Embedding Critical Pedagogy and Representation in Information Technology Education: A Reflective Practice-Based Study

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Abstract: This paper presents a reflective, practice-based study examining the integration of Critical Pedagogy and representation into Information Technology (IT) education at a South African university. Drawing on Critical Pedagogy, culturally responsive computing, participatory learning, and transformative learning, the study reflects on practices implemented across undergraduate and postgraduate IT modules. Retrospectively analysed teaching materials, assessment artefacts, reflective records, and anonymised student feedback were used to explore how these approaches may contribute to student engagement, agency, representation, and critical awareness. Findings suggest that context-sensitive examples, participatory assessment, dialogical teaching, and problem-based learning can help students connect technical concepts with lived experiences and broader social, ethical, and societal issues. These approaches may also support belonging, engagement, and ownership of learning, although causal effects cannot be established from the retrospective qualitative evidence. Challenges, including large class sizes, resource constraints, uneven participation, and tensions surrounding sensitive social topics, highlight the need for pragmatic adaptation. The study contributes a context-sensitive pedagogical framework integrating cultural relevance, student agency, participatory learning, and reflective practice, with implications for IT curriculum design, assessment, teaching, and institutional support.

Keywords: Critical Pedagogy, Computing Education, Scholarship of Teaching and Learning.

1. Introduction

Despite global efforts to broaden participation in computing, students from historically marginalised communities continue to face structural, cultural, and epistemic barriers to full participation in Information Technology (IT) education (Morales-Navarro & Kafai, 2023; Leonard & Sentance, 2021). Traditional approaches to computing education have often prioritised technical competence over critical engagement, framing learning as the transmission of neutral knowledge rather than a socially situated and power-laden process (Tedre et al., 2006). Such approaches risk reproducing exclusionary norms and limiting students' ability to interrogate the ethical, social, and political implications of technology.

Critical Pedagogy offers a transformative framework for reimagining IT education as a site of empowerment rather than reproduction (Kincheloe, 2008; Smith, 2021). Rooted in the work of Freire and extended by scholars such as McLaren and Kincheloe, Critical Pedagogy positions education as a dialogical, participatory, and emancipatory practice that challenges oppressive structures and cultivates critical consciousness (Freire, 2018; McLaren, 2023). Within computing education, this approach aligns with calls for culturally responsive pedagogy, socially responsible computing, and ethical technology design (Morales-Navarro & Kafai, 2023; Benjamin, 2019).

This paper presents a reflective, practice-based study of the integration of Critical Pedagogy and representation into undergraduate and postgraduate IT modules at a South African university. It addresses the following research questions:

1. How can Critical Pedagogy be operationalised within IT curricula to promote student empowerment, engagement, and ethical awareness?
2. What role do representation and cultural relevance play in student motivation and learning in computing education?
3. What challenges and tensions arise in implementing critical, participatory approaches within large, diverse, and resource-constrained educational contexts?

By addressing these questions, the paper contributes to the growing body of scholarship on socially just computing education. It offers a contextually grounded pedagogical model for educators seeking to balance technical rigor with critical, inclusive teaching practices.

2. Literature Review

2.1 Critical Pedagogy in Higher Education

Critical Pedagogy conceptualises education as a political and ethical practice aimed at challenging inequality and fostering student agency (Freire, 2018; Kincheloe, 2008). Freire's critique of the "banking model" of education advocates for dialogical, problem-posing approaches that position learners as co-creators of knowledge rather than passive recipients (Freire, 2018). McLaren (2023) and Kincheloe (2008) extend this framework by emphasising the role of culture, identity, power, and resistance in educational contexts.

In higher education, Critical Pedagogy has been associated with increased student engagement, critical thinking, and civic responsibility (Smith, 2021). However, its integration into STEM and computing education has historically been limited due to perceptions of technical neutrality and curriculum rigidity (Guzdial, 2015; Tedre et al., 2006). Recent scholarship increasingly challenges this separation, arguing that computing education must address ethical concerns such as algorithmic bias, data surveillance, and digital inequality (Morales-Navarro & Kafai, 2023; Benjamin, 2019).

