Digital Society (2025) 4:49
https://doi.org/10.1007/s44206-025-00203-9

ORIGINAL PAPER

"Where is Agency Moving to?": Exploring the Interplay between AI Technologies in Education and Human Agency

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Received: 1 November 2024 / Accepted: 12 May 2025 / Published online: 11 June 2025

Abstract

This study explores the relationship between human agency and the use of sociotechnical AI technologies in educational contexts. While AI applications in education promise benefits such as personalised learning experiences and enhanced efficiency, empirical evidence supporting these claims remains limited, particularly regarding their implications for agency across different levels. Reflecting on these issues, this research critically evaluates how these technologies impact agency dynamics, namely on the subjective, intersubjective, and collective dimensions of agency as perceived by educators. The current study forms part of a broader Educational Design Research project, structured across multiple stages (including a Systematic Literature Review, a Delphi study, and focus groups with teachers). Drawing on this triangulated methodological architecture, the paper specifically focuses on the qualitative analysis of discussions about how AI systems may transform human agency across different levels. This methodology facilitates a comprehensive examination of both the opportunities and risks associated with the increasing integration of AI in educational settings. Insights gathered reveal that educators present a layered understanding of their students' subjective agency but may overlook the broader intersubjective impacts of AI systems, potentially leading to narratives that envision a future where the role of teachers is diminished. While the immediate focus is on understanding educators' perceptions of agency transformations through AI integration, the study also contributes to a wider. Objective informing the design of a professional development framework for teachers. In particular, the research aims to provide critical foundations for the development of pedagogical interventions that intentionally address agency within educational contexts where AI systems are increasingly present. education, providing meaningful substance for debates among educators, policymakers, and researchers.

Keywords Teacher agency · Artificial intelligence in education · Professional development · Training · Human agency · Participatory research

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1 Introduction

In an age of increasing automation and technological reliance, the dynamics of agency are evolving. Interactions with sociotechnical systems, especially Artificial Intelligence (AI), present new challenges and opportunities for individual and collective agency. In response, there is a pressing need to foster forms of agency that are not only personal but also relational and collectively distributed, grounded in individuals' capacity for internal conversation, which enables them to reflect on and shape their engagements (Archer, 2003), and in their interdependence with others and with the natural world in which we live and learn (UNESCO, 2021).

More recently, the interplay between human and non-human entities has challenged the idea of agency as an individual property. These non-human entities can include machines, algorithms, technologies, animals, and even objects or environmental factors. Thus, debates have been exploring the extent to which agency is distributed across a network of actors, both human and non-human (Deleuze & Guattari, 1980; Haraway, 1985, 2016; Latour, 2005, 2018). Latour (2018), in particular, explores how the alignment (or misalignment) between macro-level planetary concerns, meso-level institutions, and micro-level everyday actions is entangled, calling for multiple levels of agency. These discussions hold particular significance in helping remember and actively engage with our shared agency within this trading zone. As Latour (2014, 2018) suggests, there are two main values to this approach: first, it allows us to identify potential actants before they become actors; second, it fosters a connection between citizens and their concerns, linking them to their surroundings and shared environment, gradually shaping a common world to be collectively built.

Building on these broader debates on distributed and relational agency, this paper turns to the field of education as a critical space for exploring how agency is experienced, challenged, and shaped in the age of AI. Education is not only where individual autonomy is cultivated, but also where collective responsibilities are negotiated.

In light of these concerns, this study forms part of a broader Educational Design Research (EDR) project, structured across multiple stages. The research has progressed through a Systematic Literature Review (SLR), a Delphi study employing Futures Studies methodology, and focus groups involving teachers and trainers from K-12 and higher education sectors. In this way, the study builds on a triangulated methodological architecture, drawing insights from critical mapping, scenario exploration, and empirical inquiry. Together, these phases aim to collaboratively inform the design of a professional development course focused on agency and AI integration. While the present paper primarily focuses on the findings from the focus group study on the theme of agency, it is situated within this wider EDR framework, which also engages with the regulatory and policy implications of AI in education. In particular, the findings highlight the absence of clear agency frameworks to guide the ethical adoption of AI technologies, which is an issue that will be further explored through the subsequent design, implementation, and evaluation stages of the training project.

To explore these questions in greater depth, the next subsections of the introduction elaborate on two core foundations: first, by tracing how the concept of human agency has evolved across philosophical, psychological, and sociological traditions, and second, by exploring how agency has been framed and fostered within educa-

tional contexts. These discussions then lead into a framework for examining how AI affects agency on three interconnected levels (subjective, intersubjective, and collective), which structure both the theoretical framing and the empirical analysis presented in the paper.

1.1 The Concept of Human Agency

The concept of human agency, which can be largely defined by the capacity to act independently and make choices that influence one's environment, holds profound significance for human and societal development (Bandura, 2001). As a temporally embedded process, shaped by the past, oriented towards future possibilities, and responsive to present contingencies, it allows individuals to explore and reconfigure their relationship to social structures, which are themselves temporal and relational. Social actors continuously shift their orientations within overlapping temporal contexts, enabling them to engage in flexible, situated action (Emirbayer & Mische, 1998). This notion extends beyond mere individual decision-making, encapsulating social, cultural, and technological dimensions that shape collective experiences and behaviours. In a world characterised by rapid technological advancements and evolving societal norms, understanding agency has become increasingly critical, particularly within the realms of education. The ability to assert agency is not only foundational for personal development but also key for collectives, fostering responsible citizenship, engaged practices, and contextual-relevant frameworks for action within societies (UNESCO, 2021).

Debates surrounding agency have long focused on the nature of free will, moral responsibility, and the tension between individual autonomy and social structures. During the Enlightenment, thinkers framed human freedom as a response to deterministic views rooted in religious morality (Biesta & Tedder, 2006). People were seen as wilful beings, capable of independent judgment and autonomous action, embodying the Enlightenment ideal of rational individuals with moral agency. Philosophical perspectives on agency evolved to include both normative, non-rational action (influenced by Kantian ethics) and rational, instrumental action, later developed by American pragmatism and Continental phenomenology. The former reflects a moral will, where actors (individually or collectively) engage in moral action (Kant, 2005), while the latter frames agency as rational, goal-oriented behaviour to achieve personal interests or fulfil material needs (Marx & Engels, 1976).

