

Supplementary File 1

Coding Tree for Themes, Subthemes, CHAT Components, and Contradictions

Manuscript: Faculty and Administrative Perspectives on Artificial Intelligence Tool Integration in Higher Education Using Cultural Historical Activity Theory

Author: Manal N. Dawood

Purpose and analytic pathway. This supplementary coding tree summarizes the analytic structure reported in the revised manuscript. Interview transcripts were read repeatedly, coded line-by-line, and analysed through a combination of inductive coding and CHAT-guided interpretation. Related codes were clustered into broader themes and then mapped to CHAT components and structural contradictions. The reported analytic chain was: raw quotation → initial code → CHAT component → contradiction → interpretive theme. The code labels below are concise descriptors of the evidence and themes reported in the manuscript.

A. Hierarchical Coding Tree

Theme 1. AI aligns with students' digital learning culture

Subtheme / code cluster 1.1: Digital learning orientation

- Students are deeply embedded in digital or 'cyber' environments
- AI fits existing student digital habits and expectations
- Digital familiarity can support engagement and interaction

Subtheme / code cluster 1.2: Accessibility and inclusion

- AI-assisted sign-language translation
- AI-assisted Braille translation
- AI as a support for students with disabilities

Theme 2. AI as a pedagogical support tool

Subtheme / code cluster 2.1: Workplace readiness and digital skills

- AI as a professional 'co-pilot'
- Preparing graduates for AI-enabled workplaces
- Development of relevant digital skills

Subtheme / code cluster 2.2: Teaching support and personalization

- AI can support educator productivity
- AI can mediate teaching and learning activities
- AI can support personalized learning and engagement

Theme 3. Roles and responsibilities in AI integration

Subtheme / code cluster 3.1: Automation and workload redistribution

- Automation of repetitive grading tasks
- Reduction of administrative workload
- More time for direct interaction with students

Subtheme / code cluster 3.2: Preservation of the educator's role

- AI redistributes rather than replaces teaching responsibilities
- Human guidance and motivation remain necessary
- Need for clearer institutional roles, training, and support

Theme 4. Institutional rules, assessment integrity, and AI governance

Subtheme / code cluster 4.1: Assessment integrity and misuse

- Risk of AI-assisted cheating
- AI used as a shortcut rather than for independent learning
- Concern about over-reliance and reduced critical engagement

Subtheme / code cluster 4.2: Policy clarity and acceptable use

- Need for explicit university guidelines
- Uncertainty about acceptable boundaries for AI use
- Institutional rules have not fully caught up with AI adoption

Subtheme / code cluster 4.3: Privacy and ethical safeguards

- Student data privacy concerns
- Need to protect personal information
- Responsible AI use requires ethical and governance frameworks

B. Coding Traceability Matrix

Representative evidence is taken from the quotations and participant summaries reproduced in the revised manuscript. The matrix shows how evidence was condensed into codes, code clusters, final themes, and CHAT interpretation.