Despite these contributions, Critical Pedagogy presents a tension between its transformative theoretical orientation and the practical realities of higher education. Critical Pedagogy emphasises student agency, dialogue, and the questioning of established structures. At the same time, formal IT education is often organised around prescribed curricula, defined technical competencies, standardised assessment, large student cohorts, and institutional resource constraints. Consequently, adopting Critical Pedagogy in principle does not necessarily provide educators with sufficient guidance on how to operationalise its principles within complex computing education environments.

A further limitation is that Critical Pedagogy provides a broad account of power, inequality, and agency, but does not necessarily specify how students' cultural identities and lived experiences should be incorporated into technical learning. This is particularly important in computing education, where the presentation of technical knowledge as culturally and socially neutral can obscure how technology reflects particular social assumptions and power structures (Tedre et al., 2006; Morales-Navarro & Kafai, 2023). Critical Pedagogy, therefore, provides an important philosophical foundation for this study, but requires complementary approaches that address representation, cultural relevance, and practical mechanisms for student participation.

The relevance of this distinction is particularly evident in diverse higher-education environments. A pedagogical approach may promote critical discussion and student agency while still failing to address whether students recognise themselves, their communities, and their experiences in the content being taught. Similarly, encouraging participation without addressing structural and contextual barriers may result in only some students benefiting from increased autonomy. This suggests that critical pedagogy in computing education needs to be understood not only as a philosophy of teaching but also as a set of practices that must be adapted to the cultural, institutional, and material contexts in which learning occurs.

2.2 Representation, Belonging, and Culturally Responsive Computing

Representation plays a critical role in shaping students' sense of belonging, motivation, and identity in STEM disciplines (Dasgupta, 2016; Valdez & Kelp, 2023). Students are more likely to persist and succeed when they see themselves reflected in the curriculum, faculty, and institutional culture (Dasgupta, 2016). Culturally responsive pedagogy extends this principle by advocating for teaching practices that draw on students' cultural knowledge and lived experiences as epistemic resources rather than deficits (Ladson-Billings, 1995).

Within computing education, culturally responsive computing (CRC) frameworks emphasise integrating culturally relevant contexts, community issues, and identity-affirming practices into technical instruction (Morales-Navarro & Kafai, 2023; Leonard & Sentance, 2021; Guzdial, 2015). Leonard and Sentance (2021) demonstrate that culturally responsive approaches in computing enhance student engagement and comprehension, particularly for underrepresented groups. Similarly, Elsinbawi et al. (2023) show that CRC-informed instructional design supports transformative learning and identity development among girls in STEM.

The CRC literature consequently extends Critical Pedagogy by making culture, identity, and representation more explicit dimensions of the learning experience. However, a tension remains between the principle of cultural responsiveness and the practical requirements of formal computing curricula. Culturally relevant examples and contexts can increase engagement, but relevance alone does not necessarily produce critical consciousness,

student agency, or meaningful participation. A curriculum may contain culturally familiar examples while continuing to position students primarily as recipients of technical knowledge.

This distinction is important because representation operates at multiple levels. It can involve the examples and problems used in teaching, the people and communities represented in those examples, the identities of educators and students, and the extent to which students can contribute their own experiences to the learning process. The existing literature establishes the importance of these dimensions. However, there remains a need to clarify how representation and cultural relevance can be systematically connected to participatory learning and critical reflection in IT education.

The literature, therefore, suggests that culturally responsive computing should not be treated as an isolated strategy for improving engagement. Instead, it can serve as a mechanism for connecting technical knowledge to students' social and cultural realities. This creates opportunities for students not only to understand computing concepts but also to question how technology affects different communities and whose needs are prioritised in technological design. Such an approach provides an important link between CRC and Critical Pedagogy and creates a foundation for problem-based and participatory learning.

