From Macro to Culturally Responsive and Sustaining Contextualized Micro-Prompts: Guiding Teacher Candidates Through an AI Prompting Continuum

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Abstract: This study explores how generative artificial intelligence (Gen AI), and strategic prompt engineering enhances culturally responsive pedagogy and informs the design of lesson plans, for pre-service teachers. It introduces an AI prompting continuum ranging from macro-prompts to culturally responsive pedagogy (CRP) and culturally sustaining pedagogy (CSP) contextualized micro-prompts, supporting agency in teacher candidates to personalize instruction, develop culturally responsive and sustaining teaching practices, and design inclusive learning experiences for students. A mixed-methods approach is used involving 52 pre-service teachers, highlighting significant gains in AI prompting competency, with post-intervention assessments showing improved instructional design quality and pedagogical adaptability. Findings indicate that AI, when guided through intentional, scaffolded prompts, amplifies student voices and mitigates biases while enabling pre-service teachers to develop culturally responsive, context-aware learning pedagogies and practices. These insights demonstrate the necessity of AI literacy training in teacher education programs to ensure ethical, equity-focused, and best-practice integration.

Keywords: Generative AI, Culturally Responsive Teaching, Culturally Responsive Pedagogy, Equity, Diversity, Inclusion, AI Prompting (Continuum), Prompt Engineering, Educational Equity, Pre-Service Teachers, Teacher Education Programs, Lesson Planning.

Introduction

Imagine a classroom where every student feels seen, heard, and valued. A classroom where learning experiences are not just engaging but deeply resonate with each students' unique learning styles, academic needs and identity. This is the commitment of using generative Artificial Intelligence (GenAI) as a tool to strengthen the development of culturally responsive pedagogy (CRP) and culturally sustaining pedagogy (CSP) and the design of teaching materials that are representative and fulfil the needs of all students. Artificial Intelligence (AI) is driving a paradigm shift in education in a profound way, making culturally responsive and sustaining pedagogy more critical than ever. By reimagining instructional approaches, AI can enable educators to connect with diverse learners in ways like never before. AI can serve as a transformative guide in a student's learning journey, supporting the design of lessons and assessments that honour student's strengths, needs, interests, and preferred ways of learning. To harness its full potential, we must examine how these advancements not only enhance learning outcomes but also democratize access to knowledge by fostering culturally responsive teaching (CRT) (Gay, 2018). As GenAI continues to shape and support the way we teach and learn, it also has the power to make teaching more inclusive by supporting culturally responsive teaching practices. A moral imperative of the modern educational landscape, requires advancing equity through CRP (Ladson-Billings, 1994) and culturally sustaining pedagogy (Paris & Alim, 2017), ensuring all students can access, engage, and succeed in learning environments reflective of their backgrounds, identities, and experiences. Embedding this imperative in teacher education programs where pre-service teachers learn the fundamentals of AI education and AI literacy through scaffolded prompt engineering instruction, is key.

Even prior to the wide-spread integration of GenAI in society and more specifically, AI tools in education, pre-service teachers have historically struggled to design differentiated and engaging learning experiences, with even greater difficulty internalizing and implementing the foundational principles of CRP and CSP (Evans et al., 2020). These challenges often stem from gaps in technological, pedagogical, and content knowledge (TPACK),

which hinder their ability to effectively integrate CRP and CSP into practice (Tyarakanita, 2020). Despite GenAI's potential, many pre-service teachers remain uncertain about how to apply these technologies effectively within educational contexts. AI resources, if used without strategic knowledge or appropriate implementation, can inadvertently perpetuate biases and ineffective instruction (Crompton et al., 2024; Mosher et al., 2024).

