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RECONFIGURING PEDAGOGY IN THE AGE OF GENERATIVE AI: A BLENDED CONTINUING PROFESSIONAL DEVELOPMENT PROGRAMME FOR BASIC AND SECONDARY SCHOOL TEACHERS

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ABSTRACT

Background: The accelerated diffusion of Generative Artificial Intelligence (GAI) tools is reshaping teaching, assessment and the cultivation of intellectual autonomy. Continuing professional development (CPD) is a strategic mechanism for addressing these challenges, yet pedagogically grounded GAI literacy programmes remain scarce (Bond et al., 2024; UNESCO, 2023). **Objectives:** This paper analyses a structured CPD programme designed to foster teachers' critical and responsible integration of GAI into classroom practice, with attention to its impact on professional identity, pedagogical differentiation and the reconceptualisation of assessment. **Methods:** The programme was implemented in a Portuguese private school during the 2025/2026 academic year, involving 143 teachers across basic and secondary education. Structured as a 25-hour blended course (12 sessions; 18 synchronous and 7 asynchronous hours), it adopted a modular, progressive approach articulating conceptual demystification, hands-on experimentation and ethical reflection. Data were generated through participant observation, collaborative artefact analysis and structured group discussion, and analysed thematically using a deductive-inductive coding scheme aligned with the DigCompEdu framework (Moreira et al., 2024). **Results:** Participants progressively reconceptualised GAI from a perceived threat to a complementary pedagogical resource. Gains were observed in teachers' capacity to evaluate GAI outputs critically, design differentiated pathways and rethink assessment. The community of practice proved central in sustaining reflective dialogue beyond formal training. **Conclusions:** Structured, ethically grounded CPD can meaningfully advance teachers' GAI literacy and transform pedagogical practice when it integrates theoretical depth, experiential learning and sustained peer collaboration (Selwyn et al., 2025).

Keywords: Generative Artificial Intelligence, teacher professional development, AI literacy, blended learning, basic and secondary education

RESUMO

Enquadramento: A rápida difusão das ferramentas de Inteligência Artificial Generativa (IAG) está a reconfigurar o ensino, a avaliação e o desenvolvimento da autonomia intelectual. A formação contínua de professores constitui um mecanismo estratégico para responder a estes desafios; contudo, continuam a ser escassos os programas de literacia em IAG pedagogicamente fundamentados (Bond et al., 2024; UNESCO, 2023). **Objetivos:** Este artigo analisa um programa estruturado de formação contínua concebido para promover a integração crítica e responsável da IAG na prática letiva, com

particular atenção ao seu impacto na identidade profissional docente, na diferenciação pedagógica e na reconceptualização da avaliação. **Métodos:** O programa foi implementado numa escola privada portuguesa durante o ano letivo de 2025/2026, envolvendo 143 professores do ensino básico e secundário. Estruturado como um curso b-learning de 25 horas - 12 sessões, 18 horas síncronas e 7 horas assíncronas - adotou uma abordagem modular e progressiva, articulando desmistificação conceptual, experimentação prática e reflexão ética. Os dados foram recolhidos através de observação participante, análise colaborativa de artefactos e discussão estruturada em grupo, tendo sido analisados tematicamente com recurso a um esquema de codificação dedutivo-indutivo alinhado com o referencial DigCompEdu (Moreira et al., 2024). **Resultados:** Os participantes reconceptualizaram progressivamente a IAG, passando de uma perceção inicial de ameaça para a sua compreensão como recurso pedagógico complementar. Foram observados ganhos na capacidade dos professores para avaliar criticamente os resultados produzidos pela IAG, desenhar percursos diferenciados e repensar a avaliação. A comunidade de prática revelou-se central para sustentar o diálogo reflexivo para além da formação formal. **Conclusões:** A formação contínua estruturada e eticamente fundamentada pode promover de forma significativa a literacia docente em IAG e transformar a prática pedagógica quando integra profundidade teórica, aprendizagem experiencial e colaboração sustentada entre pares (Selwyn et al., 2025).

