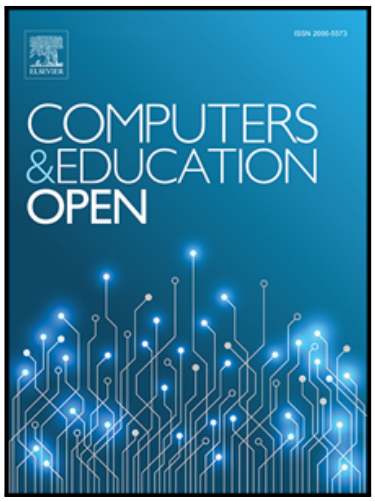

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Situated AI Ethics: A Cultural-Historical and Ecological Framework for Education

Juliana Elisa Raffaghelli[1]*, Henriikka Vartiainen[2], Matt Bower[3], Martina Ronci[4], Chris Shelton[5], Kathryn MacCallum[6], Jihyun Lee[7], Mary Webb[8], Yousra Cthouki, and David Smith[9]

[1] Department of Philosophy, Sociology, Education and Applied Psychology (FISPPA), University of Padua, Italy
[2] School of Educational Sciences and Psychology, University of Eastern Finland, Finland
[3] School of Education, Macquarie University, Australia
[4] Université Paris Cité, France
[5] School of Education, University of Chichester, United Kingdom
[6] Faculty of Education, University of Canterbury, New Zealand
[7] School of Education, University of New South Wales, Australia
[8] King's College London, United Kingdom
[9] Al Akhawayn University, School of Science and Engineering, Morocco
[9] Department of Business and Information Technology, Purdue Global, Purdue University, United States

Corresponding Author: juliana.raffaghelli@unipd.it

Author Contributions (CRediT)

Juliana Elisa Raffaghelli: Conceptualization; Investigation; Methodology; Project administration; Resources; Supervision; Validation; Visualization; Writing – original draft; Writing – review & editing.

Henriikka Vartiainen: Conceptualization; Investigation; Methodology; Resources; Validation; Visualization; Writing – original draft; Writing – review & editing.

Matt Bower: Investigation; Methodology; Project administration; Resources; Supervision; Validation.

Martina Ronci: Conceptualization, Investigation; Resources; Validation; Writing – review & editing.

Chris Shelton: Conceptualization, Investigation; Methodology; Writing – review & editing.

Kathryn MacCallum: Investigation; Validation; Writing – review & editing.

Jihyun Lee: Investigation; Validation.

Mary Webb: Project administration; Writing -review & editing. Validation.

Yousra Chtouki: Validation, visualization

David Smith: Writing -review & editing.

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

ABSTRACT

This paper proposes a situated approach to AI ethics in education, grounded in Cultural-Historical Activity Theory (CHAT) and ecological systems theory, to conceptualize how ethical decision-making around AI emerges across interconnected individual, institutional, cultural, and geopolitical contexts. Moving beyond universalist and principle-based ethics frameworks, we frame AI as a non-neutral socio-technical assemblage whose ethical implications are historically produced and locally negotiated. The framework is applied to a comparative analysis of 7 national cases (Australia, Finland, England, France, Italy, New Zealand, and South Korea), mapped across five ecological levels: self, classroom/group, state/geopolitical, cultural norms, and global. The analysis reveals recurring tensions between innovation agendas and ethical concerns, including uneven teacher autonomy, regulatory overload, fragmented policy guidance, cultural anxieties about automation, and global pressures related to competitiveness, labour markets, and platform dependence. Across contexts, teachers are frequently positioned as moral gatekeepers of AI use while lacking adequate structural, institutional, and epistemic support to exercise ethical agency. By integrating CHAT's attention to contradictions, power relations, and transformative agency with an ecological perspective on nested systems, the paper demonstrates that ethical AI practices are not implemented through compliance but negotiated through situated action. We argue that ethical engagement with AI requires context-sensitive, collective, and transformative approaches that extend AI literacy beyond technical skills toward critical, political, and ecological forms of agency.

Keywords

AI Ethics, Cultural-Historical Activity Theory, Ecological Systems Theory, Situated Learning, Transformative Agency

Introduction

The non-neutral nature of AI (particularly generative AI), combined with the accelerating ethical, legal, environmental, and social challenges it introduces, has intensified concerns about the kind of future these tools are shaping and for whom (Author, 2024). At the core of these concerns is the recognition that AI systems are designed and programmed by

humans working within and for corporations; consequently, the mechanisms and functionalities of AI used in education inevitably reflect human intentions, commercial priorities, and specific business models and are not necessarily built with educational principles in mind (Williamson et al., 2023).

This issue is compounded by the practice of training large models on vast datasets gathered through extensive web crawling, a process that raises further ethical and epistemic questions around copyright, privacy, ownership and bias (Opderbeck, 2024). Uncritical use risks reproducing and amplifying pre-existing stereotypes and structural inequities, as they inherit the biases, prejudices, and dominant cultural patterns embedded in their training data (Liu, 2023; Benjamin, 2019; Bommasani et al., 2021). At the same time, the development of AI has been largely driven by a small group of powerful corporations, generating new dynamics of control bound up with surveillance capitalism (Zuboff, 2015). These dynamics extend to questions of data ownership and control over advanced computational infrastructure, which increasingly determine who is able to build and access the most cutting-edge models both inside and outside education (Crawford, 2021).