2.3 Participatory and Problem-Based Learning in IT Education

Participatory action and problem-based learning (PBL) closely align with Critical Pedagogy's emphasis on dialogue, collaboration, and real-world relevance (Freire, 2018; McLaren, 2023). In PBL, students engage with authentic, complex problems that require critical thinking, teamwork, and iterative problem-solving (Savery, 2006). In computing education, PBL has been shown to enhance technical competence, professional readiness, and ethical awareness (Guzdial, 2015; Kolmos & De Graaff, 2014).

Participatory assessment design, in which students contribute to the selection or framing of assessment contexts, further promotes ownership and motivation (Savery, 2006). However, implementing participatory and PBL approaches in large, resource-constrained contexts presents logistical challenges, including assessment scalability, uneven participation, and infrastructural limitations (Leonard & Sentance, 2021; Kolmos & De Graaff, 2014). These tensions underscore the need for context-sensitive pedagogical models that balance aspirational ideals with practical constraints.

While PBL provides a practical mechanism for implementing active and participatory learning, participation itself does not necessarily constitute Critical Pedagogy. Students can work collaboratively on technical problems without questioning the social, ethical, cultural, or political assumptions underlying those problems. Similarly, a problem can be described as "real-world" without being meaningful or relevant to the students who are expected to solve it. PBL, therefore, addresses how students learn through problems. In contrast, Critical Pedagogy and CRC provide complementary perspectives concerning why particular problems are selected, whose experiences are represented, and how students are positioned within the learning process.

This creates an important conceptual relationship between the three approaches. Critical Pedagogy emphasises dialogue, agency, and critical consciousness; CRC emphasises cultural relevance, representation, and attention to identity and belonging; and PBL provides a practical mechanism for students to engage collaboratively with authentic problems. Their combination, therefore, offers greater potential than the application of any single approach. However, their integration must account for the conditions within which teaching takes place.

In particular, the implementation of participatory and problem-based approaches may be constrained by large enrolments, limited laboratory resources, unequal access to technology, prescribed learning outcomes, assessment requirements, and differences in student preparedness. These constraints are not merely administrative issues; they shape the extent to which student agency and participation can realistically be realised. A pedagogical model intended for computing education must therefore recognise contextual feasibility as part of the pedagogical design rather than treating context as an external factor to be ignored.

2.4 Critical Synthesis and Research Gap

The literature reviewed above demonstrates that Critical Pedagogy, culturally responsive computing, and participatory/problem-based learning each address different but interconnected dimensions of computing education. Critical Pedagogy challenges the transmission of knowledge as a neutral process and emphasises dialogue, agency, and critical consciousness (Freire, 2018; Kincheloe, 2008; McLaren, 2023). CRC extends this perspective by foregrounding culture, representation, identity, and belonging (Ladson-Billings, 1995; Leonard & Sentance, 2021; Morales-Navarro & Kafai, 2023). PBL provides an active learning mechanism through which

students can engage collaboratively with authentic problems and develop technical and problem-solving capabilities (Savery, 2006; Kolmos & De Graaff, 2014).

However, the literature also reveals several tensions. First, there is a tension between the transformative ambitions of Critical Pedagogy and the structural constraints of formal higher education. Second, there is a tension between cultural responsiveness and the technical and curricular requirements of computing education. Third, there is a tension between student autonomy and the need for structure, scaffolding, and assessment consistency in PBL. Finally, there is a tension between aspirational inclusive pedagogy and the practical realities of large classes, limited infrastructure, and diverse levels of student preparedness.

These tensions indicate that the central challenge is not simply determining whether Critical Pedagogy, CRC, or PBL is effective. Rather, the challenge is understanding how their principles can be integrated and adapted to computing education contexts. Existing literature provides substantial conceptual justification for each approach. However, it provides less clarity on how these approaches can operate together as an integrated pedagogical model that explicitly accounts for contextual constraints.