This paper focuses on the integration of a GenAI prompting continuum approach, from broad macro-prompts to CRP and CSP contextualized micro-prompts, designed to enable pre-service educators to create curriculum-aligned content, lessons, and assessments that resonate with their students' cultural identities and learning needs. Ultimately, I argue that GenAI can fundamentally reshape the ways in which teacher candidates learn the foundations of planning, assessing, and designing, and enact pedagogical practices in their placement classrooms and beyond from an inclusive lens that uses key critical and creative thinking skills and content knowledge. My aim is to disrupt conventional approaches to instructional design and implementation to support more inclusive, equitable learning spaces that bridge diverse cultural and linguistic backgrounds (Gay, 2018). This research contributes to the evolving discourse of AI in education, advocating for structured frameworks that redefine teaching and learning.

Literature Review

By utilizing the affordances of AI and strategic prompting, educators can create personalized, inclusive, and equitable learning experiences that support every learner. This approach draws on current research and practical applications, to demonstrate how AI can revolutionize the way we teach and learn (Yadav, 2025). I believe this approach can thoughtfully disrupt and expand current pedagogical practices by integrating GenAI with culturally responsive and sustaining teaching, creating brave spaces where learners feel included, respected, and represented.

The Need for Culturally Responsive Teaching

In today's increasingly diverse classrooms, culturally responsive teaching (CRT) and culturally sustaining teaching (CST) is not just an option, it's an imperative. Culturally responsive teaching is "a pedagogy that empowers students intellectually, socially, emotionally, and politically by using cultural referents to impart knowledge, skills, and attitudes." (Ladson-Billings, 2009, p.20). This approach recognizes the importance of acknowledging and valuing students' cultural backgrounds as assets in the learning process. By connecting with students' unique identities and experiences, educators can create a more engaging and relevant learning environment that promotes academic success and personal growth. Culturally sustaining teaching builds on and extends the foundations of CRT by maintaining, fostering and revitalizing a student's culture and language in the classroom, rather than just responding to it as CRT does (Paris and Alim, 2017). A study conducted by Parkhouse et al., (2023) explores the development of culturally responsive teaching skills among pre-service teachers through a comprehensive two-year professional development program, illustrating how the four development zones: consciousness-rising, relationship-building, knowledge-building, and practice-refining resulted in the growth in teacher candidates CRT and highlight the multifaceted nature of teacher development as educators. These findings indicate that intentional, scaffolded instruction in CRT enhances teacher candidates' ability to create more inclusive learning environments. However, while many pre-service programs emphasize CRT theoretically, the practical application of these principles remains a challenge (Crompton et al., 2024). Another study by Nash et al. (2021) explored the potential of 'field-based' teacher education courses to disrupt dominant cultural norms and promote CSP among pre-service teachers. The study found that immersive, community-based experiences allowed pre-service teachers to develop more inclusive teaching practices that honour and sustain student's cultural identities. Collectively, these studies highlight the ongoing struggle many pre-service teachers face in putting culturally responsive and culturally sustaining pedagogies into practice. This is an area where GenAI, when used strategically and thoughtfully, can offer valuable support in teacher education.

Generative AI and the Macro-to-CRP/CSP Contextualized Micro-Prompting Continuum:

As faculties of education continue to navigate the complexities of translating culturally responsive and sustaining pedagogies into classroom practice, GenAI offers a promising, yet nuanced, opportunity of support, especially when used to extend critical thinking and scaffold instruction design through culturally relevant, representative, and restoratively-focused intentional prompting strategies. It is clear that GenAI has the potential to

support lesson planning, assessment design, and differentiated instruction (Baytak, 2024), particularly when guided through a CRT and CST lens; however, its effectiveness hinges on the quality of input provided by educators (Karina & Kastuhandani, 2024). Research indicates that AI-generated content is only as useful as the prompts that guide it, making prompt engineering an essential skill for teacher candidates (Sharma & Bozkurt, 2024).

The design of an AI prompting continuum framework would provide a structured approach to GenAI use in instructional design, where it could guide educators from broad instructional goals (macro-prompts) to highly specific, context-driven micro-prompts that align with students' diverse identities and learning needs (Ye et al., 2024). Studies on AI-assisted learning personalization show that when AI is guided through iterative, precise, and context-aware prompts, the quality and relevance of generated educational materials significantly improve (Brown et al., 2020). Ultimately, by thoughtfully engaging with GenAI, pre-service teachers can ensure that technology serves as a tool for equity and one that amplifies student voices rather than reinforcing systemic biases (Guan et al., 2025).