Furthermore, AI's widely acknowledged limitations, including opacity, hallucinations and bias, raise ongoing concerns about trustworthiness and the appropriateness of relying on such systems for meaningful educational or administrative decision-making (Author, 2024; Bélisle-Pipon et al., 2022). The proliferation of AI has also generated new pathways for unethical behaviour, from the creation of persuasive synthetic images, videos, and texts that accelerate the spread of fake news and mis- and disinformation, to influencing human behaviour (Loth et al., 2024; Bommasani et al., 2019). This has also led to questions of the legitimacy and authenticity of qualifications as we try to protect what are becoming increasingly outdated modes of assessment (Gallent-Torres et al., 2023). These developments contribute to broader risks, as data-driven manipulation threatens democratic processes and erodes public trust in institutions, media, science, and even one another (Coeckelberg, 2023; Solaiman et al., 2023). Alongside these social and ethical challenges, the construction, training, and maintenance of large-scale AI systems present substantial environmental and sustainability concerns. These models depend on energy-intensive data centres and high-performance computing infrastructure, contributing to considerable carbon footprints (Crawford, 2021; Bommasani et al., 2021; Floridi, 2023). The environmental impact of AI hardware also extends across its entire lifecycle - from the mining of rare earth minerals required for production to the complex issues associated with electronic waste at the end of its usefulness (Author, 2024).

This situation raises significant concerns related to education, with AI-powered tools posing relevant ethical conundrums about who should adopt such instruments, how and even whether we should adopt AI (Williamson, 2023; Selwyn, 2022). The answers to these questions are, however, not black and white and rather require a nuanced understanding of context and purpose.

Recently, attempts to integrate AI into education have multiplied, prompting major international organisations—including UNESCO (2025); the European Commission (Directorate-General for Education, 2022), or the OECD (2019)—to publish recommendations on their ethical use. In this context, ethics has been framed across multiple dimensions: design (e.g., user privacy and data ownership), use (e.g., maintaining human oversight of artificial agents), and impact (e.g., addressing discrimination, bias, or

dependence on automated responses). However, diverse socio-cultural contexts pose different moral dilemmas related to actions such as resistance, appropriation, contestation, and requests, therefore requiring a nuanced approach to critical participation (Author et al., 2025). Resolution of such dilemmas cannot be accomplished through a universal approach to how we engage or the narrowing to chosen technolog(ies) or actions. Therefore, engagement with ethical principles will depend on critical reflection upon what outcome we wish to achieve with AI. This can result in deliberately eschewing engagement where adoption is not a foregone conclusion and needs to be contested (Perera et al, 2025). In these framings, ethics cannot be presented as checklists to be applied to AI-powered technologies, or guide engagement such as inappropriate content or experiences. These simple conceptions, rather, might introduce the problem of "ethical washing" as the superficial consideration of ethical problems and decisions (Green, 2021; Floridi, 2023).

Rather than merely adapting to existing conditions and oppressive practices, people need to be empowered to question the status quo and take informed, purposeful action aimed at enacting transformative processes (Author, 2023). This calls for transformative agency, as the ability to engage creatively, shaping possible and alternative futures (Stetsenko, 2019). However, no transformation can take place without systematic support and policy making aimed at providing high-quality AI literacies for all.

In this paper, we seek to frame the problem of AI ethics in education conceptually by introducing two theoretical perspectives that underpin the notion of situated ethics and help illuminate the complexity involved in AI use (and non-use). Specifically, we draw on Cultural-Historical Activity Theory, rooted in sociocultural and cultural-historical psychology (Vygotsky, 1978; Leontiev, 1978; Engeström, 1987), together with Bronfenbrenner's Ecological Theory of Development (1994), to explore how ethical decision-making emerges across interconnected educational contexts. By combining these frameworks, we aim to establish a robust foundation for ethical action in education. We then apply this conceptual lens to a set of transnational case studies in K-12 education, illustrating how such a reframing can be translated into practice.

Our research aim is to *conceptualise situated AI ethics in education, with particular attention to teacher ethical agency*. This theoretical aim leads to a practitioner-focused question *In what ways do AI tools in education reshape the situated conditions under which practitioners exercise ethical judgment?*

The remainder of the paper is organised as follows. First, we ground the notion of situated AI ethics through Bronfenbrenner's ecological theory and CHAT, highlighting their complementarity for understanding tensions, contradictions, and agency. We then introduce the critical-ecological activity model and describe its transnational application across seven national contexts. The findings are subsequently discussed through the lens of the ecological levels, showing how ethical decision-making is negotiated across self, classroom, state, cultural, and global dimensions. Finally, we conclude by outlining implications for policy, professional development, and future research on situated AI ethics in education.