The gap addressed by this study is therefore an integration and operationalisation gap. The study does not propose Critical Pedagogy, culturally responsive computing, or PBL as new concepts. Instead, it brings their complementary principles together within a context-sensitive approach to IT education. In this approach, representation and cultural relevance create the foundation for belonging and meaningful engagement; participatory learning and problem-based activities provide mechanisms for student agency and collaboration; and Critical Pedagogy provides the overarching orientation towards dialogue, critical reflection, and the examination of social and ethical dimensions of technology. Transformative learning emerges through the interaction of these elements as students are encouraged to reconsider assumptions, connect technical knowledge with lived experience, and engage critically with authentic problems.

The proposed framework consequently treats context as an integral component rather than an implementation constraint external to pedagogy. Institutional resources, class size, curriculum requirements, assessment structures, student diversity, and access to technology influence the extent to which critical, culturally responsive, and participatory practices can be implemented. The framework, therefore, seeks to balance two potentially competing objectives: maintaining the transformative and socially just ambitions of Critical Pedagogy while ensuring that pedagogical practices remain feasible within the realities of the teaching environment.

3. Theoretical Framework

This study is grounded in Critical Pedagogy as articulated by Freire (2018), McLaren (2023), and Kincheloe (2008). Critical Pedagogy frames education as a dialogical, emancipatory process that challenges oppressive structures and cultivates critical consciousness. It rejects the notion of value-neutral education, asserting instead that all pedagogical practices are embedded within relations of power and ideology (Kincheloe, 2008; McLaren, 2023).

Three interrelated theoretical constructs inform the analysis:

1. **Representation and Cultural Relevance:** conceptualised as foundational to student engagement and belonging (Leonard & Sentance, 2021; Ladson-Billings, 1995; Valdez & Kelp, 2023).
2. **Participatory Action and Student Agency:** positioning students as co-creators of knowledge and curriculum rather than passive recipients (Freire, 2018; McLaren, 2023; Savery, 2006).
3. **Transformative Learning:** understood as a process through which students critically examine and revise their assumptions, beliefs, and worldviews through reflection, dialogue, and experiential engagement (Elsinbawi et al., 2023).

Together, these constructs provide a lens for examining the design, implementation, and outcomes of pedagogical practices in IT education.

4. Methodology

4.1 Research Design

This study adopts a reflective, qualitative, practice-based research design aligned with the Scholarship of Teaching and Learning (SoTL) tradition (Smith, 2021). SoTL emphasises systematic inquiry into teaching and learning practices to improve educational outcomes and contribute to disciplinary knowledge.

4.2 Context and Participants

The study is situated within the Academy of Computer Science and Software Engineering at a South African university. The study period is over 6 months and spans over four years (2020 - 2024). The teaching context includes:

- Undergraduate modules with large enrolments (350--400 students in first-year, introduction to programming; 250--300 students in second-year, systems development).
- Postgraduate modules with smaller cohorts (10--50 students) in cybersecurity, ethics, and network security.
- A diverse student population representing a wide range of racial, cultural, socioeconomic, and educational backgrounds.

4.3 Data Sources

Data sources include:

- Teaching philosophy statements and curriculum design documents.
- Assessment artefacts, including projects, practical assignments, and examination questions.
- Student feedback from module and teaching evaluations, consultations, and reflective discussions.
- Reflective teaching journals and practitioner observations.
- Institutional documents related to mentoring, project days, and community engagement initiatives.

4.4 Data Analysis

Data were analysed thematically using an inductive-deductive approach (Smith, 2021). Initial coding focused on identifying patterns related to student engagement, empowerment, representation, ethical awareness, and learning outcomes. These codes were then mapped onto the theoretical constructs of Critical Pedagogy, representation, participatory action, and transformative learning (McLaren, 2023; Freire, 2018; Kincheloe, 2008; Ladson-Billings, 1995).

Reflexivity was maintained throughout the analysis, acknowledging the researcher's positionality as both educator and participant in the teaching context (Smith, 2021).