These prompting strategies align closely with the TPACK framework (Technology, Pedagogy, and Content Knowledge), reinforcing the need for structured AI training in pre-service programs (Crompton et al., 2024). Research reinforces the importance of contextualizing GenAI within the TPACK framework to help educators navigate the protean, opaque, and generative nature of these tools (Mishra et al., 2023 p. 6-7). The authors argue that GenAI tools differ fundamentally from prior digital technologies due to their social and generative characteristics, which transform the relationship between technology, pedagogical, and content knowledge. They suggest that effective GenAI integration requires a reimagining of Technological Pedagogical Knowledge (TPK) urging educators to think “slow” (p. 8) to discern appropriate uses, anticipate bias, and cultivate metacognitive practices through AI interactions. Through this research is a call for a continued understanding of contextual knowledge (p.2), encouraging teacher candidates to consider broader systemic, ethical, and cultural factors that influence how GenAI can be meaningfully adopted to support equity-centred pedagogies.

Ethical Considerations and Bias Mitigation in AI-Assisted Teaching

Although GenAI presents numerous benefits, its application in education raises ethical concerns regarding bias, misinformation, and cultural insensitivity (Bender et al., 2021). If AI-generated materials lack appropriate human cognition, they may reinforce systemic biases or produce superficial representations of diverse cultural perspectives (Zawacki-Richter et al., 2019). In order for GenAI to support equitable education, pre-service teachers must be trained not only in prompt engineering but also in AI ethics, data verification, and bias mitigation strategies (Barns & Hutson, 2024) and in CRP and CSP. Programs that incorporate AI bias training, critical evaluation exercises, and culturally responsive pedagogy are more likely to produce educators who can use GenAI responsibly and equitably (Hinojo-Lucena et al., 2019).

Bridging AI and Culturally Responsive Teaching

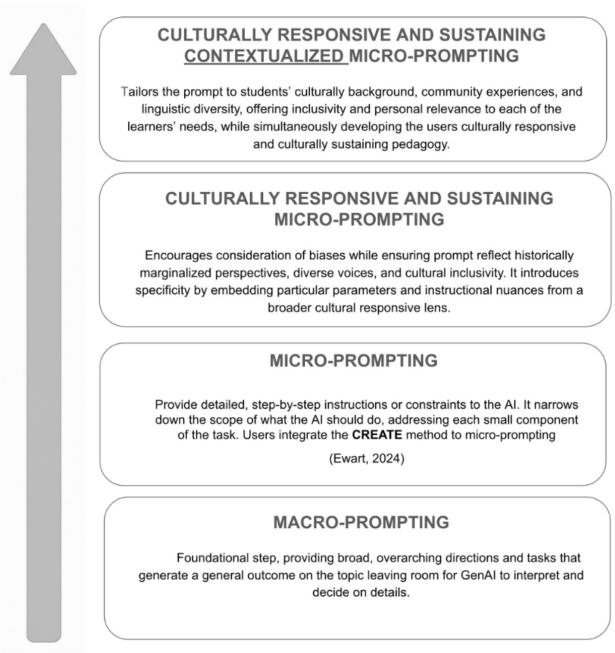
The application of GenAI prompting techniques in teacher education offers unique and dynamic possibilities for enhancing lesson planning and assessment tool design while supporting culturally responsive and sustaining pedagogy. However, its success depends on how well pre-service teachers are guided to engage with GenAI critically and strategically. By implementing structured GenAI prompting frameworks, pre-service teacher programs can facilitate learning resulting in the creation of differentiated, inclusive, and equitable experiences that reflect the diverse realities of modern educational environments. While research on GenAi’s role in culturally responsive and sustaining teaching are emerging, existing research emphasizes the importance of inclusive AI learning design where AI learning experiences need to be inclusive and tailored to diverse learners (Song et al., 2024), aligning with principles of culturally responsive pedagogy and the need to explore how a structured AI prompting continuum ranging from macro-prompts to culturally responsive and sustaining micro-prompts, enhance pre-service teachers’ capacity to design inclusive, culturally sustaining, and engaging lessons and assessments that meet the needs of all of their students through the integration of generative AI.