Palavras-chave: Inteligência Artificial Generativa, desenvolvimento profissional docente, literacia em IA, aprendizagem híbrida, ensino básico e secundário.

1 INTRODUCTION

The rapid diffusion of Generative Artificial Intelligence (GAI) tools - such as ChatGPT, Copilot, Claude, Gemini and Perplexity - is producing a profound reconfiguration of education at all levels and modalities. The pace at which these technologies enter classrooms, shape students' cognitive habits and reorganise the production and circulation of knowledge consistently outstrips the capacity of educational institutions to develop coherent, evidence-informed and ethically grounded pedagogical responses (Bond et al., 2024; UNESCO, 2023). In this context, continuing teacher professional development (CPD) assumes a pivotal strategic role, not merely as a vehicle for technical capacity-building, but above all as a mechanism for empowering teachers as reflective, critical and ethically informed professionals (Selwyn et al., 2025).

This paper documents and critically analyses a CPD experience implemented in a Portuguese private school during the 2025/2026 academic year, under the institutional theme "Enhancing Learning and Creativity with AI: Education 5.0". The programme engaged 143 teachers and educators from across basic and secondary education and was guided by the following research question: in what ways can a structured, GAI-focused CPD programme contribute to the redefinition of teachers' pedagogical practices, so as to render student learning more meaningful and to actively engage learners in the co-construction of knowledge?

The programme is grounded in a humanistic perspective of education (UNESCO, 2023) and is aligned with contemporary updates of the European Framework for the Digital Competence of Educators (Moreira et al., 2024), the European Commission's Ethical Guidelines on the Use of AI in Teaching and Learning (European Commission, 2022), the Portuguese Digital Transition Action Plan (Portuguese Government, 2020), and the Portuguese Student Profile at the End of Compulsory Schooling (Martins et al., 2017), all of which underpin an inclusive, equitable school oriented towards critical thinking and intellectual autonomy.

2 Theoretical and Contextual Framework

The transformation wrought by GAI within the educational ecosystem is not merely technological in character; it is, above all, epistemological and pedagogical. The role traditionally ascribed to the teacher as the privileged transmitter of codified knowledge is progressively being challenged by systems capable of responding to complex queries, generating plausible content and simulating sophisticated reasoning processes (Bond et al., 2024). Far from diminishing the significance of the teaching profession, this reality demands a heightened sophistication of its most distinctly human and relational dimensions, including ethical judgement, contextual sensitivity and the cultivation of relational pedagogies (Selwyn et al., 2025).

In the Portuguese educational context, the integration of GAI in schools is unfolding against a backdrop marked by significant disparities in access to digital devices and connectivity, an ageing teaching workforce, and a tradition of CPD provision that frequently remains disconnected from the realities of classroom practice. The Digital Transition Action Plan (Portuguese Government, 2020) explicitly acknowledges these structural specificities and identifies teacher training as a strategic priority for the consolidation of an equitable digital education ecosystem; nevertheless, the systematic implementation of comprehensive, school-based programmes continues to represent a considerable institutional challenge.

Recent meta-syntheses of the empirical literature on AI in education (Bond et al., 2024) document both the affordances and the risks associated with these technologies. Among the affordances, GAI offers opportunities to personalise learning pathways, identify specific competence gaps, automate administrative processes and support pedagogical differentiation, with documented benefits for inclusive education (Cabero-Almenara et al., 2022). Among the risks, the literature signals the hazards of excessive algorithmic dependence, the erosion of students' intellectual autonomy, the perpetuation of biases embedded in automated systems, and the ethical dilemmas surrounding data privacy, surveillance and academic integrity (UNESCO, 2023). The European Commission's Ethical Guidelines on the Use of AI in Teaching and Learning (European Commission, 2022) further emphasise that the responsible adoption of GAI in education requires explicit attention to transparency, human oversight, fairness and the protection of learners' rights.

