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Designing educational relationships in the age of generative artificial intelligence: A pedagogical framework for social-affective engagement in initial teacher education

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Abstract: Generative artificial intelligence (GenAI) expands the possibilities of instructional design, but its educational value depends on the pedagogical and relational conditions of its use. This conceptual paper proposes a framework for interpreting and supporting social-affective engagement in initial teacher education. The argument connects research on student engagement, self-determination theory, socio-constructivist perspectives, the pedagogy of care, and human-centred approaches to AI. The framework comprises four interdependent dimensions: pedagogical intentionality, educational relationship, shared meaning-making, and pedagogical mediation. Reflection on teaching and workshop experiences provides a context for conceptual development rather than evidence of causal effectiveness. The paper examines how GenAI may support collaborative design, dialogue, feedback, and critical reflection, while discussing risks of dependency, depersonalisation, and reduced autonomy. An illustrative application translates the framework into decisions about inclusive instructional design. The proposal assigns teachers responsibility for defining purposes, organising participation, and evaluating generated outputs. Social-affective engagement is treated as a quality to be supported through educational design; whether the framework helps achieve this requires empirical investigation. Implications for teacher preparation, limitations, and directions for research are discussed.

Keywords: teacher education; artificial intelligence; student engagement; educational technology; social-affective engagement

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1. Introduction

Generative artificial intelligence (GenAI) has brought text, image, and instructional resource generation into everyday educational practice. Its diffusion has intensified debate about personalisation, assessment, academic integrity, teacher workload, and knowledge production. Much of this discussion concerns system capabilities: generating resources, providing feedback, adapting explanations, and supporting brainstorming. These functions raise a pedagogical question that cannot be answered by examining technical performance alone: under what educational conditions can GenAI contribute to meaningful learning?

Technological availability does not itself generate participation, belonging, motivation, or shared understanding. These qualities depend on the organisation of learning environments and the relationships within them. UNESCO's human-centred guidance recommends protecting human agency and assessing pedagogical

appropriateness when adopting GenAI (Miao & Holmes, 2023). The educational task is therefore to determine how its use can serve the purposes of a particular activity and community.

This paper examines that task through social-affective engagement in initial teacher education. It connects the behavioural, cognitive, and emotional dimensions of engagement (Fredricks et al., 2004) with its relational and contextual character (Lawson & Lawson, 2013) and learners' opportunities to exercise autonomy (Deci & Ryan, 2000). Reviews of GenAI report promising effects on engagement alongside risks of over-reliance and disengagement (Heung & Chiu, 2025). Work on social-emotional learning in teacher education also stresses human oversight, ethical awareness, and relational processes (Henriksen et al., 2025).

The aim is to identify pedagogical criteria for designing GenAI activities that support participation and preserve human responsibility. Four interdependent dimensions are proposed: pedagogical intentionality, educational relationship, shared meaning-making, and pedagogical mediation. Building on discussions of GenAI and social-emotional learning, the contribution focuses on design decisions in initial teacher education. Teaching and workshop experiences contextualise those decisions, but the proposal remains theoretical and does not demonstrate effectiveness.

1.1. Approach and nature of the contribution

This paper adopts a theoretical and argumentative approach. The cited sources are brought into dialogue to develop criteria for designing and interpreting educational uses of GenAI; the paper does not present a systematic or exhaustive literature review. The four dimensions constitute the conceptual synthesis proposed here, not categories derived from coding empirical data. Teaching and workshop experiences serve a contextual and illustrative purpose and are not evaluated as interventions. This distinction limits the conclusions to the conceptual argument and separates them from the findings of the empirical studies cited.

2. From engagement to social-affective engagement

Fredricks et al. (2004) distinguish behavioural, emotional, and cognitive engagement. Behavioural engagement concerns participation, effort, and persistence; emotional engagement includes interest, enjoyment, belonging, and affective responses; cognitive engagement involves strategic investment, self-regulation, and willingness to work with complexity. Lawson and Lawson (2013) extend attention to the interactions among learners, teachers, tasks, institutions, and the wider social environment. Together, these perspectives make engagement a contextual process rather than an individual attribute or a count of actions.