Throughout the early modern period, questions of personal identity and consciousness began intersecting with concepts of agency, with existentialists like Sartre highlighting the importance of individual responsibility in one's choices (Sartre, 1943). By the 20th century, sociological thought had expanded to explore how agency is deeply influenced by historical and social contexts, investigating its embeddedness within socio-economic structures and power dynamics (Foucault, 1975). This exploration led to the development of theories aimed at bridging the structure/agency dualism. Giddens (1991) proposed that social structures emerge from repeated patterns of human action and are simultaneously shaped by, and constraining of, that activity, thus placing structure as both a product and a constraint of agency. Bourdieu (1990) similarly argued that habitual patterns, or practices, become structure over

time, guiding future actions. However, reactions to Giddens's theory emphasised that agency is not merely the repetition of patterned action; it also encompasses the ability to break with established rules, reflecting thought, reflexivity, and creativity (Emirbayer & Mische, 1998).

The rise of phenomenology introduced discussions about self-ownership and the pre-reflective experiences of causing actions, deepening the understanding of how individuals experience agency. Within the framework of social cognitive theory, Bandura (2006) offers one of the most comprehensive accounts of human agency and remains a central reference in educational and developmental psychology. His theory acknowledges the contribution of genetic heritage in providing the neural structures and mechanisms necessary for distinctively human traits like generative thinking, symbolic communication, intentionality, foresight, self-regulation, and reflective self-awareness. It rejects the dualism between individual agency and disembodied social structures, positing that humans intentionally influence their functioning and circumstances. Bandura (2001, 2006) identifies three forms of agency: individual, proxy, and collective, each playing a distinct role in how individuals and groups interact with the world and shape their existence. Individual agency is characterised by a person's ability to exercise control over their own actions. For Bandura, self-reflectiveness, the metacognitive ability to observe and evaluate one's thoughts and actions, adjusting strategies as needed to accomplish goals, is the most distinctive feature of human agency. This capacity for reflection enables individuals to align their actions with moral standards, making agency not just a matter of execution but also of ethical and moral self-regulation.

Beyond individual agency, this author is also one of the few major theorists to develop the concept of proxy agency, which occurs when a person depends on others who have the necessary resources, skills, or authority to act on their behalf. While this form of agency can be crucial for achieving certain outcomes, it also creates a reliance on external agents, potentially leading to a diffusion of personal responsibility and affecting moral accountability. This is particularly pertinent in the context of AI and education. Contemporary uses of AI systems, whether through adaptive learning platforms, generative tools, or automated feedback mechanisms, frequently involve students and teachers delegating cognitive or pedagogical tasks to technological agents. Bandura's conceptualisation helps unpack the psychological implications of such delegation, including how it affects motivation, ownership, and accountability. This dimension of proxy agency is still underdeveloped in many contemporary theories of agency, which tend to focus either on individual autonomy or distributed, collective enactments without addressing the intermediary or surrogate roles played by technologies.

On the other hand, collective agency arises when individuals engage together to achieve shared goals. This form of agency is distinguished by not merely being the sum of individual contributions but emerging from the synergistic interactions among group members, where each plays a key role. It is especially significant in social and educational settings, where a sense of belonging and shared responsibility fosters meaningful endeavours. Bandura argues that these three forms of agency often intermingle.

1.2 Human Agency and Education

The 1960s and 1970s saw a resurgence of the New School movement, originating at the start of the century, which advocated for greater democratic involvement in education. This shift was, in part, a reaction to the impacts of industrialisation, which had turned traditional schooling into a standardised and conformity-driven system. Influenced by socialist and anarchist ideals, New Schools aimed to create spaces where students could develop freely and critically engage with societal norms and structures. However, it wasn't until the 1990s that education fully pivoted toward fostering learner autonomy. This shift focused on students' responsibility for their own learning (Jones, 2007) and was influenced by Carl Rogers's humanistic approach (Rogers, 1983). In terms of learning, agency is seen as both a process and an outcome. According to Bandura (2001), learners with agency can bring about things intentionally and be responsible for their self-development, adaptation, and self-renewal. At the individual level, a robust sense of agency enhances motivation, enabling to respond to challenges with resilience. Research indicates that high self-efficacy correlates with sustained engagement and achievement across various contexts (Vera et al., 2014). Initiatives prioritising the cultivation of agency encourage students to embrace autonomy, build confidence, and engage in self-directed learning (Davis-Keen, 2005).

While crucial for individual achievement, the field of education extends far beyond the outcomes of personal agency. Educational environments are privileged spaces for cultivating the political foundation of democracies (Dewey, 1916) through collective agency, enabling students not only to take ownership of their learning but also to engage in dialogic practices that reflect the interests, dynamics, and unique experiences of their institutions. This interplay between individual and collective agency is also demonstrated by Zumeta et al. (2016), who found that shared emotional experiences and group identification in collective activities enhance team achievement, highlighting the importance of community in nurturing agency. Collaborative learning experiences in educational settings foster not only academic achievement but also social connectedness and shared responsibility – critical components for building cohesive societies (OECD, 2012). Thus, experiencing opportunities for agency within educational contexts enables students to recognise their role within a larger community, fostering a sense of belonging and collective participation. In this regard, Dewey's (1916) advocacy for an education based on principles of experimental democracy gains renewed significance.