Within this complex and contested terrain, teacher CPD assumes a strategic dimension that transcends instrumental training: it must equip educators with a robust conceptual and ethical framework for integrating GAI in a critical, responsible and pedagogically principled manner. The Pedagogical DigCompEdu Reloaded framework (Moreira et al., 2024) explicitly extends the original DigCompEdu reference (Redecker, 2017) to incorporate competences related to open and online education, AI-enhanced practice and the emergence of GAI in educational contexts, providing the orienting framework for the present study.

3 Methodology and Programme Design

The study adopts a qualitative, empirical case-study design centred on the design, implementation and analysis of the CPD programme "Enhancing Learning and Creativity with AI: Education 5.0", delivered in a blended learning format between October 2025 and January 2026 in a Portuguese private school. A total of 143 teachers and educators from diverse year groups and subject areas participated, completing 25 hours of structured training across 12 sessions - 18 synchronous contact hours and 7 asynchronous hours of guided individual and collaborative work. The modular architecture of the

programme was conceived to facilitate a graduated progression: from initial conceptual demystification to hands-on experimentation with GAI tools, and thence to ethical reflection and the collaborative construction of evidence-informed practice.

3.1 Programme Structure

Module 1 (5 hours) - Introduction to GAI in Education - was organised around three interrelated axes: demystifying GAI through accessible language and quotidian exemplification; analysing its potential to personalise learning and optimise teaching-related tasks; and critically debating the ethical challenges inherent in GAI adoption, including data privacy, algorithmic bias and the safeguarding of students in digitally mediated environments (UNESCO, 2023). The module combined 3 hours of synchronous plenary sessions with 1.5 hours of asynchronous individual reflection activities.

Module 2 (10 practical hours) - GAI Tools for Creative Production - focused on direct experimentation with visual creation platforms (Canva Magic Studio, NotebookLM), narrative co-creation tools (ChatGPT, Google Gemini, Microsoft Copilot, Claude) and multimedia solutions for the production of educational videos and presentations (Invideo.ai, Adobe Express). The methodology privileged hands-on experimentation, collaborative discussion of GAI-generated outputs and the critical evaluation of content produced, with particular emphasis on identifying limitations, biases and pedagogical affordances.

Module 3 (10 hours) - GAI as a Teaching Assistant - addressed four practical domains: intelligent lesson planning (Magic School AI, Padlet TA, Edcafe, Brisk, Diffit); pedagogical differentiation through the adaptation of texts and activities to diverse learning profiles (Cabero-Almenara et al., 2022); assessment design through the creation of personalised instruments (Wayground AI, Meiro, Gamma, Ideamap, Napkin); and the collaborative development of good-practice guides for the responsible integration of GAI in the classroom.

3.2 Data Generation and Analysis

In response to the need for transparency in qualitative inquiry, three complementary sources of data were systematically generated. First, *participant observation* was conducted across all 12 sessions by the programme designer, with structured field notes organised under four *a priori* categories aligned with the Pedagogical DigCompEdu Reloaded framework (Moreira et al., 2024): professional engagement; digital and AI resources; teaching, learning and assessment; and empowerment of learners. Second, *collaborative artefacts* produced by participants - including lesson plans, differentiated materials, assessment rubrics and good-practice guides - were analysed using a coding rubric covering six criteria: (i) pedagogical alignment with curricular objectives; (ii) evidence of critical evaluation of GAI outputs; (iii) attention to differentiation; (iv) explicit ethical reasoning; (v) transparency about GAI use with students; and (vi) originality of the teacher's pedagogical contribution. Third, *structured group discussions* were held at the end of each module, with participants prompted to articulate perceived shifts in confidence, identified tensions and emerging classroom strategies.