In digital environments, frequent interaction and continuous content production do not alone establish reflection, belonging, or autonomy. Social-affective engagement is used here to describe the interdependence of emotional investment, relational recognition, participation, and shared meaning-making. It is an interpretive lens for design, not a new measurement scale. It is also distinct from social-emotional learning, which concerns the development of personal and social competencies and is examined in relation to GenAI by Henriksen et al. (2025). The present focus is the quality of participation within an educational activity.

Self-determination theory provides a complementary foundation. Deci and Ryan (2000) identify autonomy, competence, and relatedness as basic psychological needs associated with self-determined motivation. Design can support autonomy through meaningful choices, competence through appropriately challenging tasks and informative feedback, and relatedness through recognition and connection within a learning community. GenAI may assist these processes, but it may also constrain them when it replaces learners' decisions, removes opportunities for productive effort, or displaces interpersonal exchange.

Experience, social participation, and cultural mediation further ground this interpretation. Dewey (1938) places learning in experience and reflective inquiry; Vygotsky (1978) emphasises cultural tools and the social mediation of higher psychological functions. Bruner (1996) examines education as cultural meaning-making, while Wenger (1998) connects learning and identity to participation in communities of practice. These traditions differ in their theoretical commitments, but together they support attention to how tools organise inquiry, dialogue, and participation, beyond the information they deliver.

Emotion also participates in cognition and learning (Damasio, 1994; Immordino-Yang, 2015). Noddings (2012) adds attention to care and responsibility within the educational relationship. These perspectives matter when GenAI interfaces produce fluent, socially persuasive responses. Conversational responsiveness may support an interaction, but it does not establish pedagogical care. Care involves responsibility for the learner and for the consequences of educational decisions, which remains with human participants.

3. Generative AI as a pedagogical question

Systematic reviews describe GenAI applications in content creation, tutoring, feedback, assessment support, and instructional planning. In higher education, Qian (2025) identifies emerging pedagogical uses together with concerns about outsourcing cognitive and metacognitive work. At K–12 level, Marzano (2026) discusses opportunities and challenges relating to pedagogy, teacher preparation, ethics, and implementation. These reviews provide context for the proposal; they do not establish its validity or guarantee that uses effective in one setting will transfer to another.

Heung and Chiu's (2025) systematic review and meta-analysis reports positive effects of ChatGPT-supported learning on behavioural, cognitive, and emotional engagement in the included studies. It also identifies potential disengagement associated with over-reliance. Such findings justify examining conditions of use rather than attributing engagement to the tool itself. Tasks, learning strategies, social arrangements, teacher mediation, and educational purposes must be considered when interpreting outcomes.

In initial teacher education, technological competence must be connected to professional judgement about those conditions. An activity can be technically accomplished yet pedagogically weak if it bypasses collaborative inquiry, reproduces bias, or reduces learners' decision-making. Conversely, a simple use of generated content may support substantive comparison, critique, and reflection. Prospective teachers need opportunities to explain why a particular use is appropriate and what responsibilities it entails.

Miao and Holmes (2023) place agency, inclusion, equity, and cultural and linguistic diversity at the centre of educational adoption. These principles situate GenAI within social and institutional practices whose rules are determined by people. Its outputs require contextual interpretation and validation. Designing for engagement therefore includes decisions about the distribution of responsibility, the place of interpersonal dialogue, and the limits of automated assistance.

4. A relational pedagogical framework for GenAI

The framework comprises four interdependent dimensions. They are analytical perspectives on design, not sequential stages or a validated checklist. Each addresses a different question: what the activity is for; how participants are recognised and supported; how they construct meaning together; and how tools, tasks, and interactions are organised. Their boundaries overlap, but their distinct emphases help make design decisions discussable.

4.1. Pedagogical intentionality

Technological choices acquire educational meaning through the purposes that orient them. The starting point is an educational problem, objective, or experience. Biesta's (2020) discussion invites scrutiny of the purposes and assumptions of educational research and practice, rather than treating measurable outcomes as the sole criterion of value. For GenAI, this means assessing a generated lesson plan against the knowledge, participation, and responsibilities it is intended to promote. Formal completeness is insufficient to establish its educational appropriateness.