1.3 Education and AI

Contemporary research highlights the potential of Artificial Intelligence in Education (AIED) to personalise learning experiences, streamline administrative processes, and offer tailored pedagogical support (Wang et al., 2023; Mousavinasab et al., 2018). Intelligent tutoring systems (ITS) and adaptive learning platforms can now analyse large datasets on students' strengths, weaknesses, preferences, and learning styles, creating customised learning pathways that adjust dynamically to individual needs (Miao et al., 2021; Luckin et al., 2016). More recently, greater attention has been given to the fact that students are neurodiverse, bringing with them a range of assets

derived from their experiences at home, within their communities, and across their cultural backgrounds. In response to this diversity, researchers have recognised that AI systems, with their capacity to detect patterns in complex datasets and to generate customised content, have the potential to extend beyond the most common learning trajectories and to offer personalised educational experiences that would be difficult for individuals to produce unaided (U.S. Department of Education, Office of Educational Technology [USDOE-OET], 2023). Moreover, embedded adaptive assessments facilitate real-time feedback and allow for continuous monitoring of learners' progress, engagement, and emotional states, thereby supporting more responsive teaching practices (USDOE-OET, 2023; Luckin et al., 2016). AI-driven tutoring support, through interactive simulations and virtual dialogues, can further enhance comprehension by delivering targeted feedback and gradually refining instructional strategies through ongoing learner interaction (Wang et al., 2023; Khosravi et al., 2022).

As AIED systems continue to collect and analyse performance data, they increasingly enable early identification of students at risk of falling behind, thus allowing for timely pedagogical interventions. Beyond supporting individual students, the use of AI in school administration is often seen as a way to strengthen collective agency, enabling institutions to make more informed decisions, better allocate resources, and respond more thoughtfully to the needs of their communities.

Although these technological advancements are often celebrated for their efficiency and their potential to enhance learning and education quality, they also carry the risk of diminishing individuals' sense of control and autonomy (Moore, 2016). Studies indicate that the design of human-machine interfaces significantly impacts users' perceived agency, with greater agency associated with human-like interactions (Berberian et al., 2012; Obhi & Hall, 2011). This necessitates a critical examination of how we perceive and integrate these sociotechnical systems into educational practices, ensuring that they serve as tools that provoke our collective engagement towards agency. Furthermore, the ethical implications of agency extend beyond personal development to influence societal norms and values. A diminished sense of agency can lead to moral detachment and detached behaviour, affecting how individuals attribute responsibility for their actions (Haggard & Tsakiris, 2009). In educational contexts, sense of agency has also a role in equipping students with the ethical reasoning skills necessary to question complex societal challenges, promoting accountability and moral engagement with life (Bandura et al., 1999).

As educators (and society more broadly) continue to engage with systems dominated by techniques that prioritise rationality and efficiency (Ellul, 1954), which are deeply embedded in the secular liturgies of school practices, their stance is particularly necessary for reviving the spirit that animates schools and preserving their organic capacity to respond to their own experiences. Practically, this means that teachers are expected to play a meaningful role in shaping the policies they are tasked with enacting, alongside families and community members, who are critical partners in educational development (European Union, 2018). This need for agency is especially relevant in the context of technological advances and narratives surrounding AI's autonomy. Pasquinelli (2020) argues that labour is at the root of the historical development of AI, which is shaped by a composite of dynamics reflecting social

relations and power structures, where the current control is exerted by high-tech companies. This understanding highlights why agency cannot be separated from collective dynamics and historical contexts. Teacher agency, therefore, is also the result of interactions between personal capabilities and the environmental factors influencing their actions (Priestley et al., 2015). In an era of high automation, educators have a role in reclaiming the significance of agency and challenging the contested narratives surrounding automation and work. As AI evolves into a regime that replaces an episteme of causation with one of automated correlations (Pasquinelli, 2020), educators are called to cultivate spaces where collective knowledge and agency can flourish. This perspective has direct implications for the way teacher professional development is conceived and designed, as well as for a comprehensive understanding of human and societal development processes, positioning collective agency as one of the ultimate goals of education.

So, in the context of education, three levels of concern shape our understanding of how AI systems could impact agency: the subjective, intersubjective, and collective levels. On the subjective level, agency is explored through dimensions that examine how AI may affect human experiences in areas like decision-making, moral judgment, deliberate action, achievement, individuation, and project ownership. Intersubjectively, agency is negotiated among peers, between teachers and students, and among other stakeholders, including families. Here, power dynamics, teachers' status, sense of belonging, and scaffolding experiences come into play. Collectively, agency is examined through situational freedoms within institutional policies, collective deliberation and achievement, political development, and democratic practices.

2 Method

2.1 Research Question

In this context, this study aims to understand how teachers conceptualise the transformation of human agency in relation to AI in education, underpinned by the theoretical and methodological framework of dialogic ethics. The research is based on a qualitative analysis of data collected from focus groups consisting of teachers, professors, and teacher trainers, as part of a broader Educational Design Research project aimed at designing a training programme for K-12 educators that addresses the integration of AI in education, along with ethics and agency. While the initial purpose of the study was to explore collective perspectives on what a training programme on such themes should include, a significant portion of the generated text – though not directly focused on that theme – was closely related to sociotechnical AI systems and education. This prompted a new approach to data analysis, leading to a revised goal deemed highly significant for understanding the role of agency at the intersection of these technologies and pedagogical practices, as perceived by one of the key educational actors: the teachers. Therefore, the research question for this phase was defined as follows: How do teachers conceptualise the transformation of human agency in relation to AI in education on subjective, intersubjective, and collective levels?

2.2 Participants, Implementation, and Data Analysis

Participants were selected based on their experience in K-12 teacher education and their proficiency in Spanish, the primary language of the research centre. Initially, convenience sampling was used, followed by snowball sampling to ensure cultural diversity. Out of 40 invitations, 19 educators from five countries (Colombia, El Salvador, Portugal, Mexico, Spain) participated, all of whom held roles in pre-service or in-service teacher education. The study involved a balanced representation of males ($N=10$) and females ($N=9$), with a mean age of approximately 45 years. Among them were professionals in various roles, including a Director of Digital Transformation in Higher Education, several associate professors, and former K-12 teachers who held significant positions in the Ministry of Education's Master Plans. The collective expertise of these participants spanned various aspects of education, including research methods, teacher training, and the integration of information technology in educational settings, reflecting a strong emphasis on the intersection of education and technology.