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Grounding Situated AI Ethics: Ecological theory and CHAT

Bronfenbrenner's contribution to an ecosystemic view of AI in education

Bronfenbrenner's Ecological Theory proposes that human development unfolds within a series of nested environmental systems, ranging from the microsystem (e.g., school, family) through the mesosystem and exosystem, up to the macrosystem and the temporal dimension of the chronosystem. These systems interact dynamically and reciprocally, with proximal processes between individuals and their environments acting as key engines of development, while socio-cultural change and time shape these interactions (Bronfenbrenner, 1977, 1994). In education, this perspective has informed interventions that move beyond the classroom to include family–school partnerships, illustrating how alignment across systems supports learning outcomes. In higher education, institutional policies (exosystem) and cultural norms (macrosystem) similarly influence student engagement and achievement.

In the field of educational technologies, Navarro and Tudge (2022) argue that classical ecological systems theory, developed in a pre-digital era, no longer fully captures the complexity of technology-mediated development. Their contribution lies in distinguishing between physical and virtual microsystems, recognising that young people now interact across both simultaneously. These digital contexts are shaped by features such as synchronicity, permanence, and publicness, requiring an extension of the Process–Person–Context–Time (PPCT) model to account for digital affordances and constraints. This reconceptualization shifts the focus away from reductive "screen time" debates toward a more nuanced understanding of how platforms mediate proximal processes and identity formation. At the same time, the expanded framework introduces additional analytical complexity, raising challenges for its consistent operationalisation in empirical research.

Sharples (2025) similarly adopts an ecological stance by conceptualising educational systems as integrated wholes in which AI technologies interact with institutional, pedagogical, and ethical dimensions. Drawing partly on Bronfenbrenner's framework, Sharples argues against fragmented AI adoption and instead promotes systemic and institutional innovation. The proposed ten-point agenda is pragmatic and accessible, foregrounding ethics, agency, and human-centred values. Yet, some tensions remain unresolved. While issues of bias, inequality, and over-reliance on AI are acknowledged, institutions are largely portrayed as adaptive systems rather than contested spaces shaped by power relations and epistemic struggle. Without integration with critical pedagogy and socio-political analysis, systems thinking risks sliding into technocratic reductionism. Nonetheless, Sharples' contribution offers a valuable pathway for navigating AI integration in post-digital education while keeping teachers and learners positioned as agents of change.

Building on these perspectives, we argue that applying Bronfenbrenner's ecological framework to AI in education foregrounds ethics and agency as phenomena distributed across multiple levels of influence. In school contexts, AI tutoring systems reshape the microsystem by mediating teacher–student interactions, while the mesosystem is implicated through parental and peer influences. The exosystem includes district policies and vendor practices, and the macrosystem encompasses broader societal discourses on AI ethics, equity, and surveillance. Teachers' decisions to adapt, resist, or reconfigure AI tools in line with equity goals exemplify transformative agency operating across these

layers. In higher education, AI-driven assessment platforms similarly affect micro-level pedagogical relations, meso-level departmental collaboration, exo-level infrastructures and procurement policies, and macro-level norms related to accreditation and academic integrity. Faculty responses, such as combining AI feedback with human judgement or advocating for transparent institutional policies, illustrate how ethical agency is enacted across interconnected systems.

Through an ecological lens, ethical action in AI adoption emerges not as an individual choice but as a negotiated, context-dependent process shaped by intersecting systems. At the same time, Bronfenbrenner's model and its adaptations remain limited in addressing power asymmetries, competing interests, and contested values. Ethical decision-making around AI thus unfolds not only across ecological levels but also within dynamics of resistance, influence, and structural inequality.

CHAT and transformative AI education

Many sociocultural and ecological framings of learning agency adopt a relational approach, emphasising how individual efforts, social interactions, resources, and structural conditions converge in context-bound activities (Eteläpelto et al., 2013). While these perspectives have been influential in showing how agency is shaped through participation in communities and cultural practices, they have also been criticised for implicitly privileging adaptation and socialisation into existing conditions rather than transformation, thus accommodating the world "as it is" (Engeström & Sannino, 2017; Stetsenko, 2019).

Cultural-Historical Activity Theory (CHAT), particularly through its theorisation of transformative agency, offers an alternative. CHAT centres on the activity system formed through the dynamic relationship between the subject, the object of activity, and mediating tools and artefacts (Cole & Engeström, 1993), while also accounting for community, rules, and division of labour (Engeström, 1999). Like ecological approaches, CHAT recognises that agency is context-bound, historically shaped, and mediated by cultural resources within broader political and cultural conditions (Stetsenko, 2019). However, it places stronger emphasis on contradiction, change, and the possibility of transforming prevailing practices, which are shaped by historically layered perspectives and interests:

An activity system is by definition a multi-voiced formation. (…) The re-orchestration of the multiple voices is dramatically facilitated when the different voices are seen against their historical background (Engeström, 1991, p. 14–15, cited in Engëstrom, 2015).

This perspective helps explain why teachers supported by institutional autonomy, professional communities, and resources have far greater scope to develop ethical and pedagogically meaningful AI practices than those working under restrictive conditions. Similarly, learners positioned as active designers and knowledge creators gain qualitatively different opportunities for learning and agency than those confined to passive consumption (Author, 2025a).

Crucially, while ecological approaches often foreground socialisation, CHAT stresses the need to move beyond the status quo to address entrenched contradictions (Stetsenko, 2019; Hopwood & Sannino, 2023). This orientation is particularly urgent in AI ethics, where issues such as algorithmic bias, data exploitation, surveillance, loss of agency, social inequality, and environmental harm demand transformative rather than adaptive responses (Author, 2025a). Transformative agency is both historical and projective, recognising that

present problems emerge from past trajectories while orienting action toward alternative futures (Sannino & Engeström, 2018).

