered platforms improved student engagement by 20% and academic performance by 15%. In Hong Kong, Chan [10] observed that GenAI enhanced writing quality, supported personalized learning, and strengthened research skills. Chisom et al. [13] reported similar benefits in sub-Saharan pilot projects, where AI-driven platforms facilitated collaboration and communication among students, even in digitally constrained environments. These findings suggest that, when thoughtfully implemented, GenAI can bridge pedagogical gaps across resource settings.

C. Ethical and Pedagogical Concerns

Despite these benefits, the literature highlights serious risks. Hughes et al. [14] cautioned that excessive reliance on GenAI may erode academic standards, displace lecturer roles, and undermine the credibility of qualifications. Reports from The Guardian [15] revealed student concerns about diminished academic ownership when AI-generated outputs influenced graded work. Udeh [4] further warned of algorithmic bias, misinformation, and the erosion of critical thinking. These issues underscore the importance of institutional safeguards to ensure that GenAI use enhances, rather than compromises, learning outcomes.

D. Policy and Institutional Responses

Global organizations and regional institutions have begun developing responses to these challenges. UNESCO [16] stressed the need to preserve human

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agency in AI-driven education and called for context-sensitive, ethical policies. In the African context, Nongqwenga and Funda [17] proposed a curriculum-integrated GenAI framework in South African universities to improve academic outcomes while maintaining oversight. These frameworks demonstrate an emerging shift from ad hoc adoption toward structured, ethically informed integration.

E. Research Gap

While global scholarship documents both the promise and risks of GenAI in higher education, most empirical studies originate from high-income contexts with robust digital infrastructures. Research from the SADC region remains scarce, leaving unanswered questions about how students engage with GenAI, what academic tasks they prioritize, and how they navigate ethical and institutional challenges. This study addresses that gap by providing region-specific, student-centered evidence of GenAI adoption in SADC higher education institutions.

A. Theoretical Framework: Activity Theory

This study employed Activity Theory (AT) as the guiding framework for analyzing student engagement with Generative Artificial Intelligence (GenAI) in higher education across the SADC region. Originating from Engeström's work [18], AT provides a socio-cultural lens for understanding how human activity is shaped by tools, rules, community expectations, and institutional structures. It was chosen because it captures both the individual and systemic dimensions of technology use, making it particularly suitable for contexts where social, ethical, and institutional factors mediate learning practices.

Within the AT framework, learning and technology use are conceptualized as mediated actions occurring within an activity system composed of seven interconnected elements: subject, object, tools, rules, community, division of labor, and outcome. In this study, the subject was the student, while the object referred to academic tasks and goals such as completing assignments, solving problems, or clarifying concepts. The tools were the GenAI platforms (ChatGPT, Gemini, Claude) that mediated students' learning processes. The rules encompassed institutional policies, ethical guidelines, and faculty expectations regarding AI use. The community included peers, lecturers, and administrators who shaped norms and practices around GenAI adoption. The division of labor reflected the distribution of responsibilities for knowledge creation and learning between students, faculty, and AI technologies. Finally, the outcome referred to the perceived benefits, challenges, and envisioned future of GenAI integration in higher education.

This holistic framework enabled the study to examine not only how frequently students used GenAI or what tasks they completed with it, but also how usage was shaped by surrounding institutional and socio-cultural structures. For instance, limited internet connectivity constrained tool use, while unclear or inconsistent university guidelines inhibited ethical and pedagogically sound adoption. Conversely, collaborative academic environments where peers and faculty engaged constructively with GenAI facilitated more responsible and innovative use.

Previous studies further underscore the relevance of AT in similar educational contexts. Essien et al. [12], for example, applied AT to investigate socio-cultural influences on GenAI adoption in Nigerian universities and highlighted how institutional norms and access limitations shaped student practices. These findings mirror conditions in the SADC region and justify the application of AT in this research. By employing AT, this study was able to generate a nuanced understanding of the dynamic interactions between students, technology, and institutional systems, thereby informing recommendations for context-sensitive policies and pedagogical strategies in higher education.