In 2022, they engaged in discussions of hypothetical scenarios – dystopian perspectives on AI use in education derived from a Delphi method expert group – based on earlier research (Mouta et al., 2023) across four sessions to ensure data saturation. Conducted virtually via Zoom due to pandemic constraints, these sessions gathered a range of perspectives that contributed to the programme's development. Sessions were recorded, transcribed using AI software, and verified by two researchers. This phase of the analysis combined deductive and inductive methods, identifying themes based on existing literature, earlier project phases, and insights from raw data. As the purpose for this phase of the study is to understand teachers' perspectives on how the sense of agency can be influenced or transformed by the use of AI systems in education, the entirety of the data was once again explored through different search strings, namely: "agency", "autonomy", "author", "authorship", "capacity for action", "control", "decision-making", "independence", "initiative", "personal sovereignty", "self-determination", and "self-governance". This approach emerged from the observation that participants often discussed the topic of human agency using various related terms, which, although not explicitly labelled as "agency", resonated within the same conceptual universe. This practice of broadening the scope to include associated concepts ensured a comprehensive understanding of how teachers perceive agency. The final selection of categories was determined through two reliability tests conducted with a two-month interval between coding stages, as well as an inter-rater analysis performed by two researchers who compared the data directly (in the second stage) and reached a consensus.

2.3 Results Communication

This section outlines the main findings from the focus group discussions, addressing the research question that guided this phase of the project: How do teachers conceptualise the transformation of the sense of agency in relation to AI in education on subjective, intersubjective, and collective levels?

The results are presented in a structured table format that delineates the findings across different levels of agency (cf. Table 1). Each row of the table is categorised by (1) "Level" (subjective, intersubjective, collective), highlighting the context in which teachers discussed agency. Within each level, specific (2) "Dimensions" are outlined, reflecting the key aspects of agency that emerged during discussions. Accompanying each dimension is a (3) "Description", which contextualises the findings and provides a concise overview of the issues identified. Furthermore, (4) "Examples" from the focus group discussions are included to illustrate the points made within the descriptions.

3 Discussion

This discussion section is organised into two main parts, drawing on the qualitative data presented in Table 1. The first explores how agency is perceived by teachers across individual, relational, and systemic dimensions of school life, and how AI sociotechnical systems may interfere at each of these levels. Particular attention is given to how teachers interpret the evolving role of AI in relation to students' developmental processes, the professional identity and responsibilities of educators, and the democratic ethos of educational institutions. The second part presents an integrative analysis that identifies key trends across the three levels, highlighting patterns and interdependencies between forms of agency. These include tensions between automation and authorship, the evolving nature of proxy agency, and the need for moral scaffolding and shared responsibility.

3.1 Exploring Agency across Subjective, Intersubjective, and Collective Dimensions

3.1.1 Subjective Level

Teachers expressed concerns about fundamental developmental processes, such as individuation and moral development, acknowledging their role as committed keepers of the educational mission, which extends far beyond the mere goal of content learning (Biesta, 2020). They also highlighted specific meta-cognitive and affective processes, which serve as qualitative differentiators for holistic development – a responsibility shared by all educational actors and formal institutions. These processes include the architecture of decision-making, encompassing critical reasoning, recognition of power structures, and the consideration of diverse options.

In terms of critical reasoning, teachers recognise that schools have a responsibility to create conditions that help students understand the personal variables influencing their choices throughout life; factors which, as many vocational psychologists have suggested (e.g., Guichard, 2009), directly impact vocational exploration, career self-determination, and work well-being. This task, which can be pedagogically designed, is significant for exploring personal critical development dimensions, such as interests, competencies, values, influences (both proximal and distal), and both positive and less positive personal bonds. This can be achieved through curriculum infusion

Table 1 Teachers' perspectives on AI and human agency: focus group findings

Level	Dimension	Description	Examples
Subjective	Decision-making Processes	**Critical Reasoning** AI-driven decisions may undermine students' ability to reason about personally significant variables.	• "When AI decides what is best for the student… we're taking away the student's ability to decide what they want to learn, or how they want to approach a topic." • "it makes the student unaware of why a certain personalisation process is beneficial. There is an entire external system that is managing their personalisation, which means that instead of fostering autonomy, what is actually being encouraged is heteronomy."
		Power of Structure Influence of social, cultural, and environmental factors that shape and may constrain individuals' choices based on available resources and visible opportunities, underscoring the need to critically assess whether technology and AI can expand or restrict these options.	"the reality is that the decisions we make are constrained by our surroundings, by what we can see. We choose to study from the options available in our community. (…) we shouldn't assume from the outset that technology or AI will restrict that freedom. Instead, we need to assess whether we truly have those freedoms today."
		Reduction of Diversity and Circumscription of Choices AI systems that rely on pre-defined learning paths may restrict students' ability to explore a diverse range of possibilities.	"I think there's a loss of autonomy because if the student is only able to choose from a list of options… they're just choosing what was already decided."
	Individuation	**Differentiation and Authorship** AI systems are expected to support the educational community exploring the diverse developmental trajectories and unique personal expressions of each student (e.g., learning pace, behavioural repertoire, specific manifestations) rather than enforcing standardised measures.	• "This individual vision of each student and their needs contrasts with the generic view that ultimately states we don't want everyone to be the same; we need to delve deeper into each person being distinct and unique. Therefore, this type of system that attempts to homogenize and make everyone equal ends up breaking down the personal characteristics of each individual." • "what we do is help the student, year after year and day by day, develop their capacity to take ownership of the condition of being the author of their own life. They must create their life, but that is not easy. It is definitely not easy."