From an educational standpoint, this entails designing mediated activities and cultural tools that enable teachers and students to engage critically and creatively with AI while making visible the ethical decisions and power relations embedded in sociotechnical systems (Author, 2024). Ethical AI education thus involves contextualising AI within local practices, critically interrogating dominant narratives, and developing voice and resistance through the imagination of alternatives (Author, 2025a). These aims can be pursued through learning projects that examine bias, accountability, and political influence in AI systems (Morales-Navarro & Kafai, 2023; Author et al., 2024, 2025a).

Cases such as Google Classroom or Microsoft platforms, with embedded systems like Gemini and Copilot, illustrate these tensions when adopted through institutional or national infrastructures (Kerssens et al., 2023). For actors operating in economically constrained contexts, such technologies may appear efficient and cost-free, yet embed surveillance practices and epistemic injustice, including the marginalisation of Global South knowledge (Miragoli, 2025). Responses may involve resisting specific features or adapting AI systems to reflect diverse cultures and communities (Carmi & Nakou, 2025; Author, 2023a).

Given widespread unawareness of how AI systems operate and shape everyday decision-making (Coeckelbergh, 2023; Pangrazio & Selwyn, 2023), a new digital divide is emerging between those who can critically and ethically engage with AI and those who cannot. Addressing this divide requires transformative AI education that cultivates epistemic agency, enabling learners and educators to question, resist, reimagine, and reshape sociotechnical systems in pursuit of the common good (Author, 2025a).

Method

A critical-ecological Activity Model for AI Ethics in Education

To conceptualise situated ethics in education, we bring together Bronfenbrenner's ecological systems theory and Cultural-Historical Activity Theory (CHAT). Bronfenbrenner highlights the multilayered contexts—micro, meso, exo, macro, and chrono—within which educational processes unfold, emphasising how development and learning are shaped by nested and interacting systems. CHAT introduces a critical, socio-historical perspective, foregrounding contradictions, tensions, and struggles over power that shape activities and practices. While ecological theory illuminates the systemic interplay of environments influencing teachers' and learners' engagements with AI, CHAT insists that these engagements are never neutral, but historically situated, conflictual, and imbued with cultural values and contested interests. Taken together, these frameworks reveal that ethical AI action in education is not a smooth process of adaptation within systems, but a situated and contested negotiation in which actors resist, appropriate, and transform technologies within historically layered contexts. This integrated perspective thus allows us to see AI not merely as a technical or pedagogical tool, but as a socio-cultural artifact

whose ethical implications emerge through ongoing struggles over meaning, justice, and agency across multiple levels of the educational ecosystem.

To help structure our discussion, we assembled Bronfenbrenner's model visually (according to Woolfolk-Hoy et al., 2006) and added the contextualisation, tensions, and contradictions present in the CHAT dynamic model in Figure 1.

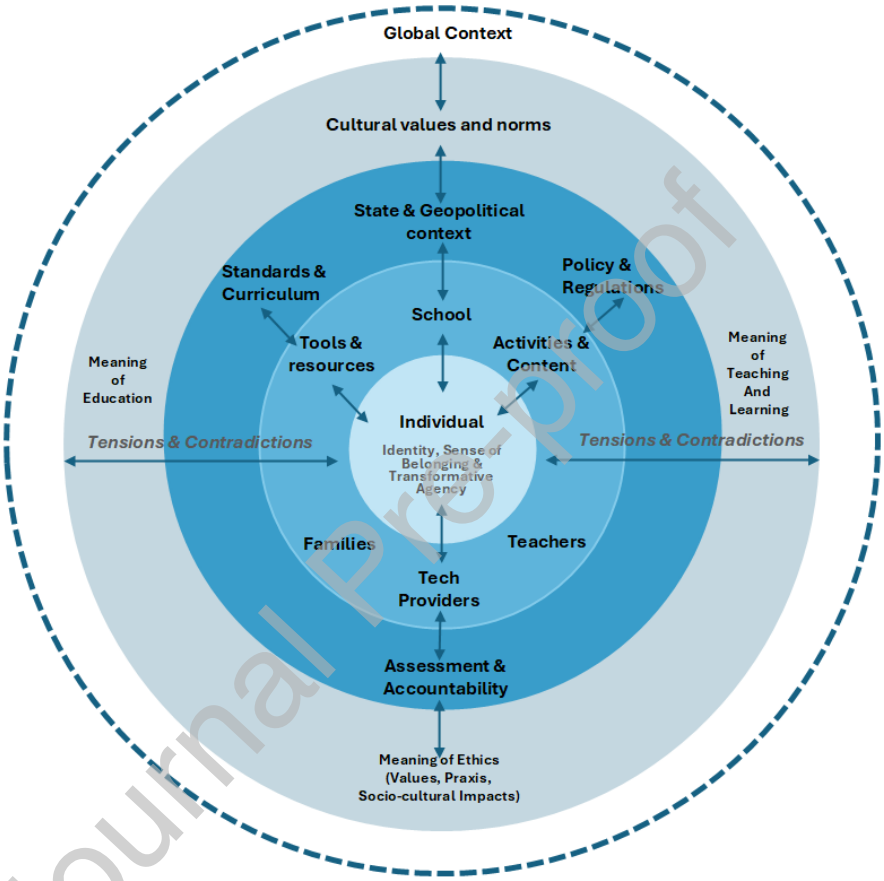

Figure 1 - Ecological Model of Teachers' Knowledge and Beliefs (Woolfolk-Hoy, Davis and Pape, 2006, p. 718) adapted to our critical-ecological model.