4.2. Educational relationship

Learning involves recognition, trust, reciprocity, and responsibility. GenAI may support these processes indirectly by helping teachers prepare differentiated materials or possible feedback. It cannot assume the ethical responsibility of the teacher–learner relationship. Fluent responses should therefore not be treated as evidence of educational care. The design must preserve opportunities for learners to receive attention, express uncertainty, and engage with human participants who can respond responsibly.

4.3. Shared meaning-making

Generated information becomes educationally useful through interpretation, comparison, justification, negotiation, and revision. Bruner (1996) and Wenger (1998) connect meaning and knowledge to cultural and social participation. Applied to GenAI, this dimension treats outputs as objects of shared inquiry. Participants must assess claims, explain disagreements, and connect proposed representations to disciplinary knowledge and learners' needs.

4.4. Pedagogical mediation

Vygotsky's (1978) account of mediation supports interpreting GenAI as a cultural tool that reorganises activity rather than simply transmitting information. The design question is how its introduction affects attention, effort, dialogue, representation, and decision-making. Teacher mediation concerns the organisation of these processes: the same function can support different learning activities depending on timing, task structure, and the role assigned to generated output.

Mediation includes deciding when learners should work independently, when an output should be introduced after peer discussion, and when authoritative

sources are required for verification. It also includes choosing not to use GenAI when it would bypass the intended learning. This dimension addresses the organisation of tools, tasks, interaction, and reflection, whereas intentionality specifies the purposes that organisation should serve.

The dimensions operate together. Intentionality specifies educational purposes; relationship concerns recognition and responsibility; shared meaning-making concerns collective interpretation; mediation organises activity. For example, generating an accessible explanation may serve an inclusive aim but still weaken participation if learners cannot question or revise it. Examining all four dimensions helps identify such tensions without assuming that technical accessibility alone establishes engagement.

5. Formative contexts and the status of the experiences

The proposal is informed by reflection on teaching and workshop experiences in different initial teacher education contexts. These experiences explored GenAI as a resource for inclusive instructional design and raised questions about participation, collaboration, reflection, and human mediation. Prospective teachers encountered the technology through concrete design problems rather than only through demonstrations of its functions.

Activities involved collaborative planning, peer discussion, and metacognitive reflection. GenAI supported the generation of alternatives, reformulation of ideas, and revision of materials. Participants were asked to consider learners' needs, accessibility, instructional purposes, and the consequences of their choices. The educational focus was the reasoning behind those choices, including how generated suggestions were accepted, modified, or rejected.

These experiences have a heuristic role in the argument. The paper does not document them through a research design, sample description, data collection instruments, or systematic analysis. They cannot therefore be treated as empirical findings or support causal inference. They contextualise professional reflection on tensions between efficiency and deliberation, assistance and dependency, and personalisation and isolation. A future empirical study would require explicit procedures and evidence to examine these tensions.

6. Implications for initial teacher education

The framework suggests connecting AI literacy with pedagogical reasoning, inclusive design, ethical evaluation, and relational competence. Tool training remains necessary, but formative tasks should also make participants explain the purposes, assumptions, and consequences of technological choices. The following implications are proposals for teacher education, not outcomes demonstrated by the present paper.

First, participants should define the learning problem, learner characteristics, intended participation, and criteria for success before choosing AI functions. This establishes a basis for deciding whether GenAI is appropriate and for reviewing its contribution after the activity.

Second, participants should compare relational consequences across AI-supported and non-AI alternatives. They can examine who speaks, who decides, how feedback circulates, and whether all group members can contribute. These questions connect social-affective engagement to concrete design choices.

Third, generated content should become material for critical inquiry. Verification, source evaluation, bias detection, and adaptation to context are professional responsibilities. Teacher preparation should require participants to justify revisions and explain why a plausible output may still be inaccurate or unsuitable.

Fourth, educators should model uses that preserve agency. GenAI may provide options, questions, or feedback while participants retain responsibility for interpretation and decisions. This follows Miao and Holmes's (2023) emphasis on human agency and addresses the risks of over-reliance discussed in the reviews.