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Figure 1
Activity Theory framework for student engagement with Generative AI in higher education.

III. Methodology

This study adopted a quantitative research design grounded in Activity Theory (AT), which conceptualizes human actions, including learning, as mediated by tools and shaped by broader social structures [18]. In this context, Generative Artificial Intelligence (GenAI) platforms were treated as mediating artifacts influencing student activity within higher education systems. A structured, self-administered questionnaire was employed to collect data on student engagement with GenAI across the Southern African Development Community (SADC).

A. Instrument Development

The survey instrument was designed in alignment with the core elements of AT, ensuring that each component of the activity system was represented. The instrument consisted of six thematic sections. The Demographics section collected data on students' academic backgrounds, including institution, discipline, and mode of study (on-campus or online), to contextualize responses. The Awareness and Usage section examined familiarity with GenAI platforms and frequency of use, reflecting the subject and tool dimensions of AT. The Perceived Benefits section investigated how students believed GenAI supported their academic objectives, aligning with the object. The Challenges and Concerns section focused on ethical issues, institutional rules, and guidance, corresponding to the rules and community dimensions. The Future Integration section explored student perspectives on the long-term role of GenAI in their institutions, representing desired outcomes. Finally, Reflections captured broader student insights on how GenAI could address educational inequities in the region.

B. Data Collection

The questionnaire was disseminated via Google Forms to maximize accessibility across multiple countries and institutions in the SADC region. Data collection occurred over one month in early 2025. Participation was voluntary and anonymous, and no incentives were offered to avoid response bias. A total of 1,527 responses were received. Following data cleaning to remove incomplete or duplicate entries, 908 valid responses were retained. The sample represented a wide range of academic levels (Diploma, Bachelor's, Master's, and Doctoral) and disciplines (e.g., Science, Engineering, Business, and Social Sciences), providing a diverse perspective on student engagement with GenAI. Both traditional and online learners were included, ensuring that multiple learning environments were represented.

C. Data Analysis

Data were analyzed using Python and Microsoft Excel. Descriptive statistics, including frequencies, means, and percentages, summarized demographic characteristics and GenAI usage patterns. Cross-tabulations were performed to explore relationships between demographic variables and usage. Inferential analyses included Spearman's correlation to test associations between usage frequency and perceived usefulness, a Mann–Whitney U test to compare perceptions of usefulness between groups with and without ethical guidance, and Chi-square tests of independence to assess associations between usage categories and institutional responses. A linear regression model was also applied to evaluate whether frequency of use and ethical guidance predicted perceived usefulness. These analyses enabled both descriptive and explanatory insights into student engagement with GenAI.

D. Limitations

While the study achieved wide geographic reach and a large sample, certain limitations were acknowledged. Urban institutions were likely overrepresented due to better connectivity, which may have excluded students with limited internet access. Additionally, the reliance on self-reported data introduced potential response bias. Despite these limitations, the dataset provided robust and meaningful insights into how students across the SADC region engage with GenAI in higher education, reinforcing the suitability of Activity Theory as an analytical framework.

IV. Results

The analysis of 908 valid responses revealed high awareness and growing engagement with Generative

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Artificial Intelligence (GenAI) tools among students across higher education institutions in the SADC region. The results are presented in five thematic areas consistent with the study objectives.

A. Awareness of GenAI Tools

A significant majority of students (84.2%) reported familiarity with GenAI platforms such as ChatGPT, Gemini, and Claude. Of these, 73% had actively used the tools in academic work, while 7.1% were aware but had not used them. Only 3.1% reported no prior exposure, suggesting that GenAI awareness is nearly ubiquitous across the sample.

B. Frequency of Use

Students reported varying levels of engagement with GenAI tools. Approximately 29% indicated regular use (at least once per week), 14% occasional use (a few times per month), and 13% rare use. By contrast, only 3% reported never using GenAI for academic purposes. These figures demonstrate that GenAI is becoming embedded in students' study routines across the region (Fig. 2).