At each of the levels of this model, those working within that level need to be aware of their context. They need to be able to recognise the specific ethical issues for their ecosystem entangled with dilemmas, tensions and contradictions. Hence, engaging in ethical decision-making becomes a form of human activity that aims to calibrate such tensions and resolve contradictions. The historical unfolding of human activity means that at any equilibrium, new tensions and contradictions emerge, requiring fresh adjustments.

In using this model to structure our discussion, we must acknowledge that the tensions introduced by the Activity Theory in this model are not clear. We need to consider the fact

that these systems are never separated, but rather entangled and potentially contradictory. Therefore, we present this model as a useful structure for our discussion rather than claim that these are distinct levels.

As we observe in the figure, at the centre of the model lies the individual. Each human engaging with AI is situated not only within a local and national context but also within their own knowledge, attitudes, and skills toward AI. The ethical issues that emerge for an individual vary according to the activities and practices they are involved in and the subject domain, placing them in situations of moral decision-making. For instance, one may ask: Should I use AI even if its use verges on plagiarism? Should I adopt AI knowing that its material conditions of production disrupt local populations through practices such as mining or the labelling of violent content in the Global South? (Arora et al., 2023). Ethical decisions are thus intertwined with identity-building, in terms of how individuals position themselves in relation to technology. Ethical understanding can, therefore, empower teachers and students alike to act with confidence in their choices. Consequently, the "self" should not be understood only as the isolated individual (e.g., the student), but as the individual embedded in family, culture, and social background. These dimensions interact dynamically, and when honoured, empower learners to become actors who can confidently apply their knowledge, adapt to change, and exercise their agency.

At the immediate level of the classroom (micro-system), students and teachers interact to conduct the educational process. However, the micro-system is influenced by the meso-system, where small and medium enterprises (SMEs) and technology providers may enter the scene through the provision of local applications, while researchers studying AI integration may intervene with either observational or interventionist approaches. Between the micro and meso-system, ethical questions arise not only from pedagogical choices but also from how external actors shape practices, values, and available resources.

At the state and national level (exo-system), policymakers influence adoption through standards, curricula, and regulations. However, precision in language is crucial: umbrella terms like AI understood as a conversational agent (like ChatGPT) becomes a broad discourse that can obscure nuances and lead to policies that fail to capture contextual complexities. The use of clear, contextually grounded terminology by policymakers and professional communities is therefore essential to avoid misalignment between discourse, practice, and regulation.

At the level of cultural norms and values (macro-system), it becomes evident that AI is not a neutral tool but one embedded with cultural assumptions. For example, Raus (2022) shows how the European Parliament and the European Commission present AI as a revolutionary force that will transform society positively. In this framing, AI is legitimised and even personified ("it develops itself," "it learns"), while risks are softened as mere "challenges." Citizens are positioned as needing to trust AI and to benefit from its use in both personal and professional lives. This discursive framing, however, risks legitimising surveillance capitalism and the wider spread of information capitalism through official policies. Therefore, generative AI solutions must include cultural content that is representative of users and aligned with institutional contexts. Likewise, standards and regulations should ensure: (a) data collection guidelines that adequately represent cultural and contextual diversity; (b) clear protections of user privacy in the adoption of generative AI; and (c) robust protocols for data encryption, enabling safe use of collected data for research or for retraining large language models. Moreover, care must be taken with notions such as

"inclusivity." The very term "inclusion" implies "otherness," reinforcing existing orders rather than fostering genuine co-developmental processes. Since multiple sources of marginalisation (e.g., age, gender, culture) generate new "others," inclusivity should be approached dynamically, as a process of negotiation and co-construction rather than as a fixed end-state.

At the global level (integrating the macro-system), broader issues arise, particularly the environmental and labour dimensions of AI. As highlighted by Crawford (2021), the carbon footprint of AI systems and the exploitation of workers in the Global South must be critically addressed. Ethical practices deemed acceptable in one context (e.g., using generative AI to train soft skills for future labour markets) may have hidden consequences elsewhere, such as reliance on resource-intensive mining or underpaid labour for data labelling. Therefore, ethical appraisal must go beyond individual "critical thinking" to encompass systemic critiques of interests, power, labour conditions, and geopolitical entanglements. A recurring concern here is techno-solutionism—the belief that technology can solve inherently complex human problems (Selwyn, 2024). As Mochizuki, Bruillard, and Bryan (2025) ask: *What role does UNESCO play in legitimizing—or contesting—the alignment of governments' and Big Tech's political and economic interests?* UNESCO indeed plays a dual role. On one hand, it legitimises alignment by promoting international cooperation and global standards that benefit governments and corporations—for example, through digital education initiatives and open science policies that serve common goals such as sustainability and inclusion. On the other hand, UNESCO contests alignment when it threatens human rights, cultural diversity, or ethical norms, advocating for internet governance, data privacy, and cultural heritage protection. In this way, UNESCO provides a counterbalance to unchecked corporate power by promoting ethical guidelines and policies prioritising the public good. Nevertheless, as Linderoth, Hultén, and Stenliden (2024) argue, a recent analysis of AIEd policy documents by major international organisations reveals a persistent neoliberal, techno-solutionist framing of AI in education, often underpinned by dystopian "Big Brother" imaginaries.