Data were analysed thematically following a deductive-inductive procedure (Bond et al., 2024). An initial deductive coding frame was derived from the four DigCompEdu Reloaded areas; emergent inductive codes were then added through iterative reading of field notes, artefacts and discussion transcripts. Cross-checking across the three data sources supported triangulation of findings. Given the developmental nature of the programme, results are reported as preliminary, with a longitudinal follow-up planned for the 2026/2027 academic year.

3.3 Ethical Considerations

Ethical procedures were observed throughout. Participation in the data-generation activities was voluntary and based on informed consent; participants were assured of anonymity in any reporting. Particular attention was paid to the ethical sensitivities of assessment-related data, given the potential professional implications of disclosing teachers' evolving practices. Discussions about students' use of GAI were framed in terms of transparency, fairness and the protection of intellectual authorship, in line with UNESCO (2023) and European Commission (2022) guidance. No student data were collected. The programme designer's dual role as researcher and trainer was openly acknowledged with participants and addressed methodologically through structured peer debriefing during the analytical phase.

4 Results and Discussion

The preliminary analysis identifies a set of significant impacts upon the practices, perceptions and professional dispositions of the participating teachers. The findings are organised below around five interconnected dimensions, with explicit attention to the relationship between observed shifts and specific programme activities.

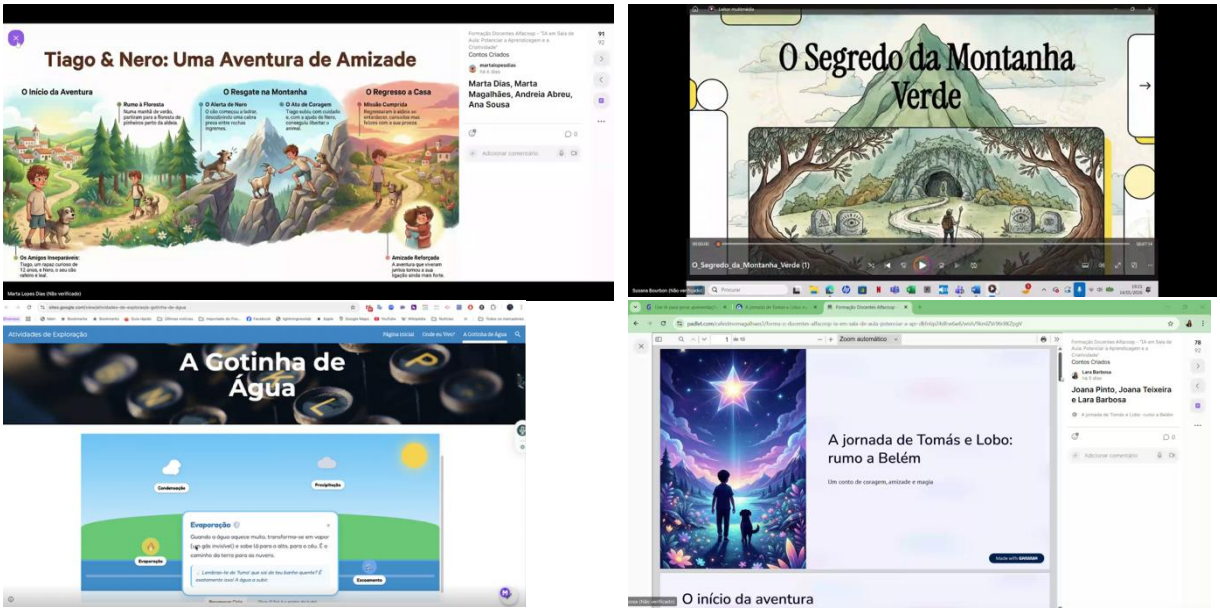
4.1 Reconceptualization of the Teacher's Role

Participants demonstrated a progressive shift from an initial perception of GAI as a threat to professional autonomy towards its reconceptualization as a complementary pedagogical resource. This attitudinal reorientation was neither immediate nor linear: field-note analysis indicates that the most marked transitions occurred during Module 1 (after the demystification activities) and Module 3 (following the collaborative co-design of differentiation rubrics), suggesting that combining conceptual clarity with concrete classroom application is a key driver of professional repositioning. This finding resonates with Selwyn et al. (2025), who emphasise that AI integration is not a question of automation but of teachers' active mediation.