Table 1 (continued)

Level	Dimension	Description	Examples
	Foresight, self-regulation and self-reflectiveness	**Agentic Properties** Qualities that enable individuals to take ownership of their lives and decisions, enabling individuals to actively shape their experiences and achieve their goals.	"The ability to take ownership of one's own life (…) the day my time runs out, my life runs out. Therefore, autonomy is about development; autonomy is about beginning to give the student time so that they can take ownership of their time, envision their future, plan ahead, and be capable of committing their ability to act over time, almost to the point of being able to commit their capacity for work."
	Moral Development	**Moral Disengagement** Progressive detachment from responsibility and erosion of ethical standards that occurs when individuals justify or rationalise actions, often by attributing decision-making to external forces, such as technology or authority figures. This can diminish personal accountability and moral reasoning.	"efforts are being made to incorporate Artificial Intelligence into these autonomous cars (…) Artificial Intelligence can reduce our capacity for agency. For some people, this may be satisfying because making those decisions is certainly not easy, and there are individuals who may feel relieved not having to make those choices."
Intersubjective	Purpose and values	**Teachers' roles** Erosion of teachers' roles and purpose, as AI begins handling core pedagogical tasks, potentially turning their role into one of mere oversight.	"If AI starts taking over the planning and grading, then where does that leave us as teachers? We don't want to just be there to supervise what the machine is doing."
	Authority and professional status	**Proxy Agency** AI systems are viewed as supportive tools, with the expectation that teachers will maintain their role as proxy agents, preserving their professional autonomy and authority.	"AI can make suggestions, but it shouldn't make decisions. It should be the teacher who decides… because we know the students better than any algorithm."
	Modelling and confidence	**Scaffolding** Supportive process through which teachers leverage their own experiences and socio-emotional skills to guide students in developing critical competencies.	"But the experience and socio-emotional skills that they have developed, along with the failures they have encountered in the past, will allow the teacher to guide students in discerning what information is good, what information is not good, how to work in teams, how to communicate better, how to collaborate, and how to solve problems (…) their experience, can help their students develop these socio-emotional skills"

Table 1 (continued)

Level	Dimension	Description	Examples
Collective	Political Space	**Participation** Importance of a participatory approach where all stakeholders (e.g., students, teachers, parents) are involved in shaping AI's role in education.	"There needs to be a way for students, teachers, and even parents to give input on how AI is used… so we should all have a voice."
		Distributed Decision-making Call for collaborative decision-making in AI integration, with teachers advocating for a role in shaping its implementation, highlighting the need for democratic practices at an institutional level.	"We need to have a say in how AI is being used in our schools. It shouldn't be a top-down decision…"
		Democracy and Rule of Law Importance of participation, agency, and responsibility, rooted in the needs of the community. It promotes a society guided by established institutional frameworks that protect individual freedoms and enhance social welfare.	"In my view, I believe that two beautiful aspirations in a person's life can be striving to live in a democratic system and being guided by the factors established within the framework of institutions. This means aspiring to these two ideal goals that exist in most countries."
	Distributed Agency	**Sociotechnical Assemblages** Dynamics and shared agency between human and technological actants create a unique context for learning and reinforce the idea that the educational experience is co-constructed, shaped by the interplay of diverse influences.	"We could engage in dialogue with parents and teachers about viewing Artificial Intelligence and other aspects of information and communication technologies as added values to the learning processes and the construction of knowledge that have been developed. The very systems of life and the evolution of societies drive us to recognise that there must be different approaches to build learning."

activities, project-based learning, and role-taking experiences, where intentionality and systematicity are key. In this context, the role of AI systems is expected to be critically examined. AI systems that provide overly rapid feedback and excessive automation may progressively be interpreted as authoritative figures that "hold the truth", negatively impacting students' sense of control. As research suggests, this perceived loss of control can be explained by high levels of automation and hierarchical structures within collaborative tasks. According to Gozli's (2019) hierarchical model of agency, such a loss is not merely cognitive but begins at the foundational level of sensorimotor fluency, the capacity to skilfully and confidently engage with one's environment. When this fluency is disrupted, students may experience agency as distant or inaccessible, leading to increased passivity and conformity. Consequently, such systems can reinforce passivity and conformity while distancing students from engaging with diverse significant others, potentially limiting the freshness of perspectives and contributing to emotional blunting.

Teachers also demonstrated sensitivity in recognising that social, cultural, and environmental factors shape personal agency (Larreamendy, 2011) at various instances and levels throughout different moments in life. This expanded awareness opens up the possibility of understanding agency as emerging from the interplay of heterogeneous elements, where objects and technologies do not merely assist human action but actively participate in shaping outcomes (Latour, 2005). In schools, this calls for a shift in how learning experiences are understood: rather than viewing agency as a purely human trait expressed through choice or autonomy, it becomes something co-constructed with the tools, spaces, and systems that surround learners. As the human-machine boundary becomes increasingly blurred (Haraway, 1985), and as material environments exert their own quiet pressures and affordances (Bennett, 2010), schools are called to move beyond simplistic binaries, such as active/passive or autonomous/dependent, and instead design for agency as something distributed, situated, and always in-the-making.

The power of structures, and their tendency to push the margins towards the centre, is reflected in education through the dominant discourse of efficacy that permeates the Big EdTech world and underpins AI applications in learning environments. This often places the burden of adoption and exploration of associated challenges on individuals, irrespective of the structural inequalities they may face, reinforcing a model shaped by minimal governance and free-market dynamics (Selwyn, 2016). Rather than fostering individual agency, such a distanced and individualised approach to what Zuboff (2019) describes as an unprecedented transformation in the exercise of power may lead to a diminished, if not detached, experience of agency, ultimately weakening the capacity to connect with others and build agency collectively. Furthermore, as Watters (2021), Williamson (2022), and Saltman (2020) highlight, educational platforms and AI applications mirror Big Tech strategies by embedding practices of categorisation, optimisation, and impact measurement, promoting models of learning that reinforce privatisation, outsourcing, and labour exploitation. Such logics, while marketed as efficient, risk narrowing the space for variation, error, and alternative pedagogical approaches. This structural emphasis on predictability also affects how uncertainty is valued in emotional and cognitive development. Yet uncertainty, can bolster creative and resilient approaches to dealing with circumstances and

chance, and it may even contribute to the concretisation of technological tools in the process of their appropriation.