Application and Results

Transnational application of the Model

To operationalize the Critical-Ecological Activity Model for AI Ethics in Education from a transnational perspective, we developed a comparative table mapping the different ecological levels—Self, Classroom/Group, State, Cultural Norms, and Global—within K-12 education across a selection of countries. The table serves as a heuristic device to illustrate how ethical decision-making around AI unfolds at each level, and is shaped by specific cultural, political, and institutional contexts. For each cell, we drew on key sources such as mass media articles, policy documents, case studies, institutional websites, and research publications that exemplify how questions of AI ethics are being debated and enacted.

The exercise was launched within the group of experts representing each context (i.e., the authors of this article) involved in the EDUsummIT Sessions (TWG5). Each expert represented a country in which they are actively engaged in research, teaching, and policy-making activities. Participants also held a substantial level of seniority, ranging from 10 to 30 years of experience in the field of educational technologies.

The individual investigation of grey literature was conducted between June and September 2025 through online collaboration, with each author contributing several documents to the table. Subsequently, between October and November, two researchers reviewed the sources for alignment and coherence and provided feedback. In December, each author revised the final complete country report (presented in Annex 1).

The full report was then used by the first author to develop a synthetic table, which was subsequently validated by each country expert prior to the final submission of this article. This comparative mapping method is an exercise to make visible the situated nature of ethical practices, showing not only the similarities but also the tensions, contradictions, and unique trajectories that emerge across national contexts and levels of the ecosystem. Comparing the different ecological levels across our selection of countries (Annex I), illustrates the similarities and differences between these national contexts but also the highly complex nature of ethical decision-making about AI in Education.

Table I - Mapping national AI-ethics approaches onto the CHAT ecological mode*

Case	Self	Classroom / Group	State / Geopolitical	Cultural Norms	Global
Australia	High AI access: ethical use framed as individual responsibility.	Teacher discretion constrained by school and system policies; widespread uncertainty.	Federal guidance promotes cautious AI use; child protection prioritised.	Conservative stance toward technology in schooling.	Tension between AI literacy for workforce and risk-averse schooling.
Finland	Early AI exposure with low awareness of data, ethics, and governance; equity gaps.	Strong teacher autonomy but curricular and regulatory ambiguity.	Tension between legal responsibilities (e.g. GDPR, the AI Act) and the institutional capacity to enforce them.	Fragmented public imaginaries (utopian vs dystopian).	Tension between economic competitiveness and democratic-social aims of education.
England	High student and teacher uptake of GenAI with mixed ethical comfort.	Governance decentralised to schools or Trusts; limited ethical guidance.	Pro-innovation regulation with technical safeguards.	Public scepticism; concern over automation and loss of human judgment.	Aspires to global AI leadership while managing ethical and social risks.
France	Growing GenAI use alongside strong public anxiety about risks.	Institutional guidance unclear; teachers use AI mainly for preparation and assessment.	Strong national AI strategies focused on efficiency and productivity.	Utilitarian vision of AI aligned with economic liberalism.	Positions itself as an AI leader through investment and innovation rankings.
Italy	Teachers and learners pressured to adopt AI amid uneven support. Ethical use framed as individual responsibility.	AI used mainly for content creation; integrity concerns persist.	Strong EU-driven compliance focus (GDPR, AI Act); schools as deployers, exceeding local capacity.	Hierarchical pressure on schools. AI seen as driver of modernisation, much needed to thrive in a competitive world.	Dependent on EU frameworks; caught between innovation pressure and risk aversion.
New Zealand	AI literacy framed through cultural identity and critical questioning.	High teacher experimentation within evolving, risk-averse guidelines.	Curriculum reform balances future skills with delayed tech introduction.	Bicultural commitment shapes AI governance and classroom use.	*Glocal* model aligning international frameworks with indigenous rights.

South Korea	Strong expectation of universal AI readiness.	Nationwide rollout of AI textbooks; compulsory teacher training.	Centralised, long-term national AI strategies.	Broad societal acceptance of AI as progress.	Global frontrunner narrative in AI readiness and education reform.

* The Discussion is based on the extended version (Annex 1),.

At the level of the 'Self', teachers and students are increasingly using AI in all our sample localities but not always with a full understanding of how AI functions and the associated ethical issues (e.g. Finland, England). Use of AI appears frequently as a responsibility of the teacher's professional activity, namely, presented as a personal choice. Developing confident and ethical personal decision-making can hence be seen as an important desired educational outcome (e.g. New Zealand). However, in some areas, teachers can sometimes feel under pressure to use AI and be ill-supported (e.g. Italy) or concerned about how they are using AI (e.g. France, England).