Methodology

This study utilized a mixed-methods approach to examine how pre-service educators develop AI literacy through a structured AI prompting continuum. The continuum includes four progressive levels of AI engagement: macro-prompting, micro-prompting, culturally responsive and sustaining micro-prompting, and culturally responsive and sustaining contextualized micro-prompting (Figure 1).

Figure 1

AI Prompting Continuum



This four-tiered continuum enables pre-service teachers to refine their instructional focus by ensuring that GenAI produces content that aligns with pedagogical goals and student-centered learning. It progresses from broad macro-prompting to specific micro-prompting, then to culturally responsive and sustaining micro-prompting and culminates in culturally responsive and sustaining contextualized micro-prompting customized to diverse classroom needs.

Participants & Data Collection

This preliminary study involved 52 pre-service teachers from a large university in Canada. All students in a single BEd cohort received culturally responsive teaching and AI prompting continuum training as part of their regular Language and Literacy programming. This resulted in the implementation and use of a culturally responsive and sustaining customized GenAI ChatGPT to help create lessons and classroom resources. Additionally, 28 participants who implemented GenAI-supported lessons during their practicum experience, submitted structured reports detailing their implementation processes and perceived outcomes.

Analysis

Quantitative data were analyzed using paired t-tests for pre- and post-intervention comparisons and repeated measures ANOVA to track progression across multiple time points within the continuum. The TPACK-based Technology Integration Assessment Rubric, developed and validated by Harris, et al. (2010). was used to evaluate the quality of AI-generated lesson plans, assessing the integration of technology, pedagogy, and content

knowledge. Qualitative data underwent thematic analysis (Braun & Clarke, 2006) using NVivo, with integrated findings presented through joint displays (Fetters et al., 2013) integrating quantitative and qualitative findings.

AI Prompting Competency Development

Analysis of pre- and post-intervention assessments demonstrated significant gains in AI prompting competency, with scores increasing from 2.84 (SD=0.67) to 4.35 (SD=0.52), $t(46)=12.76$, $p<.001$, $d=2.47$. Repeated measures ANOVA indicated that competency improved significantly across the continuum, $F(2,92)=28.43$, $p<.001$, $\eta^2=0.38$, with the most substantial gains occurring between micro-prompting and contextualized micro-prompting phases.

Instructional Design Quality

Evaluation of AI-supported instructional artifacts revealed improvements in instructional design quality. The mean TPACK rubric score increased from 3.05 (SD=0.64) in the macro-prompting phase to 4.28 (SD=0.53) in the contextualized micro-prompting phase, $F(2,92)=31.72$, $p<.001$, $\eta^2=0.41$. Notably, growth in technological content knowledge and technological pedagogical knowledge was strongly correlated with AI prompting competency ($r=0.73$, $p<.001$).

Qualitative Insights

Thematic analysis identified four key developmental shifts with the first being the evolving conceptualizations of AI's role**.** Initially AI was seen as a content-generation tool as demonstrated in the students' responses from the pre-survey, but AI was later recognized as a collaborative partner in instructional planning. The second shift was the development of critical discernment. Participants moved from uncritical acceptance of AI outputs to nuanced evaluation, applying professional judgment to align AI-generated materials with student needs. Third, there was a shift in pedagogical decision-making. Participants utilized AI not just to generate content but to explore multiple instructional approaches and refine pedagogical choices. Lastly, was the emergence of contextualized AI literacy. Students using the highest level of the continuum, CRT contextualized micro-prompting, not only showed significant gains in their own conceptual understanding and application of CRP and CSP, but also developed AI literacy that was context-sensitive, student-responsive, and aligned with CRT.