5. Findings

5.1 Representation and Cultural Relevance

Student engagement and comprehension were significantly influenced by the cultural relevance of teaching materials and examples, consistent with prior research in culturally responsive computing (Morales-Navarro & Kafai, 2023; Leonard & Sentance, 2021; Ladson-Billings, 1995). Early iterations of first-year programming modules relied on scenarios that were unfamiliar to many students, such as agricultural contexts that did not resonate with urban or digitally oriented learners. We encountered cases where several students admitted to struggling to comprehend the scenarios or to misunderstanding the question, as most of the students do not use English as their first language. These mismatches compounded the cognitive demands of learning to program and contributed to disengagement.

Curriculum content and assessment scenarios were subsequently redesigned to reflect students' lived experiences and contemporary contexts, including social media, sports, elections, load-shedding, and financial management. These changes improved students' ability to relate abstract programming concepts to real-world applications, fostering deeper understanding and motivation, as reported in the CRC literature (Morales-Navarro & Kafai, 2023; Leonard & Sentance, 2021; Elsinbawi et al., 2023). The assessment pass rate increased by over 10% with the introduction of more relatable scenarios and the use of less technical language.

Representation also extended beyond content to include the instructor's identity and lived experience. Students frequently reported that seeing a lecturer with a similar racial, cultural, and educational trajectory enhanced their sense of belonging and belief in their own potential, aligning with findings on representation and identity in STEM (Dasgupta, 2016; Valdez & Kelp, 2023).

5.2 Participatory Curriculum and Assessment Design

Participatory action was operationalised through student involvement in curriculum and assessment design, particularly in selecting thematic contexts for tests, exams, and projects. Although student participation was initially limited, targeted incentives increased engagement over time. This aligns with participatory learning frameworks that emphasise ownership and agency (Freire, 2018; Savery, 2006).

Group-based projects in second-year modules required students to collaborate on real-world systems development tasks, often addressing community needs and social challenges. These projects fostered a sense of ownership, accountability, and relevance, consistent with PBL and community-engaged learning models (Guzdial, 2015; Kolmos & De Graaff, 2014).

At the postgraduate level, participatory approaches extended to research supervision and to design science methodologies, in which students engaged stakeholders, co-defined problem domains, and developed solutions responsive to contextual needs, reflecting participatory research traditions (Freire, 2018; Savery, 2006).

5.3 Dialogical and Problem-Based Teaching Practices

Dialogical teaching methods and problem-based learning were central to the pedagogical approach across modules (Freire, 2018; McLaren, 2023; Savery, 2006). Lectures were structured around questions and scenarios designed to provoke critical reflection on the societal, ethical, and political implications of technology, aligning with socially responsible computing education (Morales-Navarro & Kafai, 2023) (Benjamin, 2019).

Weekly practicals emphasised iterative problem-solving, peer collaboration, and oral explanation of work, enabling instructors to diagnose misconceptions and provide targeted feedback. Supplementary revision sessions and tutoring created additional spaces for dialogue and personalised support, particularly benefiting students who were hesitant to engage in large-lecture settings, as suggested in the inclusive pedagogy literature (Ladson-Billings, 1995; Valdez & Kelp, 2023).

In postgraduate modules, the dialogical approach facilitated critical engagement with complex topics such as cyber warfare, critical infrastructure protection, and ethical governance, contributing to successful student publications and scholarly outputs, consistent with research on inquiry-driven learning in advanced computing education (Guzdial, 2015; Kolmos & De Graaff, 2014).

5.4 Challenges and Tensions in Implementation

Several challenges emerged in implementing Critical Pedagogy within large, diverse, and resource-constrained contexts. Infrastructural limitations, particularly inadequate laboratory hardware, constrained the feasibility of certain pedagogical practices and necessitated adaptations such as take-home assessments. While these changes improved access for some students, they introduced concerns regarding equity and academic integrity, reflecting tensions identified in the literature (Leonard & Sentance, 2021; Kolmos & De Graaff, 2014).

Not all students responded positively to problem-based and inquiry-driven approaches. Some expressed a preference for direct instruction and model solutions, citing anxiety and uncertainty when required to develop independent problem-solving strategies. This tension mirrors broader debates within computing education regarding the balance between scaffolding and autonomy (Guzdial, 2015; Savery, 2006).