While personal choice regarding AI is highly valued, consideration of the other ecological levels shows that ethical decision-making is always situated within wider contexts. At the *Classroom/Group* level, strong professional autonomy in some settings (e.g. Finland) contrasts with stronger institutional autonomy in others (e.g. England). School policies may support ethical AI use (e.g. Australia), yet are not always consistently available (e.g. England, France), and may reflect either relatively risk-averse (e.g. New Zealand) or more permissive approaches (e.g. South Korea). In some contexts, diversity and inclusion also shape pedagogical decision-making around AI (e.g. Italy). Personal ethical decisions must therefore be understood in relation to school policy, diversity, and structures of autonomy, which can act as either enablers or constraints.

Individuals and institutions are further embedded within the wider *State* level, where both convergences and differences emerge across national approaches to AI in education. Our examples also reveal contradictions across levels of influence. In some countries (e.g. South Korea), national strategy and institutional AI use appear aligned; in others, tensions arise between national aspirations and local capacity, particularly in terms of expertise (e.g. Finland, England), shifting policy orientations (e.g. New Zealand), or the distribution of responsibility (e.g. Italy).

These contradictions persist and multiply at the *Cultural Norms* level. Across all countries considered, societal attitudes towards AI varied considerably and were shaped by multiple public and private actors. Some contexts maintained broadly positive orientations (e.g. South Korea), while others adopted more cautious positions (e.g. Australia) or highlighted mismatches between cultural priorities and dominant AI systems (e.g. New Zealand). Conservative cultural norms may also generate tensions with emerging AI ambitions (e.g. Italy) or parental resistance to proposed uses (e.g. England). In other cases, specific cultural traditions (e.g. French liberalism) orient AI in education towards particular goals, such as efficiency.

Although all nations operate within a *Global* context, the interpretation and enactment of international trends and policies vary substantially. Priorities related to growth and international competitiveness can drive specific AI ambitions (e.g. Finland, Australia, France, England), sometimes in tension with institutional or individual values. Some countries critically filter global initiatives through national priorities (e.g. New Zealand),

while others position AI decisions within supranational legal frameworks, such as the EU in the case of Italy.

The ecological model therefore shows that, as tensions and contradictions emerge across levels, agency is continuously negotiated across ecological layers. At the same time, individuals should not be seen as passive recipients of external forces, but as actors operating within dynamics of resistance, influence, and structural inequality. This is where the historical activity theoretical perspective, with its insistence on the non-neutrality of technology and its attention to systems of power and resistance, becomes essential to our analysis.

Discussion

Across the seven national contexts examined, a complex picture emerges of how teachers navigate the ethical challenges introduced by GenAI within deeply situated conditions. In Finland, strong teacher autonomy coexists with regulatory ambiguity and uneven support for children's AI awareness, creating tensions between professional discretion and systemic uncertainty. Australia presents a more cautious environment, where restrictive school policies, cultural conservatism around minors' technology use, and uneven teacher confidence limit opportunities for meaningful experimentation. South Korea, by contrast, illustrates a highly coordinated national strategy in which policy initiatives, AI-enhanced textbooks, and expectations of technological readiness position teachers as central actors in accelerated digital transformation. Italy reflects a hybrid landscape marked by institutional fragmentation, regulatory oversight, inequalities in teacher preparation, and cultural narratives oscillating between innovation enthusiasm and anxiety over data protection. France, finally, shows how public concern about risks, utilitarian policy discourses, and the absence of unified directives create a setting in which teachers navigate ambiguity while students engage with AI in more modest and uneven ways than often assumed.

Together, these cases highlight how ethical decision-making with AI is situated within historically produced, culturally mediated, and institutionally structured conditions, aligning with research on professional learning and agency (Eteläpelto et al., 2013). They also point to the need for a framework able to capture how ethical action emerges within broader educational ecosystems, not only through individual competencies. Accordingly, we argue that neither ecological approaches (Bronfenbrenner, 1986) nor Cultural Historical Activity Theory alone (Engeström, 1999) fully capture the complexity of ethical AI use in education. Brofenbrenner's ecological systems theory does not capture the inherent tensions and contradictions involved in ethical decision making, while Cultural Historical Activity Theory does not highlight the levels of operation from individual to meso to macro. When ecosystems are understood as socio-historical activity systems, ethical decision-making appears as a practice shaped by tensions and contradictions. Following Bélisle-Pipon et al. (2022), ethics here concerns not merely knowing principles but acting ethically within systems that politically, institutionally, and professionally support such action.

AI systems are never neutral tools (Coeckelberg, 2023); they embed cultural assumptions, economic and political interests, and power relations (Crawford, 2021), mediating human activity in distinctive ways (Hopwood, 2023). For example, when under-resourced schools

adopt ChatGPT as a standard tool, epistemic injustice may arise through the marginalisation of minority languages and perspectives. Teachers who seek alternatives such as Jan.ai or GPTforAll may be institutionally sidelined, while students may internalise deficit perceptions shaped by these systems. Ethical responses may therefore include resistance, experimentation with alternative tools, or critical classroom discussion, constituting forms of transformative agency (Green, 2021; Author et al., 2025).