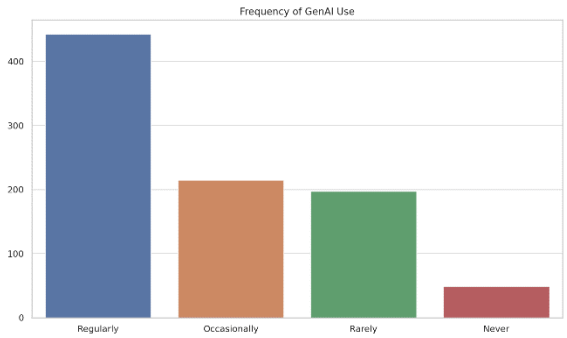


Fig. 2-Frequency of GenAI use

C. Perceived Academic Benefits

Students expressed generally positive perceptions of GenAI's contribution to their studies. On a five-point Likert scale, the mean perceived usefulness score was 3.96 (SD ≈ 0.91), indicating strong satisfaction. Reported benefits included simplifying complex concepts, improving essay writing, solving mathematical and logical problems, and generating study aids such as summaries and flashcards (Fig. 3). Qualitative responses reinforced these findings, highlighting improved writing quality, efficiency in study routines, and greater independence in learning.

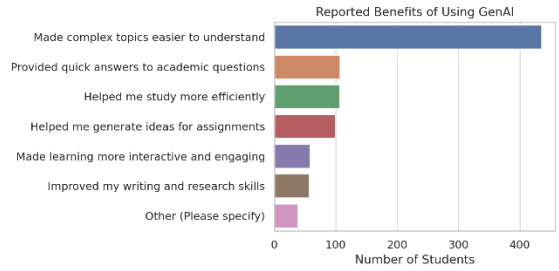


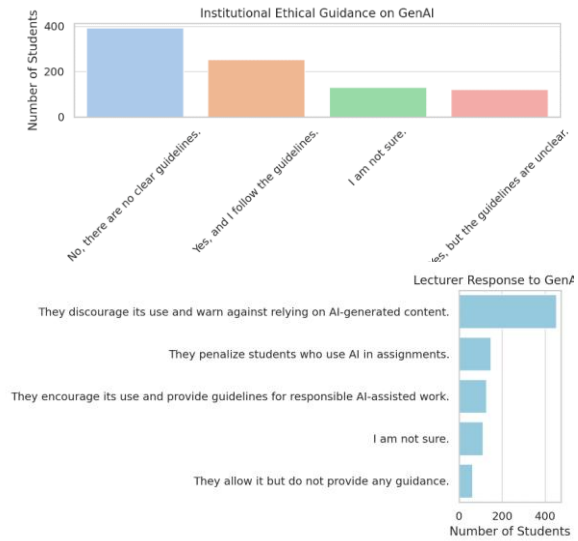
Fig. 3: Reported Benefits of using GenAI

D. Institutional Guidance and Faculty Attitudes

Despite high levels of adoption, institutional support was limited. Nearly half of the students (49%) reported receiving no formal guidance on ethical AI use from their institutions. Only 31% had received and followed such guidance, while 14% were unsure or found existing rules unclear (Fig. 4).

Fig. 4: Institutional Ethical Guidance on GenAI

Faculty responses were inconsistent: 38% of students reported that lecturers discouraged GenAI use, 12% had been penalized for using it, and only 11% stated that lecturers encouraged responsible engagement. A further 5% noted that GenAI was permitted without accompanying guidelines, and 12% were uncertain about lecturer positions (Fig. 5). These findings



indicate significant institutional-policy gaps and misalignment between student practices and faculty expectations.

Fig. 5-Lecturer Responses to GenAI

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E. Statistical Analyses

Several statistical tests were conducted to examine relationships between GenAI usage, perceptions, and institutional guidance:

- Usage Frequency and Perceived Usefulness

  Spearman's correlation indicated a moderate positive association ($\rho = 0.25$, $p < 0.001$), suggesting that students who used GenAI more frequently also rated it as more useful.