The role of education in supporting the development of students' individuation through differentiation authorship was also acknowledged, recognising a process in which one's voice, the diversity of experiences and actors, and the ability to articulate one's experiences through timely discursive connectors set the stage. How can a speculative argument on personalisation account for processes of meaning-making and signification? Adaptive learning systems may weaken or disconnect knowledge and learning from the cultural backgrounds, unique identities, experiences, and subconscious processes that are foundational to subjectivities. While educational sciences and psychology have moved beyond strictly behavioural and cognitive models, the continued reliance of adaptive learning systems on these frameworks, as both inputs and outputs, raises questions about their adequacy in addressing the complexity of human learning.

The properties of agency, as described by Bandura (2001, 2006), were referred to. Once again, teachers demonstrated their awareness of the conditions that enable their students to become not only knowledgeable but also the architects of their own lives. They recognise that intentionality and planning are only possible when opportunities for self-regulation and self-reflectiveness are experienced. These factors are, in fact, critical ingredients for learning and meaningfully exploring the world – enabling individuals to act and integrate through processes of signification within meaningful relationships. As AI systems grow more powerful and sophisticated, their explainability becomes increasingly difficult. Moreover, a greater sense of agency arises from outcomes generated by humans rather than machines, with emotional feedback playing a crucial role in behavioural adjustment. This leads to speculation that automated feedback may be less relevant for fostering lasting behavioural changes. Moreover, AI evaluations used for grading, particularly when lacking critical discussions from peers and teachers, can negatively impact self-regulation and self-reflectiveness processes. This may result in students struggling to connect curricula with personal development, leading to disengagement from the learning process and transforming the experience of achievement into a dualistic and impoverished experience of success versus failure.

Finally, teachers recognise that values and norms are context-dependent and can vary within a classroom, from classroom to classroom, from school to school, and from region to region, as well as among different stakeholders. With the advent of Generative AI, it may be challenging to harmonise perspectives on what should be accepted from this tool. For instance, can a student's work that utilised Generative AI be considered original? If students and researchers are honest about their use of the tool, can their work genuinely be regarded as their own? Are honesty and transparency equivalent? Furthermore, can Generative AI be seen as a proxy agent? The answer to these questions, as well as the plurality of these questions and their capacity to provoke further inquiry will be critical for moral reasoning and development moving forward.

3.1.2 Intersubjective Level

In terms of the intersubjective dimension, teachers primarily emphasised their role, which can be explained by narratives that view AI as a potential replacer or, at the very least, as a tool for fulfilling several critical functions traditionally held by teachers, while stripping away their core purposes and values. This raises the question: when teachers are relieved of administrative tasks, what other responsibilities are they freed from, and where are they displaced to? Some insights into possible answers may help explain why teachers highlighted their importance as role models, as well as their unique capacities for scaffolding. They also stressed their significance as proxy agents, possessing an authority that must be preserved to maintain their professional status and consistency.

However, the teachers involved in this research were notably silent regarding transformations among peers and the relevance of a sense of belonging in the learning experience. They did not address parents' concerns, nor did they discuss how distributed agency – where parental engagement is key – could serve as a touchstone for a meaningful accomplishment of educational initiatives. Such an approach to parents could help ensure that learning is transferable and generalisable to other contexts while preserving both the conditions and content relevant to learning. Furthermore, such a commitment may support the rise of AI literacy levels within educational communities.

Considering how detailed and prolific teachers were regarding the potential effects of AI systems on the subjective dimension of agency, this focus on their roles on the intersubjective level may express not only how hegemonic narratives from BigTech can affect their professional autonomy and deliberation but also their capacity to critically examine the impacts on various relationships and actors within schools. This narrowing of thought can be a consequence of these procedures, as well as the processes through which these sociotechnical systems reinforce their own entrenched status and solidify their influence, pushing aside the relevance of, or obscuring, the various levels of relationships that education encompasses.

3.1.3 Collective Level

From a collective perspective, teachers continue to uphold the vision of schools as democratic spaces, echoing Dewey's principles. In today's society, where political spaces are increasingly under threat – dialogues being replaced by (short and efficient) talks, plurality giving way to homogeneity, and politics overshadowed by policies – this vision holds significant importance. Creative writing and expression (often diminished by Large Language Models), for instance, do not merely produce novel outputs; they provide intellectual nourishment, prompting meaningful, context-driven innovation. Furthermore, achieving shared flow and emotional synchrony can foster a strong sense of belonging, enhancing participation, accountability, and distributed agency with expanded roles and synergies.

Situational freedoms have long been threatened by psycho-pedagogical techniques that presented themselves as a pharmakon in education, obscuring the vocation of education as a collective foundation for experiencing societal challenges and explor-