Through our model shown in Figure 1, ownership can be seen as an ethical concern.. Academic integrity is challenged by the blurred boundary between AI-supported performance and authorship. Ballale and Pannilage's (2025) review highlights how minimal prompting can undermine claims of understanding and critical insight, raising dilemmas that vary across socio-historical and cultural contexts.

Classroom practices are thus embedded in wider systems shaped by global and social dynamics. Ethical responses to AI bias, opacity, and data extractivism (Bélisle-Pipon et al., 2023) intersect with power relations, including policy pressure without adequate institutional guidance. Our model proposes a layered approach, from individual agency to socio-cultural, technological, and economic structures, whose interdependence is essential for supporting ethical practices as AI transforms education.

Conclusion and Recommendations

More than ever, human technological creations raise existential questions about what is human and what is not. The moral use of instruments that mimic human responses remain an open question requiring both conceptual and empirical inquiry. In this study, we argue that AI ethics in education cannot be reduced to universal assumptions of "good use." AI systems, understood as socio-technical and ecological assemblages shaped by historical, cultural, political, and economic forces, generate contexts of complexity and ethical dilemma. To address this, we combine Bronfenbrenner's ecological theory with Cultural-Historical Activity Theory to show how ethical decision-making emerges across nested systems marked by tensions, contradictions, and power asymmetries. Through this critical-ecological lens, agency appears as situated and negotiated, shaped by structures that both enable and constrain ethical action. The national case studies illustrate how AI ethics is enacted differently across cultures, regulatory environments, institutional conditions, and global pressures. Consequently, ethical interventions must be situated and transformative, empowering educators and learners to interrogate AI critically, resist harmful practices, and co-create more just digital futures. A multi-layered and dynamic model of AI and data ethics thus offers a way to engage with technologies that increasingly resemble human intelligence.

Like any conceptual model, our work should be considered and applied in light of its limitations. The model has not been rigorously validated but is instead demonstrated as an analytic instrument. It draws together two highly established frameworks for analysing education systems, to capture the complexity of ethical decision making relating to the use of AI. Further work would be required to validate the veracity and applicability of the proposed conceptualisation. Relatedly, attempting to provide a general framework that accounts for the diversity of educational systems, and their contextual considerations may reduce the utility of the model. We have attempted to showcase how the model can be applied to compare levels of ethical decision making and their tensions. Tools to support ethical decision making within particular contexts may be more easily applied if local

parameters are specified (e.g. cultural values and norms, policies and regulations). However, defining these elements may ultimately limit critical ethical decision-making, so care needs to be taken when attempting to apply the model in context.

Insights from the UNESCO Edusummit Working Groups can lead recommendations overall (Phillips & Fisser, 2025). Across TWG1, TWG3, and TWG5, emphasis was placed on cultural embeddedness, co-learning, the use divide, and participatory co-design with marginalised communities. Moving forward, policymakers must create conditions that support teacher agency while resisting both top-down imposition and uncritical adoption. Practitioners need pedagogically grounded literacies that preserve human values and meaning- making. More broadly, cultivating AI ethics requires collective action beyond schools, including regulation, corporate accountability, interdisciplinary research, and international collaboration to ensure AI in education contributes to human flourishing (Author, 2025). Therefore, a key implication for education is that ethical engagement with AI and data cannot be fostered through information-focused training alone. Professional development should instead create spaces for contextualised critique, critical stance-taking, and resistance to oppressive practices and power imbalances. Democratic participation requires involving diverse actors—students, teachers, families, and marginalised communities—in questioning and co-designing equitable digital futures, potentially through local initiatives that can scale into cross-boundary and cross-national collaborations.

For educators' professional development, local scenarios and cases can be mobilised to explore political, professional, and personal positionings. While remaining attentive to universal ethical principles, domain-specific cases grounded in concrete decision-making can support the co-design of ethical practices. Students should likewise engage in ethical reflection through AI inquiry or design projects, critically examining societal impact, justice, privacy, and bias, supported by evidence-based argumentation (Author et al., 2024). Such practices enable learners to interrogate existing data-driven systems and envision alternatives.

In line with work applying Bronfenbrenner's framework to educational action (Navarro et al., 2022), attending to multiple systemic levels supports professional development across roles, from educators and technologists to developers, policymakers, families, and civil society. While AI presents opportunities for enhanced interaction, personalisation, and critical engagement (Yeo, 2023), challenges persist, including policy–practice gaps, insufficient professional development, static frameworks, and risks to human agency as power concentrates in the edtech industry (Author et al., 2025a; UNESCO, 2025).

As for future research, the agenda should include systematic reviews as a method for mapping the field. In parallel, more specific empirical studies could examine the tensions and contradictions emerging across selected dimensions through empirical studies, for instance between the individual and classroom/institutional levels. Transnational comparative studies may also focus on cultural norms and their influence on policy-making processes, particularly in relation to how ethical AI frameworks are interpreted and enacted across contexts.

Overall, we hope this work offers a strong rationale for recognising that ethical AI initiatives can easily become well-intentioned yet inequitable practices when detached from situated perspectives. The challenge ahead is therefore to cultivate collective, transformative

agency across educational ecosystems capable of shaping more ethical, democratic, and sustainable AI futures.

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Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.