- Impact of Ethical Guidance

  A Mann–Whitney U test showed that students who received ethical guidance reported higher usefulness scores than those who did not ($U = 24{,}145.0$, $p = 0.034$).

  However, a regression model including both usage frequency and guidance as predictors revealed that only frequency of use significantly predicted usefulness ($\beta = 0.35$, $p < 0.001$), while ethical guidance was not significant ($\beta = -0.06$, $p = 0.533$). The model explained 8.3% of the variance in usefulness ($R^2 = 0.083$, $F(2,481) = 21.83$, $p < 0.001$).

- Institutional Policy and Usage

  A Chi-square test of independence showed no significant association between frequency of GenAI use and whether students had received guidance ($\chi^2(6, N = 908) = 11.03$, $p = 0.093$).

F. Summary of Findings

Taken together, these results demonstrate that students in the SADC region are actively engaging with GenAI tools, perceiving them as highly beneficial for academic purposes. However, institutional readiness remains limited, with inconsistent faculty attitudes and a lack of clear ethical guidelines. The Activity Theory framework highlights a misalignment between student adoption of GenAI (subjects and tools) and the institutional structures (rules, community, division of labor) that should support its responsible use.

V. Discussion

This study examined how students across the SADC region engage with Generative Artificial Intelligence (GenAI) in higher education and explored the institutional and systemic factors influencing this engagement. The findings provide critical insights into the interplay between student agency, faculty responses, and institutional preparedness.

A. Student Engagement and Perceived Benefits

The results confirmed widespread awareness and adoption of GenAI tools, with 73% of students reporting active use. The moderate positive correlation between usage frequency and perceived usefulness ($\rho = 0.25$, $p < 0.001$) indicates that repeated engagement with GenAI reinforces students' recognition of its academic value. These results align with global evidence showing that GenAI enhances academic writing, conceptual understanding, and personalized learning [4], [10]. Importantly, this study extends the literature by demonstrating that even in resource-constrained contexts, students are creatively integrating GenAI into their academic practices.

B. Institutional Gaps and Faculty Resistance

While student adoption was high, institutional support was inconsistent. Nearly half of respondents reported receiving no ethical guidance, and faculty attitudes ranged from encouragement to penalization. The Chi-square test revealed no significant association between institutional guidance and usage frequency ($\chi^2(6, N = 908) = 11.03$, $p = 0.093$), suggesting that students' engagement is largely independent of formal oversight. This reflects a widening digital culture gap between students, who embrace GenAI, and faculty, many of whom remain resistant. Similar resistance has been observed in other contexts, where concerns about academic integrity, loss of pedagogical control, and lack of institutional capacity drive opposition to GenAI [14], [15]. If unaddressed, this misalignment risks creating adversarial dynamics that hinder responsible innovation in higher education.

C. Role of Ethical Guidance

The Mann–Whitney U test suggested that students with ethical guidance perceived GenAI as more beneficial ($p = 0.034$). However, regression analysis showed that guidance was not a significant predictor of usefulness once frequency of use was controlled for

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($\beta = -0.06$, $p = 0.533$). This finding implies that institutional guidelines alone are insufficient to shape student attitudes; rather, hands-on experience with GenAI drives perceptions of value. This resonates with Udeh's [4] argument that active engagement with AI systems is central to learning, while policy structures must operate as enablers rather than substitutes for experiential use.

D. Interpretation Through Activity Theory

From the perspective of Activity Theory, the results reveal a misalignment between the subjects (students), tools (GenAI), and surrounding institutional elements (rules, community, and division of labor). Students actively use GenAI to pursue academic objectives, but institutional structures have not evolved to support this activity. Faculty discouragement (community) and absence of clear policies (rules) constrain effective use, while responsibility for content creation (division of labor) is unevenly negotiated between students, faculty, and AI systems. This systemic fragmentation threatens to undermine both academic integrity and pedagogical innovation. Conversely, where collaborative environments exist, students are able to harness GenAI more ethically and productively, confirming the mediating role of social and institutional contexts in technology adoption [12], [18].