Classroom dialogue on sensitive topics related to race, gender, and social justice occasionally generated conflict and discomfort. Maintaining a neutral facilitative stance while upholding ethical standards and fostering respectful engagement required ongoing reflexivity and emotional labour, as documented in critical pedagogy scholarship (Kincheloe, 2008; McLaren, 2023).

6. Discussion

The findings suggest that Critical Pedagogy can be operationalised in IT education through intentional curriculum design, participatory learning practices, dialogical teaching, and reflective evaluation. Rather than demonstrating a direct causal relationship between these practices and particular student outcomes, the evidence provides contextual indications of how such approaches may shape students' engagement with learning. This interpretation is consistent with the broader literature, which positions Critical Pedagogy as a means of encouraging dialogue, critical reflection, student agency, and engagement with the social dimensions of education (Freire, 2018; McLaren, 2023; Kincheloe, 2008).

The findings further suggest that representation and cultural relevance may contribute to students' ability to connect abstract IT concepts with familiar social and cultural contexts. The shift from examples perceived as less relevant to those involving social media, sport, elections, load-shedding, and financial management was, according to the practitioner's observations and available student feedback, associated with greater contextual engagement and participation. However, because these observations were retrospective and were not generated through a controlled comparison, they should be interpreted as indicative rather than as evidence that cultural relevance directly improves motivation or learning outcomes. This finding nevertheless supports arguments in culturally responsive computing and related literature that students' identities and lived experiences should be recognised as legitimate resources within computing education (Ladson-Billings, 1995; Leonard & Sentance, 2021; Valdez & Kelp, 2023).

The findings also suggest that participatory curriculum and assessment practices can create opportunities for greater student agency and ownership of learning. Allowing students to engage with real-world problems, contribute to thematic contexts, and participate in collaborative projects created opportunities for students to connect technical learning with social and community concerns. These practices are consistent with participatory and problem-based approaches described in the literature (Kolmos & De Graaff, 2014; Savery, 2006), but the present study does not provide sufficient evidence to establish that participation independently produced improvements in academic performance or other learning outcomes. Instead, the findings illustrate how participation can be incorporated into IT teaching while maintaining technical and curricular requirements.

Dialogical teaching and problem-based learning also appeared to create opportunities for students to engage more explicitly with the ethical, social, and political dimensions of computing. Questions concerning cybersecurity, critical infrastructure, cyber warfare, privacy, and ethical governance encouraged students to consider computing beyond its technical dimensions. The evidence, therefore, suggests that dialogical and problem-based approaches can provide useful pedagogical spaces for critical engagement with the societal consequences of technology, although the extent to which such engagement results in sustained changes in students' attitudes, identities, or professional practice would require longitudinal investigation.

At the same time, the findings highlight tensions that complicate the implementation of Critical Pedagogy in practice. Resource constraints, large classes, uneven participation, student preferences for structured instruction, and discomfort surrounding discussions of race, gender, and social justice indicate that critical and participatory pedagogy cannot simply be transferred into an IT classroom without adaptation. These tensions reinforce the importance of the context-sensitive framework proposed in this study. The framework does not assume that greater student autonomy, cultural relevance, or critical dialogue will automatically produce improved educational outcomes. Instead, it positions these elements as interconnected pedagogical conditions that require appropriate scaffolding, institutional support, and adaptation to local circumstances.

Taken together, the findings provide preliminary, contextually grounded evidence supporting the usefulness of integrating Critical Pedagogy, representation and cultural relevance, participatory learning, and transformative reflection within IT education. The principal contribution is therefore not a claim of demonstrated effectiveness, but an empirically informed account of how these principles can be brought together within a particular South African university context and the tensions that arise during implementation.

