

TRANSFORMING UNIVERSITY EDUCATION WITH GENERATIVE AI: STRATEGIES, CHALLENGES AND IMPACTS

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Abstract

Generative artificial intelligence (GenAI) is rapidly shifting the contours of university teaching, learning, and administration. To identify concrete pathways for responsible adoption, we conducted 12 in-depth interviews with lecturers, students, and senior administrators at three research-intensive Chinese universities. Reflexive thematic analysis uncovered six inter-locking themes: GenAI as a pedagogical co-designer that accelerates content creation; heightened student engagement through low-stakes, iterative exploration; assessment redesign as a more effective integrity strategy than detection-and-deterrence; persistent digital-equity gaps driven by hardware, bandwidth, and licensing costs; staff capacity as the critical bottleneck, with structured “prompt-engineering” micro-credentials proving particularly effective; and the need for agile, participatory governance to keep pace with fast-moving tools. Taken together, the findings show that GenAI’s transformative promise materialises only when technological affordances are matched by inclusive infrastructure, professional learning, and transparent policy. We therefore propose a three-pillar framework for institutions: i) pedagogical co-design: embed GenAI in curricula via task redesign and reflective documentation of AI use; ii) equitable enablement: invest in campus-wide compute resources, subsidised licences, and student support to prevent new digital divides; and iii) agile governance: establish multi-stakeholder committees that iteratively refine ethical guidelines, data-privacy safeguards, and citation norms. This study extends socio-technical theories of educational technology by linking micro-level user practice to macro-level organisational policy, and offers actionable recommendations for policymakers, educators, and technologists to cultivate a future-ready, ethically grounded learning ecosystem.

Keywords: *Generative AI, higher education, innovation, learning technologies, in-depth interviews.*

1. Introduction

The integration of artificial intelligence (AI) in education has evolved significantly over the past few decades, with generative AI emerging as a transformative force in recent years. Historically, AI in education was primarily focused on rule-based systems and basic machine learning models, which were limited in their ability to generate content or engage in creative tasks. However, the advent of large language models (LLMs) and generative AI (GenAI) has revolutionized the educational landscape, enabling personalized learning, automated content creation, and interactive tutoring systems (Rashid et al., 2024; Chakraborty, 2024).

The transition from traditional teaching methods to AI-enhanced education has been gradual. Early AI applications in education were confined to simple tasks such as grading and administrative support. However, with advancements in natural language processing (NLP) and deep learning, generative AI has become a powerful tool for creating educational content, simulating real-world scenarios, and providing personalized learning experiences (Singh, 2024; Łodzickowski et al., 2024).

Generative AI is reshaping university education by supporting personalized learning experiences, content creation, intelligent tutoring, assessment, and administrative efficiency. First, it enables tailored study guides, adaptive assessments, and individualized feedback that let students learn at their own pace, thereby boosting academic performance and engagement (Singh, 2024; Moore & Tsay, 2024; Fahlapi et al., 2024). Second, educators can rapidly craft high-quality lecture notes, case studies, and multimedia materials while also receiving AI-driven suggestions for learning objectives, outcomes, and assessment methods aligned with institutional goals, ensuring curricula remain current and relevant (Rashid et al., 2024; Chakraborty, 2024; Tillmanns et al., 2025; Nartey, 2024). Third, AI-powered intelligent tutoring systems deliver real-time guidance, answer complex questions, and simulate authentic

scenarios where students can safely apply newly acquired knowledge (Singh, 2024; Maity & Deroy, 2024). Fourth, generative AI automates grading and provides detailed, formative feedback that helps students pinpoint areas for improvement while reducing instructors' workload and grading bias (Francis et al., 2025; Moore & Tsay, 2024). Finally, by streamlining scheduling, enrollment, and record-keeping, generative AI frees educators to concentrate more on teaching and research (Singh, 2024; Chakraborty, 2024).

Despite its promise, integrating generative AI into education presents a set of intertwined challenges, maintaining academic integrity in the face of AI-enabled plagiarism and contract cheating (Francis et al., 2025; Nartey, 2024); mitigating algorithmic bias to avoid unfair treatment of particular student groups (Morandín-Ahuerma, 2024); safeguarding the significant volumes of learner data that underpin AI-driven personalisation (Singh, 2024); bridging the digital divide so that all learners can access and benefit from AI tools (Morandín-Ahuerma, 2024; Nartey, 2024); and ensuring transparency and accountability in AI decision-making, especially for grading and feedback, so that outputs remain auditable and trusted (Francis et al., 2025). These challenges manifest differently across educational tiers: higher-education institutions, which more often possess the infrastructure and expertise to deploy AI for personalised learning, content generation and assessment, must wrestle primarily with academic integrity, privacy and bias (Moore & Tsay, 2024), whereas vocational-training providers leverage generative AI for simulation-based skill acquisition and workplace support but must tailor tools to learners' specific industry contexts and address unequal technological access (Rashid et al., 2024; Chakraborty, 2024; Tillman, 2025).