4.2 Pedagogical Differentiation

In the domain of pedagogical differentiation - consistently identified by teachers as a strategic priority, yet notoriously difficult to operationalise in real classroom contexts - the use of GAI tools revealed considerable potential. Artefact analysis showed that 78% of differentiated lesson plans submitted in Module 3 explicitly evidenced adaptation across at least three proficiency levels, compared with the more limited differentiation reported in baseline activities at the start of Module 1. Consistent with Cabero-Almenara et al. (2022) and Bond et al. (2024), teachers came to recognise how GAI can support the creation of personalised pathways and targeted assistance for students with specific educational needs, without supplanting the teacher's irreplaceable pedagogical judgement (Figure 1).

Figure 1. Examples of resources created by teachers for use with their students.



4.3 Reconceptualising Assessment

Assessment constituted one of the domains of greatest tension and richest discussion. Participants acknowledged the pressing need to rethink prevailing assessment models in light of GAI's capacity to generate texts, solve problems and simulate reasoning with increasing sophistication (UNESCO, 2023). In response, the programme encouraged sustained reflection on assessment methodologies centred on the learning process, oral communication, metacognitive development and the creation of original, contextualised outputs, in alignment with the competence areas defined in the Portuguese Student Profile (Martins et al., 2017). The structured group discussions in Module 3 were the principal locus of this reconceptualisation: artefact analysis evidenced a progressive movement from product-oriented assessment towards process- and dialogue-oriented instruments, accompanied by explicit ethical clauses about permissible GAI use.

4.4 Development of GAI Literacy

A discernible increase in teachers' confidence and autonomy in critically engaging with GAI tools was observed across the duration of the programme. Participants demonstrated a growing capacity to interrogate GAI-generated outputs, identify embedded biases, communicate transparently with their students about technology use, and establish subject-specific criteria for responsible and ethical adoption, in accordance with the Pedagogical DigCompEdu Reloaded framework (Moreira et al., 2024). The hands-on experimentation activities in Module 2 - in which participants were required to compare outputs across competing tools - emerged in field notes as the activity most consistently associated with this growth in critical literacy.

4.5 The Community of Practice

The establishment of a community of practice emerged as one of the most highly valued dimensions of the programme, providing a structured space for collaborative reflection that transcended the individualised logic of much formal CPD provision. Echoing the theoretical premises advanced by Bond et al. (2024) and Selwyn et al. (2025), the most robust forms of professional learning observed in this programme occurred through participation in shared social practices, where meaning was negotiated collectively and professional identities were progressively reconstructed.

5 Identified Tensions and Pedagogical Implications

The implementation of the programme was not without its tensions and challenges, several of which merit explicit consideration.

5.1 The Risk of Instrumental Adoption

A first recurring tension concerned the risk of instrumentalising GAI: the tendency, particularly evident in the early stages of the programme, for teachers to adopt the tools superficially - as convenient shortcuts for the rapid production of content - without critically engaging with the quality, accuracy or pedagogical appropriateness of the outputs (Selwyn et al., 2025). Addressing this tendency required deliberate formative intervention, incorporating structured moments of comparative analysis and guided discussion of the pedagogical implications of each technological choice.

5.2 Digital Equity

A second significant tension related to digital equity. Although the programme took place within an institutional context characterised by relatively homogeneous access to devices and connectivity, participants articulated legitimate concerns regarding their students' differential access to technology and, in particular, families' variable capacity to accompany and supervise the use of GAI tools at home. The risk that GAI may amplify rather than mitigate existing educational inequalities is extensively documented (Bond et al., 2024; UNESCO, 2023) and reinforces the policy commitments articulated in the Digital Transition Action Plan (Portuguese Government, 2020).