7. Implications for Practice

The study offers several practical implications for IT educators and institutions:

1. **Curriculum Design:** Integrate culturally relevant examples, case studies, and applications that resonate with students' lived experiences while maintaining technical rigor (Morales-Navarro & Kafai, 2023; Leonard & Sentance, 2021; Ladson-Billings, 1995).
2. **Assessment Practices**: Employ participatory and authentic assessment strategies that promote ownership, collaboration, and ethical awareness (Kolmos & De Graaff, 2014; Savery, 2006).
3. **Teaching Methods:** Adopt dialogical and problem-based approaches that foster critical thinking, reflection, and real-world relevance (Freire, 2018; Guzdial, 2015; McLaren, 2023).
4. **Student Support:** Provide supplementary learning spaces, such as revision sessions and tutoring, to support diverse learning needs and engagement styles (Ladson-Billings, 1995; Valdez & Kelp, 2023).
5. **Professional Development:** Encourage reflective practice and pedagogical training focused on inclusive, critical, and transformative teaching (Kincheloe, 2008; Smith, 2021).

6. **Institutional Policy:** Invest in infrastructural resources and support structures that enable equitable access to learning technologies and environments (Leonard & Sentance, 2021; Kolmos & De Graaff, 2014).

8. Conclusion and Future Work

This paper presents a reflective, practice-based study of the integration of Critical Pedagogy and representation into IT education within a South African university context. The findings suggest that intentional, context-sensitive pedagogical practices can create opportunities for student engagement, agency, ethical awareness, and critical reflection. However, given the retrospective and qualitative nature of the evidence, these findings should be interpreted as contextually grounded indications rather than definitive evidence of improved motivation, identity development, or learning outcomes.

The study's primary contribution is a context-sensitive pedagogical framework that brings together Critical Pedagogy, representation and cultural relevance, participatory action, and transformative learning. The framework provides a way of conceptualising how these elements can interact within IT education while accounting for practical constraints such as large enrolments, resource limitations, differing student preferences, and institutional requirements.

Future research should test and extend the preliminary insights from this reflective study through empirical designs that examine student outcomes more systematically. Mixed-methods studies could examine changes in learning outcomes, engagement, motivation, sense of belonging, and retention using appropriate quantitative and qualitative measures. Longitudinal research could further investigate whether exposure to critical and culturally responsive pedagogical approaches contributes to sustained changes in students' identities, ethical awareness, or professional practice.

Comparative studies across institutions, disciplines, and national contexts would further clarify the transferability of the proposed framework rather than simply its generalisability. Such research could examine how differences in institutional resources, student populations, curriculum structures, class sizes, and assessment practices influence implementation and outcomes.

Overall, this study suggests that positioning IT education as both a technical and ethical endeavour can provide a productive basis for rethinking computing pedagogy. Rather than presenting Critical Pedagogy as a universally applicable solution, the findings highlight the importance of adapting critical, participatory, and culturally relevant approaches to the specific institutional and student contexts in which they are implemented.

Ethical Declarations

This study utilised retrospective secondary data generated through routine teaching and learning activities, including existing curriculum and assessment documents, reflective teaching records, and previously collected student feedback. No new data were collected from students specifically for this study, and no direct participant recruitment or intervention was undertaken. The student feedback used in the analysis was anonymised, and no personally identifiable information was accessed or reported.

The study was conducted in accordance with the institutional research ethics requirements. In particular, the study treated the existing teaching and learning materials as retrospective secondary data and did not seek to obtain additional information from students for research purposes. The analysis was conducted at an aggregate level, with individual students and identifiable responses excluded from reporting. Because ethical approval cannot be granted retrospectively, the study does not claim retrospective ethical clearance. Where institutional or faculty-level exemption or waiver procedures apply to the use of such secondary data, these should be determined in accordance with the relevant Research Ethics Committee requirements.

Given the practitioner-researcher nature of the study, particular attention was also given to confidentiality, minimising the possibility of student identification, and separating reflective analysis of teaching practices from the evaluation of individual students. The findings are therefore presented as aggregated patterns and reflective interpretations rather than individual student cases.

AI Declaration

Artificial intelligence (AI) tools were utilised to aid in the development of this paper, specifically for language polishing and structural editing. The author maintained full responsibility for reviewing, validating, summarising, and interpreting all outputs to ensure the accuracy and integrity of the final work.

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