2. Methods

2.1. Research design

This study adopted a qualitative, multiple-case design to explore how generative AI is being understood and trial-integrated at three research-intensive Chinese universities, Tongji University (Shanghai), Dalian Maritime University (Dalian) and Central South University (Changsha). A qualitative approach was selected because the phenomenon is emergent, context-dependent and best examined through the lived experiences of those directly involved. Semi-structured, in-depth interviews enabled participants to narrate their perceptions in their own words while giving the researchers latitude to probe for clarification and examples. The three universities were purposefully chosen for their distinct disciplinary profiles and documented interest in digital learning innovation. For example, Tongji University combines strong engineering and design schools with an institution-wide "AI-Empowered Teaching" initiative. Dalian Maritime University is China's leading maritime-transport institution and has piloted AI-supported simulators for professional training. Central South University has a nationally recognised Big-Data teaching centre and extensive experience with blended-learning platforms. Studying sites with differing cultures and governance structures captures a broader spectrum of organisational opportunities and constraints surrounding generative AI adoption.

2.2. Participant recruitment

We relied on maximum-variation purposive sampling to ensure representation of key stakeholder categories, teaching staff, senior administrators, learning-technology specialists and students. Deans or equivalent gatekeepers circulated an information sheet; interested volunteers contacted the research team directly to minimise coercion. Inclusion criteria were i) active involvement in course design, delivery during 2024-2025 and ii) familiarity, however nascent, with generative AI tools, e.g., ChatGPT, Deeseek. Sample size was guided by information power (Malterud et al., 2016): heterogeneous roles coupled with focused research questions meant 12 interviews were sufficient to achieve analytic saturation; nevertheless, we scheduled two contingency slots that were not ultimately needed.

Table 1. An overview of the in-depth interview participants.

Participant	Position	Major / Disciplinary Area	Gender
P1	Lecturer	Economics	Female
P2	Lecturer	Civil Engineering	Male
P3	Director of Digital Learning (Administrator)	Educational Technology	Female
P4	Undergraduate Student	Sociology	Male
P5	Professor	Maritime Law	Male
P6	Lecturer	Marine Engineering	Female
P7	Learning-Technologies Officer (Administrator)	Information Systems	Male
P8	Undergraduate Student	Logistics & Supply Chain	Male
P9	Lecturer	Accounting	Female
P10	Instructional Designer	Education	Female
P11	Academic Affairs Officer (Administrator)	Higher-Education Management	Male
P12	Undergraduate Student	Computer Science	Female

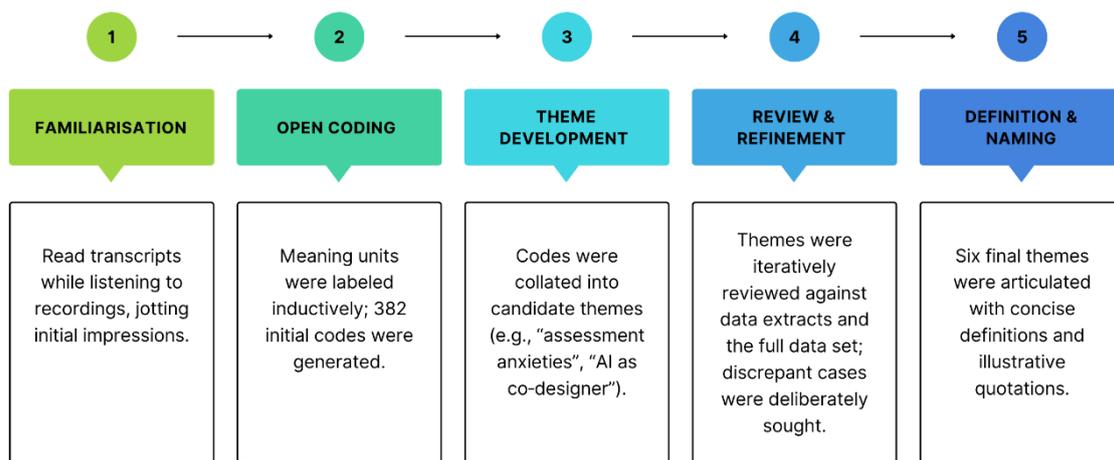
2.3. Data collection procedure

Data were gathered January–April 2025. Owing to geographical dispersion, 12 interviews were conducted via Zoom. Each session lasted 45–70 minutes and followed a semi-structured protocol comprising five thematic blocks: 1) Professional background and current teaching and learning context; 2) Encounters with generative AI, first use, frequency, typical tasks; 3) Perceived benefits, e.g., curriculum design, assessment, student engagement); 4) Perceived risks and challenges, e.g., integrity, bias, workload, policy; 5) Institutional readiness, training, infrastructure, governance, future plans.