E. Broader Implications

The findings highlight the beginning of a generational and institutional divide. Students, as early adopters, are embedding GenAI into daily academic practices, while institutions remain slow to adapt. If governance frameworks continue to lag behind student behavior, the risk is not only academic dishonesty but also inequitable access, where only digitally literate students benefit from these technologies. Structured responses are therefore essential. International organizations such as UNESCO have called for context-sensitive, ethical integration of AI [16], while regional scholars propose curriculum-based frameworks to balance innovation and oversight [17]. This study reinforces these calls by providing empirical evidence from a region where digital inequalities remain acute.

F. Synthesis

In sum, the discussion reveals a paradox. Students in the SADC region are both enthusiastic and creative in adopting GenAI, yet institutional inertia threatens to limit its positive potential. Addressing this paradox requires bridging the gap between student agency and institutional structures through coherent policies, faculty development, and inclusive digital infrastructure. By applying Activity Theory, this study demonstrates that sustainable integration of GenAI depends not only on access to tools but also on the alignment of rules, community practices, and shared responsibilities in higher education systems.

VI. CONCLUSION AND RECOMMENDATIONS

- *Conclusion*

This study provided a region-specific analysis of student engagement with Generative Artificial Intelligence (GenAI) in higher education across the Southern African Development Community (SADC). The findings revealed widespread awareness and frequent use of platforms such as ChatGPT, Gemini, and Claude, particularly for writing support, conceptual clarification, and study material generation. Students who used GenAI more frequently reported significantly higher perceptions of usefulness, underscoring its academic value in resource-constrained environments. However, the results also highlighted a structural imbalance between student practices and institutional readiness. Nearly half of respondents reported receiving no ethical guidance, while faculty attitudes ranged from supportive to punitive. This inconsistency has created a gap in which students adopt GenAI autonomously, often without adequate institutional support or ethical clarity. From the perspective of Activity Theory, this reflects a misalignment between the subjects and tools of academic activity and the rules, community norms, and division of labor that should mediate responsible integration. Without deliberate intervention, this imbalance risks exacerbating academic integrity challenges and deepening existing digital divides.

- *Recommendations*

To address these challenges, higher education institutions in the SADC region must move from reactive regulation toward proactive, inclusive support for GenAI integration. First, clear and accessible

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institutional guidelines should be established to regulate the ethical use of GenAI by both students and faculty. These guidelines should be embedded within academic policies, with mechanisms such as honor codes or usage declarations to promote transparency and integrity in coursework and assessments.

Second, digital and AI literacy must be systematically embedded within curricula. Introducing foundational training modules for first-year students across all disciplines would equip learners with the technical skills, critical evaluation abilities, and ethical awareness required for responsible AI use. In parallel, institutions should invest in continuous professional development for academic staff, enabling lecturers to understand GenAI's potential, risks, and pedagogical applications. Faculty-led pilot projects can serve as testbeds for innovative integration, while simultaneously building institutional confidence and expertise.

Third, improving digital infrastructure and access is essential to ensure equitable participation. Institutions should prioritize expanding connectivity and pursue partnerships with technology providers to develop localized, low-bandwidth-compatible GenAI platforms suited to diverse regional contexts. Such efforts would reduce inequalities and enable students in under-resourced environments to benefit from these technologies on equal terms.

Finally, sustainable integration requires ongoing monitoring and research. Institutions should establish dedicated AI-in-education hubs to gather evidence, track emerging trends, and guide policy development. Longitudinal studies are particularly important to assess the long-term effects of GenAI on learning outcomes, digital inclusion, and academic integrity. By institutionalizing evidence-based decision-making, universities can adapt to the evolving dynamics of AI adoption while safeguarding educational quality.

In conclusion, the responsible integration of GenAI in SADC higher education depends on the alignment of student practices, faculty capacities, and institutional governance. With carefully designed policies, inclusive digital infrastructure, and context-sensitive pedagogical strategies, GenAI can become not only a tool for enhancing learning but also a catalyst for more equitable and innovative higher education systems in the region.

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