Representative data extract / evidence	Initial code	Subtheme / code cluster	Final theme	Participant(s)	CHAT component	Linked contradiction
"The new generation thinks differently. They rely on cyber. They live in the cyber world."	Students live in digital environments	Digital learning orientation	AI aligns with students' digital learning culture	P1	Community	Community–Object
"AI integration was viewed positively, particularly in supporting students with disabilities, like translating sign language or being able to translate Braille."	AI supports accessibility for students with disabilities	Accessibility and inclusion	AI aligns with students' digital learning culture	P3	Community / Tools	Community–Object
"When students graduate, they go to a workplace where this (digital skills) is expected from them... we need to make sure they are ready for a world where AI is increasingly used as a co-pilot in professional environments."	AI prepares students for workplace expectations	Workplace readiness and digital skills	AI as a pedagogical support tool	P2	Tools / Object	Tools–Rules (when use is not clearly governed)
"AI handles the repetitive grading tasks, so I can spend more time working directly with students on their understanding of the material."	AI automates repetitive grading and frees teaching time	Automation and workload redistribution	Roles and responsibilities in AI integration	P2	Division of Labor / Tools	Subject–Division of Labor
"While AI helps with administrative duties, it doesn't replace the human element of teaching; we still have to guide and motivate our students."	Human guidance remains central despite automation	Preservation of the educator's role	Roles and responsibilities in AI integration	P4	Division of Labor / Subject	Subject–Division of Labor
"I worry that students might use AI to cheat on assignments if we don't establish clear boundaries."	AI may facilitate cheating without clear boundaries	Assessment integrity and misuse	Institutional rules, assessment integrity, and AI governance	P1	Rules	Tools–Rules
"We need explicit guidelines from the university about when and how AI can be used; without them, I'm not sure how far we're supposed to go."	Uncertainty caused by lack of explicit AI guidelines	Policy clarity and acceptable use	Institutional rules, assessment integrity, and AI governance	P3	Rules / Subject	Subject–Rules; Tools–Rules
"Data privacy is a big issue if we ask students to use AI tools; we have to make sure their information is protected."	Student information must be protected when AI tools are used	Privacy and ethical safeguards	Institutional rules, assessment integrity, and AI governance	P4	Rules	Tools–Rules
Participant contribution table identifies 'Concern about over-reliance' as shared by P1 and P5.	Concern that excessive AI dependence may weaken independent engagement	Assessment integrity and misuse	Institutional rules, assessment integrity, and AI governance	P1, P5	Community / Object / Rules	Community–Object
Discussion reports uneven access to training and institutional support, contributing to inconsistent AI adoption across courses.	Community readiness and institutional support are uneven	Training, support, and implementation readiness	Cross-cutting implementation condition	Multiple participants	Tools / Community	Tools–Community

C. CHAT Contradiction Map

CHAT contradiction	Data-driven manifestation in the study	Themes / code clusters contributing	Interpretive implication
Subject–Division of Labor	Faculty recognise AI's potential but responsibilities for implementation, training, technical support, and policy are not always clearly defined.	Automation and workload redistribution; preservation of educator role; role clarity and institutional support.	AI adoption requires clearer allocation of responsibilities while preserving human judgment and teaching leadership.
Tools–Rules	AI tools offer teaching and learning opportunities, while institutional guidance, assessment rules, privacy safeguards, and acceptable-use boundaries remain uncertain.	Pedagogical support; assessment integrity and misuse; policy clarity; privacy and ethical safeguards.	Institutional policies and assessment practices need to evolve alongside AI capabilities.
Community–Object	Students' enthusiasm for digital tools and AI may support engagement, but over-reliance may conflict with educational goals such as independent thinking, critical engagement, and meaningful learning.	Digital learning orientation; accessibility and inclusion; concern about over-reliance.	AI use should support engagement while protecting critical thinking and the educational purpose of learning activities.
Tools–Community	The potential of AI tools may exceed the readiness of faculty, students, or institutional support structures when training and resources are	Teaching support and personalization; training, support, and implementation readiness.	Professional development, equitable access, and institutional support are needed for consistent and responsible

CHAT contradiction	Data-driven manifestation in the study	Themes / code clusters contributing	Interpretive implication
	uneven.		implementation.
Subject–Rules (cross-cutting tension)	Faculty uncertainty about how far AI use is permitted creates tension between professional judgment and incomplete or evolving institutional rules.	Policy clarity and acceptable use; assessment integrity; role clarity.	Clear governance can reduce uncertainty and support consistent faculty decision-making.

D. Summary of the Coding Process

- Familiarisation: interview transcripts were read repeatedly.
- Initial coding: line-by-line codes were generated from participant accounts.
- Code refinement: related codes were iteratively refined and clustered into code groups / subthemes.
- Theme development: code clusters were consolidated into broader interpretive themes.
- CHAT mapping: themes and code clusters were mapped to Subject, Object, Tools, Rules, Community, and Division of Labor.
- Contradiction analysis: tensions within and between CHAT components were identified and interpreted as systemic challenges.
- Final review: themes and contradictions were reviewed against the full dataset; coding was completed manually in Microsoft Word/Excel with a coding log and decision trail.