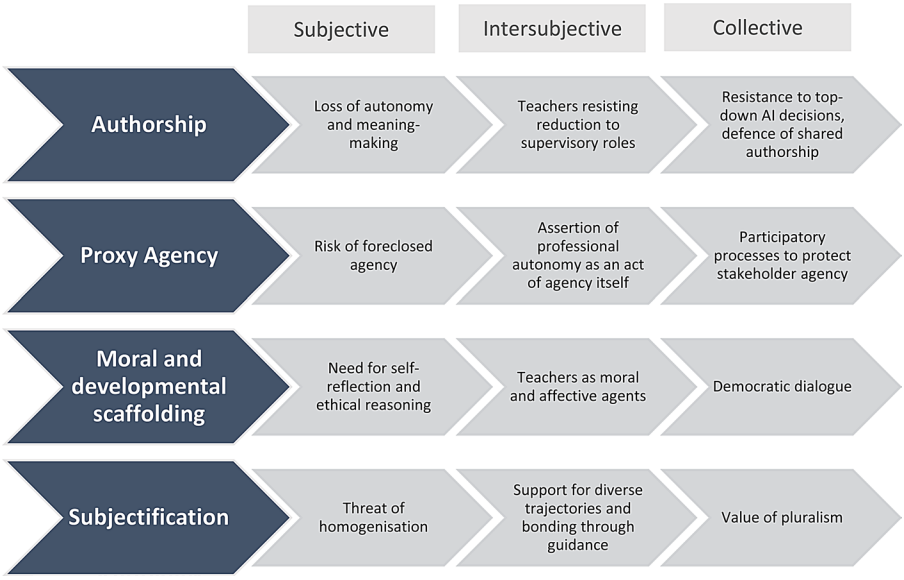

Fig. 1 Thematic flowchart of core categories across the subjective, intersubjective, and collective levels. Note. The diagram illustrates how the four key thematic categories are articulated across three analytical levels. Each level reflects a specific dimension of agency: subjective, intersubjective, and collective. Source: Authors' own elaboration based on qualitative analysis (2025)

ing personal genealogies of feelings and bonds. Technologies like automated essay scoring, predictive learning analytics, and AI-enhanced classroom management tools may offer immediate or short-term benefits but pose potential threats in the medium to long term. Critical pedagogy, which has traditionally integrated technology to support self-directed and heutagogic learning processes, is at odds with behaviour conditioning practices, such as gamified engagement. For instance, AI-enhanced peer tutoring systems can provide guidelines for constructive feedback, and gamified learning platforms powered by AI can facilitate role assignments tailored to students' unique characteristics. Teachers and students are less likely to view this technological support with suspicion if there are opportunities for organic interactions and spaces for personal and collective recognition of each individual's contributions. Such an environment can provoke affective-cognitive dissonance, which is crucial for embracing contradiction and divergence in social interactions and for building genuine common ground, far removed from illusions of full mastery.

3.2 Cross-Level Patterns and Interdependencies

A cross-dimensional analysis of the qualitative (cf. Fig. 1) data reveals thematic patterns that cut across the subjective, intersubjective, and collective levels. These themes illustrate the intricate nature of agency in educational contexts and demonstrate how AI sociotechnical systems may influence or reconfigure agency across these domains. Particularly, teachers' perspectives emphasise that agency is not a

fixed attribute but a dynamic, relational process, continually shaped by institutional structures, technological environments, and interpersonal interactions.

3.2.1 Tension Between Automation and Authorship

Across all three levels, teachers voiced concerns about how automation might displace human authorship and control. At the subjective level, this concern manifests in the perceived loss of students' autonomy, especially when AI-driven decisions bypass personal meaning-making. At the intersubjective level, the fear of being reduced to mere supervisors threatens teachers' roles as intentional and relational figures; roles that are critical to education's dual desideratum of subjectification (which is always made possible through the alterity of significant others) and socialisation (Biesta, 2020). Collectively, the emphasis on distributed decision-making reflects a broader anxiety over top-down AI implementations that may further erode stakeholder agency.

This analysis of the recurrence of the themes of authorship, meaning-making, and control across the three levels offers a comprehensive vision of agency as a composite phenomenon that intrinsically nurtures itself: the more it grows subjectively, the more it can be gained collectively; and the more it grows collectively, the more it can be regained subjectively.

3.2.2 Foreclosed Agency as a Substitute for Proxy Agency

Another thematic recurrence concerns the complex balance between proxy agency (teachers and technologies extending the agency of students) and a kind of foreclosed agency, in which both significant others and tools acquire the power to *resonate* or *act* on behalf of students. While teachers accept a mediating role, they caution against the complete outsourcing of educational decisions to AI. At the intersubjective level, teachers assert that professional autonomy must be preserved; this very assertion constituting a foundational act of agency. At the collective level, they advocate for participatory processes in AI implementation, ensuring that decisions are not dictated solely by external agents or commercial interests.

Once again, this pattern illustrates that agency is deeply relational. The development of autonomy in students is conditioned by the autonomy and reflexivity of educators, which, in turn, depends on democratic and transparent policies and institutional frameworks.

3.2.3 Moral and Developmental Scaffolding

Teachers repeatedly highlight their role in guiding moral development, fostering foresight, and supporting emotional and meta-cognitive growth, especially at the subjective and intersubjective levels. These processes, including the development of critical reasoning and self-reflection, are seen as critical for meaningful and context-sensitive learning. At the collective level, teachers view democratic participation and dialogue as key not only for institutional functioning but for cultivating students' sense of social responsibility.

Teachers conceive themselves not merely implementers of curriculum or AI facilitators working solely toward qualification (Biesta, 2020). They not only recognise, but seem to embody, a professional and expressive dimension: to be moral and affective agents in the lives of their students.

3.2.4 Subjectification and Diversity

The theme of diversity, both in learning experiences and in the exploration of possible developmental paths, is central. At the subjective level, AI's potential to homogenise education poses a threat to processes of subjectification (Biesta, 2020), where learners construct their identities through engagement and choice. Within the intersubjective space, teachers draw on their socio-emotional skills to support diverse student trajectories and to cultivate bonds and context-sensitive socio-learning experiences. At the collective level, an emphasis on inclusive, participatory decision-making reflects the value of diverse perspectives, both in fostering political and democratic development and in reinforcing a sense of belonging, shared flow and emotional synchrony, which significantly contributes to a sense of collective achievement (Zumeta et al., 2016). Therefore, as individuals become more attuned to their environment and to one another, they are also better positioned to exercise agency in transformative ways. This aligns with Archer's (2015) concept of double morphogenesis, which describes how structural changes create new conditions that elicit responses from social actors, who in turn reshape those very structures. In schools, evolving educational policies, social expectations, and technological shifts do not simply impose change from above; rather, they invite reflective engagement, collaborative tinkering, and new practices within communities. Through this recursive process, teachers and students move from merely responding to projects and initiatives to actively shaping them, making collective agency both a consequence and a catalyst of meaning-making and transformation.