Discussion and Implications

Preliminary findings reinforce that AI literacy development follows a structured trajectory, with CRT contextualized micro-prompting emerging as a redefined and specialized competency integrating technical skill, pedagogical reasoning, and cultural responsiveness.

Implications for Teacher Education

This study highlights the need for explicit AI literacy instruction and training using the AI prompting continuum in teacher education, positioning AI not as a substitute for educator expertise but as a tool for enhancing pedagogical decision-making through a culturally responsive and sustaining lens. This reconceptualization aligns with Crompton and Burke's (2023) expansion of TPACK for AI-integrated educational environments while providing empirical support for the practical development of such knowledge through structured interventions. The continuum approach appears to effectively scaffold the development of this integrated knowledge domain by progressively increasing the complexity and contextual specificity of GenAI utilization. As well, by thoughtfully crafting AI prompts through a culturally responsive and sustaining contextualized lens, educators can design lesson

plans, assessments, and learning experiences that reflect the diverse perspectives and experiences of their students. This can be valuable in subjects like history and social studies, where certain narratives often marginalize or exclude certain groups.

The integration of GenAI and strategic prompting using the AI continuum has the potential to transform teacher practice in several ways by enhancing planning and design. GenAI can assist in creating culturally responsive and sustaining lesson plans, assessments, and learning activities that align with curriculum expectations and address the diverse needs of students (Cheah et al., 2025).

Limitations and Future Research

Several limitations of this study warrant acknowledgment. The relatively small sample size and single-institution in a preliminary context limit generalizability, necessitating replication across diverse teacher education contexts. Additionally, the 12-week intervention timeframe may not capture long-term development or transfer to autonomous teaching practice, highlighting the need for longitudinal research examining how AI literacy evolves throughout pre-service teachers' transition to in-service teaching.

Longitudinal studies examining how AI literacy developed through the continuum transfers to independent teaching practice should be a consideration of future research as it would provide valuable insights into long-term efficacy. Second, comparative studies of different developmental frameworks for AI literacy could clarify best-practice approaches for specific contexts or populations. Finally, investigating how the AI Prompting Continuum might be adapted for in-service teacher professional development would extend the framework's applicability.

Overall, AI literacy development appears most effective when structured as a developmental progression rather than a discrete skill set and contextualized micro-prompting represents an enhanced proficiency that integrates technical skills with pedagogical knowledge and contextual understanding (TPACK), suggesting that AI literacy frameworks should emphasize contextual application. As well, effective AI literacy development must incorporate critical evaluation alongside technical skill development to foster what might be termed "AI pedagogical reasoning." As GenAI continues to transform educational landscapes, structured frameworks for developing teacher candidates' AI literacy and CRT and CST practices, represent a critical priority for teacher education programs. The AI Prompting Continuum offers an empirically supported approach to this challenge, providing a pathway for preparing future educators to apply AI tools thoughtfully, ethically, and contextually to enhance teaching and learning.

Conclusion

By guiding educators through a structured AI prompting continuum, pre-service teachers not only refine their technical AI skills and develop increased AI literacies but learn to be culturally responsive and culturally sustaining in their practice by undergoing important transformations in their pedagogical decision-making and understanding of AI’s role in education. The findings in this study highlight the growing need to embed AI literacy into teacher education programs in order for future educators to be ready to use AI intentionally and ethically with their students’ needs at the forefront of consideration. Beyond technical proficiency, this research demonstrates that AI prompting encourages critical engagement, pedagogical adaptability, and the ability to design CRP and CSP-infused lessons and assessments. To maximize the impact of AI in education, teacher preparation programs should integrate structured AI literacy training that emphasizes contextualized and reflective AI use. Future research should explore longitudinal impacts, scalability, and applications in in-service teacher professional development, ensuring that AI-driven pedagogical strategies remain dynamic, ethical, and responsive to diverse classroom contexts. By integrating GenAI with intentionality, educators can create responsive and represented learning spaces that honour and include all students. There is immense potential for the AI Prompting Continuum to act as a powerful tool for advancing culturally responsive and sustaining pedagogy.

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