5.3 Intellectual Authorship and Academic Integrity

The debate surrounding intellectual authorship and academic integrity proved to be a moment of considerable formative richness. Participants engaged in the discussion of practical cases and collaboratively developed subject-specific pedagogical guidelines aimed at promoting students' original thinking and ensuring that GAI functions as a scaffold for learning rather than a substitute for genuine intellectual effort (UNESCO, 2023; European Commission, 2022).

5.4 Sustainability of Post-Training Practices

The question of the sustainability of practices beyond the formal training period raises important considerations. Investment in CPD only yields lasting impact when accompanied by an organisational culture that actively values pedagogical experimentation and sustained peer collaboration (Bond et al., 2024). Drawing on this experience, four concrete strategies are proposed to consolidate the community of practice in the medium term: (i) the formal allocation of monthly peer-coaching slots within teachers' working time; (ii) the institutional designation of GAI "pedagogical referents" to support colleagues in subject departments; (iii) the integration of GAI literacy criteria into the school's teacher appraisal framework; and (iv) the maintenance of a shared, curated digital repository of approved GAI-supported resources, governed by transparent ethical guidelines.

5.5 Limitations and Transferability

Several limitations should be acknowledged. First, the study was conducted within a single, well-resourced private school in Portugal, which constrains the transferability of the findings to contexts marked by greater socioeconomic disadvantage, more constrained connectivity or different cultural framings of teacher autonomy. Second, the programme designer also acted as researcher, which, although addressed methodologically, introduces a degree of interpretive proximity. Third, the results reported are preliminary and based on perceived shifts and artefact analysis, rather than on measured

changes in student learning outcomes. Future research should test the transferability of the model in publicly funded, socio-economically diverse settings, and should incorporate a longitudinal component capturing classroom-level effects (Bond et al., 2024).

6 Discussion and Conclusion

The CPD experience documented in this paper suggests that it is possible to construct meaningful and pedagogically robust responses to the reconfiguration of education by GAI, provided that such responses are deliberate, rigorously structured and ethically grounded. Read alongside Bond et al. (2024) and Selwyn et al. (2025), the school programme demonstrates that teacher CPD can transcend the mere acquisition of technical skills, instead promoting a critical, reflective and pedagogically informed appropriation of GAI tools. Specifically, the programme contributed to the redefinition of pedagogical practice in three observable ways: by reframing the teacher's role as an active mediator and curator of meaningful learning; by enabling differentiated, student-centred pathways supported (but not determined) by GAI; and by initiating a reconceptualisation of assessment that foregrounds process, dialogue and originality.

The most significant contributions of this work reside, firstly, in the proposal of a modular and progressive training model that purposefully articulates theoretical depth with practical experimentation and ethical reflection, anchored in the Pedagogical DigCompEdu Reloaded framework (Moreira et al., 2024). Secondly, in the empirical demonstration that teacher communities of practice constitute a high-value mechanism for sustaining pedagogical transformation beyond the temporal boundaries of formal training, when complemented by concrete institutional arrangements (see Section 5.4). Thirdly, in the systematic identification of tensions and limitations that may inform the design of future CPD programmes in analogous educational contexts.

The fundamental question raised by this experience is not whether teachers should integrate GAI into their practice, but how they might do so in a manner that genuinely serves student learning - and never the reverse (Selwyn et al., 2025). The challenge confronting the profession is not primarily technological, but profoundly human and social: how to harness GAI in the service of building an educational system that is more equitable, more inclusive and more effectively oriented towards preparing young people for the complex challenges of the twenty-first century, in alignment with the Portuguese Student Profile (Martins et al., 2017) and the European Commission's ethical guidance (European Commission, 2022).

Future research should longitudinally track the impact of such CPD programmes on classroom practices and student learning outcomes and should undertake comparative studies across diverse Portuguese school settings to identify the contextual, organisational and pedagogical factors that determine the success or failure of GAI integration (Bond et al., 2024; UNESCO, 2023).

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