2.4. Data analysis

We conducted a reflexive thematic analysis (RTA) (Braun & Clarke, 2023) in NVivo 12, beginning with independent familiarisation as two authors read the Mandarin transcripts while listening to the audio, jotting first impressions. During open coding we inductively assigned labels to meaning units, generating 382 initial codes that were then clustered into provisional themes, e.g., “AI as co-designer,” “assessment anxieties”. These themes were iteratively reviewed and refined against the full data set, with discrepant cases actively sought, before being precisely defined, named, and illustrated with exemplar quotations; six themes were retained. The procedure of data analysis is summarized in Figure 1.

Figure 1. Procedure of data analysis.



3. Results and discussion

Integrating findings with interpretation, this section presents the six themes that emerged from the reflexive thematic analysis, weaving illustrative quotations with analytical commentary and links to the broader literature.

3.1. Generative AI as a pedagogical *co-designer*

Participants framed GenAI as an assistant that amplifies human creativity rather than a replacement for subject expertise. The technology accelerates the ideation phase, freeing academics to focus on higher-order curation, an enactment of the “co-agency” paradigm (Toiviainen et al., 2022). This shift reconceptualises instructional labour, yet participants emphasised the non-negotiable need for disciplinary vetting, echoing Selwyn’s (2019) warning that teacher judgement remains central.

P1: “It used to take me a whole weekend to draft differentiated case studies for three tutorial groups. Now I give ChatGPT my learning outcomes and it spits out first drafts in ten minutes—then I spend the time refining instead of writing from scratch.”

P5: “The model generated new maritime-law questions aligned with each competency level. It’s like having an invisible teaching assistant who never sleeps.”

3.2. Energising student engagement through iterative exploration

GenAI supported a low-stakes, dialogic learning loop that encouraged experimentation and reflection. Students perceived the tool as a non-judgemental interlocutor, aligning with social-constructivist theories emphasising the value of dialogic interaction. Yet two educators cautioned against superficial acceptance of AI outputs, underscoring the need for scaffolded criticality; without such scaffolds, the technology may foster shortcut behaviours rather than deep learning.

P4: “My programming students run draft code through the model, see the error, tweak it, rerun...it’s a dialogue. They say it feels less intimidating than asking me in front of 60 peers.”
P12: “The AI gave me three visualisations of the same shipping schedule. Comparing them helped me notice patterns I had missed.”

3.3. Equity and the digital divide

While GenAI promised levelling effects, hardware disparities and API throttling reproduced pre-existing inequities, echoing findings on technology “amplification (Toyama, 2011).” Participants called for targeted investment in computing resources and subsidised licences to ensure equitable participation, reaffirming argument that digital equity is fundamentally a socio-technical issue (Baskara, 2023).

P2: “Graphic-design students have RTX-GPUs; humanities share an old lab PC. Access shapes ambition.”
P9: “Our campus network sometimes blocks the API after midnight. That’s when part-time students finally log on.”

3.4. Staff capacity and professional development

Professional learning emerged as the linchpin of responsible AI adoption. Tongji’s structured micro-credential programme bolstered staff confidence and innovation, whereas Central South’s ad-hoc approach left educators feeling “two steps behind” students. The data thus extend existing calls (Tillmanns et al., 2025) for systematic, community-based faculty development in prompt engineering, data ethics, and AI-supported assessment design.

P6: “I’m comfortable asking ChatGPT for quiz stems, but I’ve no clue how to craft a good prompt for adaptive feedback.”
P11: “Our micro-credential on ‘Prompt Engineering for Educators’ filled in 48 hours—there’s huge appetite.”

3.5. Governance and ethical frameworks

Stakeholders unanimously demanded clear but agile governance encompassing acceptable use, data privacy, and citation norms. Institutions involving multi-stakeholder committees reported fewer “shadow AI” practices, supporting the notion that governance legitimacy arises from participatory design (Huybrechts et al. 2017). The unresolved question of referencing AI-generated artefacts highlights an urgent agenda for sector-wide standardisation.