Professional reflection should also address enthusiasm, anxiety, uncertainty, and pressure to innovate. Discussing these responses can help prospective teachers consider how their own attitudes shape decisions about technology. Such reflection should be connected to educational responsibilities and supported by opportunities to examine actual design choices.

6.1. An illustrative application to inclusive instructional design

An illustrative workshop can ask prospective teachers to adapt a text for a heterogeneous class. Before using GenAI, the group defines the comprehension objective and the language barriers to address, using a fictional case without personal data. This makes intentionality explicit. The educator then organises discussion so that each participant can justify choices and receive responses from peers. The relationship dimension is expressed through opportunities for participation and recognition.

GenAI may generate two adaptations. Participants compare them with the original, check inaccuracies and simplifications, and agree on a revised version. Shared meaning-making lies in this negotiation. Mediation concerns when the tool is introduced, which checks are required, and which decisions remain with participants. The final product can include the adapted text and a short explanation of the decisions, limitations, and contribution of AI.

The educator may consider participation in decisions, justification of revisions, source verification, and participants' perceptions of being heard. These are possible observation criteria, not validated research indicators. The example illustrates how the framework can inform design; it does not report an intervention evaluated in this paper.

7. Discussion

The framework links purposes, relationships, collective interpretation, and mediation in a proposal for initial teacher education. Its contribution is their joint articulation as design perspectives. The dimensions draw on established traditions; they are not claimed as newly discovered mechanisms or as empirically validated predictors of engagement. The proposal is intended to help teachers explain and review the conditions under which they use GenAI.

Heung and Chiu (2025) and Qian (2025) describe opportunities for engagement and learning alongside dependency risks. Their findings do not validate the present framework and cannot be transferred automatically to initial teacher education. They do, however, support investigating task design, learning strategies, disciplinary context, group configuration, and the role of technology. The framework makes these conditions explicit without predicting an outcome for every combination.

Social-affective engagement directs attention to participation quality. Producing more text does not itself demonstrate cognitive investment, and continuous chatbot interaction does not establish belonging. Personalisation can also coexist with dependence if learners relinquish decisions to a system. These distinctions explain why observation of activity should be complemented by attention to learners' interpretations, opportunities for choice, and experiences of recognition.

Implementation also depends on organisational conditions that the four dimensions do not exhaust: access to tools, accessibility, time for revision, and institutional rules governing data. Teachers need to select appropriate tools and protect personal information. Case-based workshops should avoid entering identifying pupil data and require participants to assess the appropriateness of generated materials (Miao & Holmes, 2023). These conditions can constrain an otherwise defensible pedagogical design.

7.1. Limitations and directions for future research

The framework is a theoretical design and interpretive proposal. It has not been validated as a measurement model, and the formative experiences discussed provide no experimental evidence of effectiveness. The sources are used in a focused conceptual argument rather than a systematic review. The framework's practical usefulness, the boundaries between its dimensions, and its applicability across contexts remain open questions.

Future studies could operationalise the dimensions and investigate their relationships with behavioural, cognitive, emotional, and relational indicators of engagement and with learners' opportunities for agency. Qualitative research could examine collaborative design decisions, disagreement about outputs, and the negotiation of responsibility. Longitudinal studies could investigate whether preparation based on the framework informs later classroom practice. Such research should specify sampling, instruments, analytical procedures, and relevant ethical safeguards.

Research should also examine inclusion. Access, language, disability, cultural representation, and system biases may condition the opportunities offered by GenAI. A design that supports some learners can create barriers for others. Empirical work should therefore consider variation among participants and avoid treating accessibility or engagement as uniform consequences of technological adoption.

8. Conclusions

The educational value of GenAI depends on its purposes and relational conditions of use. Social-affective engagement offers a lens for examining emotional investment, recognition, participation, and shared meaning-making beyond interaction counts or generated content.

The proposed framework connects pedagogical intentionality, educational relationship, shared meaning-making, and pedagogical mediation. It can guide the design and review of initial teacher education activities while preserving explicit human responsibility. The paper provides a conceptual proposal, not evidence that applying it increases engagement.

Teacher preparation should provide opportunities to justify GenAI use and assess its consequences for participation. Further research must investigate the

framework's usefulness and develop context-sensitive indicators of social-affective engagement.

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