These perspectives point to a vision of agency that is developmental, dialogical, and contextually situated (Archer, 2003; Biesta & Tedder, 2006; Emirbayer & Mische, 1998). Moreover, the analysis of these aspects is valuable not only as a safeguard for the mechanisms that sustain human authorship at each specific level, but also as a recognition of agency as a compositional phenomenon, where the diminishing of agency at one level appears to reinforce its erosion at others, ultimately cutting off the roots of schools as spaces for the joint elaboration of possible subjective and collective futures. And this goes beyond the idea of merely creating futures from which the present condition deprives us. It raises a more fundamental question: what kinds of futures can we imagine without a present that nourishes desire? In digital capitalism, the collapse of desire manifests as a frantic urgency to appear alive, set against an ever-expanding void of meaning. A truly collective future is to be conceived as a project both dictated by and dedicated to attentional forms of care, at once psychic and social (Stiegler, 2013). This is a project that understands desire as the intensification of individuation, rooted in the dynamics of attention, memory, and becoming. In this sense, agency can be understood as *protention*, in Stiegler's (2015) terms: the capacity to anticipate and project oneself into the future through the practice of imagination and desire. It is a temporal orientation that links subjectivity with the

not-yet, with what can still be created, decided, or hoped for. Within this framework, technologies, particularly AI, could occupy a meaningful role as forms of *tertiary memory*, that is, as externalised supports of human thought and collective experience. Rather than replacing memory, judgment, or intentionality, they could reconfigure traces of past knowledge and imaginative projections, helping individuals and communities to sustain or question their orientation toward meaningful futures. However, for this potential to be realised, we must break the cycle of closure, standardisation, and overdetermination that shapes these technologies; and this means the obvious: they must be reinvented.

4 Conclusion

This study highlights how human agency may be transformed through the use of sociotechnical AI systems in education. It explores the potential impact of these systems at subjective, intersubjective, and collective levels, drawing on the perspectives of teachers and professors responsible for teacher training. Concrete AI applications are presented in relation to their potential dimensions of impact, particularly concerning metacognitive and affective processes that contribute to long-lasting developmental processes, such as vocational, moral, and political growth.

The insights gathered reveal that teachers demonstrate high levels of differentiation when considering their students' subjective agentic dimensions. However, their focus appears more constrained when exploring the impact of AI systems on the intersubjective substratum. This narrowing may indicate an epistemic encroachment into narratives of dystopian futures devoid of teachers, paving the way for their own alienation from meaningful references within the framework of school bonds and strategic connections necessary for bringing projects to life and achieving impact.

This study is not without limitations. While the qualitative approach provides rich insights, it may not comprehensively capture the breadth of experiences and perspectives across various educational contexts and regions. Additionally, the focus on a specific demographic of educators may not represent the wider educational landscape. Future studies could include a broader range of voices, particularly from students, parents, educational administrators, and even vendors, to gain a more comprehensive understanding of the potential impact of AI on agency and institutional powers. Moreover, although the focus groups included educators from diverse backgrounds across K-12 and higher education, the findings were not differentiated systematically according to educational sector, subject area, or level of teaching experience. Future research could meaningfully explore these differences. For instance, teachers working in vocational education, operating closer to industry demands, might conceptualise agency differently from those in more academically oriented settings. Similarly, younger or less experienced teachers, potentially more familiar with digital tools and AI applications, may engage with these technologies in ways that differ from more experienced educators, who may be more sensitive to relational disruptions and the complexities of situated educational contexts.

Furthermore, while this study discussed AI in broad terms, it did not distinguish between the implications of different types of AI systems. Future work could usefully

examine whether co-creative AI tools, which invite students to generate, reflect, and revise, better foster agency than prescriptive systems that may automate decisions and narrow learner autonomy.

Regulatory frameworks to support agency-centred integration of AI into education were also beyond the primary focus of this study. Nonetheless, the findings highlight the absence of such frameworks as a critical gap, which future research should address, particularly in designing participatory and ethical approaches to AI governance in education.

Finally, although this study draws on a triangulated Educational Design Research methodology involving a systematic literature review, a Delphi study, and focus groups, future stages, including the piloting and wider implementation of a professional development course, will offer further opportunities for empirical triangulation, refinement, and extension of the frameworks developed here. The findings are intended to inform the design of a framework on human agency and AI systems, serving as a foundation for developing sections of a professional development course for teachers on these topics. Furthermore, there is a pressing need for intervention studies focused on developing pedagogical sequences that integrate AI while maintaining the core values of education across all three levels of agency. Future research could also explore longitudinal studies examining the long-term effects of AI on agency dynamics across diverse educational settings, building on the recommendations outlined in this paper, as well as drawing from prior neuropsychological research on sense of control, intentional binding, and agency, alongside educational studies focused on agency development.

As we continue to explore the integration of evolving AI sociotechnical systems in education, we are called to strengthen distributed forms of agency, where potential and challenge coexist in a balanced manner, ensuring that collectives preserve their roles as critical actors while broadening their aspirations and renewing their capacity to desire and to hope as they move into the future.

Author Contributions All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Ana Mouta. The first draft of the manuscript was written by Ana Mouta and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Funding Open access funding provided by FEDER European Funds and the Junta de Castilla y León under the Research and Innovation Strategy for Smart Specialization (RIS3) of Castilla y León 2021-2027. Open access funding provided by FEDER European Funds and the Junta de Castilla y León under the Research and Innovation Strategy for Smart Specialization (RIS3) of Castilla y León 2021–2027.
The research leading to these results received funding from Fundação para a Ciência e Tecnologia under the grant DOI: https://doi.org/10.54499/2020.06258.BD..

Data Availability The datasets generated during and/or analysed during the current study are not publicly available to protect study participant privacy but are available from the corresponding author on reasonable request.

Declarations

Competing Interests All authors certify that they have no affiliations with or involvement in any organisation or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

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