P3: “Our draft policy says ‘AI output must be cited like any source’, but we’re still debating how to reference an image Midjourney created.”

4. Conclusion

GenAI is rapidly shifting the university education. To identify concrete pathways for responsible adoption, we conducted 12 in-depth interviews with lecturers, students, and senior administrators at three research-intensive Chinese universities. Reflexive thematic analysis uncovered six inter-locking themes: GenAI as a pedagogical co-designer that accelerates content creation; heightened student engagement through low-stakes, iterative exploration; assessment redesign as a more effective integrity strategy than detection-and-deterrence; persistent digital-equity gaps driven by hardware, bandwidth, and licensing costs; staff capacity as the critical bottleneck, with structured “prompt-engineering” micro-credentials proving particularly effective; and the need for agile, participatory governance to keep pace with fast-moving tools. Taken together, the findings show that GenAI’s transformative promise materialises only when technological affordances are matched by inclusive infrastructure, professional learning, and transparent policy.

References

- Baskara, F. R. (2023). ChatGPT-assisted English language learning: theoretical implications for global mobility and cross-cultural communication. In *International Conference on Language and Language Teaching* (pp. 105-120).
- Braun, V., Clarke, V., Hayfield, N., Davey, L., & Jenkinson, E. (2023). Doing reflexive thematic analysis. In *Supporting research in counselling and psychotherapy: Qualitative, quantitative, and mixed methods research* (pp. 19-38). Cham: Springer International Publishing.
- Chakraborty, S. (2024). Generative AI in Modern Education Society. *arXiv preprint arXiv:2412.08666*.

- Fahlapi, F., Syafitri, K., Ibrahim, S. R. M., & Ilham, F. (2024). Analisis Meta-Sintesis Dampak Artificial Intelligence Terhadap Performa Akademik di Era Digital. *JUTECH: Journal Education and Technology*, 5(2), 525-536.
- Francis, N. J., Jones, S., & Smith, D. P. (2025). Generative AI in higher education: Balancing innovation and integrity. *British Journal of Biomedical Science*, 81, 14048.
- Huybrechts, L., Benesch, H., & Geib, J. (2017). Institutioning: Participatory design, co-design and the public realm. *CoDesign*, 13(3), 148-159.
- Łodzikowski, K., Foltz, P. W., & Behrens, J. T. (2024). Generative AI and its educational implications. In *Trust and Inclusion in AI-Mediated Education: Where Human Learning Meets Learning Machines* (pp. 35-57). Cham: Springer Nature Switzerland.
- Maity, S., & Deroy, A. (2024). Generative ai and its impact on personalized intelligent tutoring systems. *arXiv preprint arXiv:2410.10650*.
- Malterud, K., Siersma, V. D., & Guassora, A. D. (2016). Sample size in qualitative interview studies: guided by information power. *Qualitative health research*, 26(13), 1753-1760.
- Moore, W., & Tsay, L. S. From Data to Decisions: Leveraging AI for Proactive Education Strategies. In *Proceedings of the International Conference on AI Research*. Academic Conferences and publishing limited.
- Morandín-Ahuerma, F. (2024). *UNESCO Proposal for the use of Generative AI in Education: Eight Challenges and Seven Actions*.
- Nartey, E. K. (2024). Guiding principles of generative AI for employability and learning in UK universities. *Cogent Education*, 11(1), 2357898.
- Rashid, S. F., Duong-Trung, N., & Pinkwart, N. (2024). Technical Foundations, Applications, and Challenges. *Artificial Intelligence and Education-Shaping the Future of Learning: Shaping the Future of Learning*, 33.
- Selwyn, N. (2019). *Should robots replace teachers? AI and the future of education*. John Wiley & Sons.
- Singh, P. P. (2024). The Impact of the Development of Artificial Intelligence with Generative Ability on Education. *Journal of Research in Vocational Education*, 6(6), 46-52.
- Tillman, K. (2025). Punitive Inertia: Anti-Blackness and the Policing of Motion. *Social Problems*, spaf007.
- Tillmanns, T., Salomão Filho, A., Rudra, S., Weber, P., Dawitz, J., Wiersma, E., ... & Reynolds, S. (2025). Mapping Tomorrow's Teaching and Learning Spaces: A Systematic Review on GenAI in Higher Education. *Trends in Higher Education*, 4(1), 2.
- Toivainen, S. (2022). Co-agency: reconsidering agency in guidance practice. *British Journal of Guidance & Counselling*, 50(4), 547-556.
- Toyama, K. (2011). Technology as amplifier in international development. In *Proceedings of the 2011 iConference* (pp. 75-82).