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Protecting teacher agency in times of strong technology push: grounding decisions in Biesta's educational purposes

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ABSTRACT

Digital technologies such as social media and artificial intelligence, and the datafication they enable, increasingly influence society and teaching and learning in schools. Where this leads to partial automation of education, teachers' agency and student learning and development are at risk. This calls for educational paradigms that emphasize the importance of teacher agency and reorient towards core educational purposes. Drawing on Biesta's domains of qualification, socialization, and subjectification, we argue that technology should enhance learning without undermining teacher agency or the social interactions that socialization and subjectification require. In this conceptual paper, we focus on protecting teacher agency and on using Biesta's domains to guide wise technology choices for the classroom. Our aim is twofold: to show why and how to protect teacher agency regarding educational technology, and to guide educational stakeholders in prioritizing Biesta's three domains when evaluating technologies. We integrate our conceptual work into the TAPP model (Teacher Agency for Pedagogical Purpose).

1. Introduction

Digital technologies such as social media and artificial intelligence increasingly influence society and, through the big data they generate, provide tools to profile and even manipulate individuals for various purposes [1]. A strong push to automate aspects of learning shapes teaching and learning in schools. Technologies promoted in schools include learning analytics, adaptive software, and generative AI. These technologies are not neutral; they often reflect the values of tech firms rather than educational values [2,3]. In this context, and amid other sometimes related, strains in the educational ecosystem, teacher agency and student learning and development may suffer. This is counterproductive, as high-quality education depends on teachers as agentic actors who support their students' broad development as responsible subjects in the natural and social world [4].

In this conceptual paper, we examine teachers' agentic role in technology use, drawing on a review of the literature. Based on Biesta's model of domains of educational purpose, we discuss whether and under what conditions technologies may foster student learning and broader development [5,6]. Biesta's model identifies three domains of educational purpose, qualification, socialization, and subjectification, that explicitly broaden horizons often narrowed to the first domain alone. We see this framework as an important foundation for teacher agency towards technology integration.

To the best of our knowledge, no prior study has used Biesta's three domains of educational purpose as a framework for supporting teachers' agentic choices about (not) using technology for student learning. We chose Biesta's framework specifically because of the distinctive role of

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subjectification. Subjectification foregrounds students' development as responsible and critical individuals who engage with the questions of the world. Moreover, subjectification posits students as subjects in education rather than objects of teaching [4,5].

We aim to answer the following research questions:

What characteristics of technology practices demonstrate successful integration of all three of Biesta's domains of educational purpose?

What institutional and policy conditions are needed to protect and promote teacher agency in technology implementation?

To answer these questions, Section 2 provides a conceptual and empirical background showing that technological strains in the educational ecosystem require a pedagogical approach centered on teacher agency and broad developmental goals for students. Subsequently, Biesta's three domains of educational purpose are introduced as a lens for evaluating how different technology paradigms support or undermine teachers' agentic role in fostering students' broad development. In Section 3, we answer research question 1 by translating Biesta's three domains of educational purpose into four concrete characteristics that technology practices should meet to integrate qualification, socialization, and subjectification. In Section 4, we answer research question 2 by examining the macro-level policy conditions and meso-level school culture and leadership conditions needed to protect and promote teacher agency in technology implementation. Sections 2–4 build towards the TAPP model (Teacher Agency for Pedagogical Purpose), which synthesizes the framework developed in these sections. Section 5 provides discussion and recommendations and Section 6 states the overall conclusion.

2. Conceptual and empirical background

2.1. Strain in the educational ecosystem

Education is not merely a matter of micro-level interactions among teachers, students, and parents. Educational goals and outcomes are strongly influenced by the wider educational ecosystem in which teachers operate [7,8]. At the meso-level, we find the school's culture and organization, leadership and policies, and collaboration among staff members. Macro-level influences come from national culture and politics, regional and national policymakers, inspectorates and other governmental organizations, commercial firms and interests, intergovernmental organizations, journalism, lobbying, and research. Teaching and learning are shaped not only by teachers and students, but by a wider ecosystem that may produce strains through counterproductive and conflicting incentives.

Throughout the world, many educational ecosystems face significant strains, such as teacher shortages and insufficient budgets [9]. Other strains are declining trust in teachers and the resulting push for more control through datafication of education [10]. The current focus on testing often leads to the use of highly scripted educational materials, whether digital or not [11], with a narrow focus on learning as lower-order knowledge acquisition with shallow short-term goals [12]. Teachers' autonomy in deciding what and how to teach is compromised when they are required to use these materials [13,14]. Students frequently feel disengaged and may adopt a shallow approach to learning [13,15,16].

These systemic strains may result in insufficient support for students to develop as responsible subjects in the world. Biesta [4] states that learning should not be a mechanistic, individualistic endeavor to master every part of the curriculum and to prove this mastery on a test. Rather, education should support students to exist in and with the social and natural world in whatever ways it manifests itself. Teachers therefore need to use their professional agency to guide students' development and to assess the importance of content for this goal [4].

2.2. Teacher agency

By teacher agency, we refer to teachers' capacity to make decisions, influence practices, and exercise choices regarding their work [17,18]. These actions encompass areas such as pedagogy, teaching materials and, as is the focus of this article, the integration and use of digital technologies. Teacher agency operates at both individual and collective levels, spanning activities within the classroom, across the school, and beyond into broader educational contexts [17–19].

Priestley et al. [20] posit that teacher agency must be understood through an ecological perspective. In this perspective, agency is not seen as a trait of the teacher but rather as emerging from the interaction of the teacher with the educational ecosystem that may facilitate or hinder agency. The ecological approach to teacher agency [20] is built on the theoretical framework of Emirbayer and Mische [21] that proposes a dynamic approach to teacher agency with three dimensions: the iterational (past), the practical-evaluative (present), and the projective (future). They see teacher agency as emerging from the interaction between individuals and their context over time. Teacher agency is shaped by teachers' past experiences and resources, their judgments and actions in the present, and their short-term and long-term goals. These dimensions all operate within specific cultural, structural, and material conditions. In the ecological approach, the iterational dimension refers to the influence of past professional and personal experiences and habits on current actions. It includes professional knowledge, beliefs and values. The practical-evaluative dimension involves the immediate context and the judgments made in the present moment. This is where the teacher enacts more or less agency. The projective dimension encompasses future orientations, including the ability to envision different possibilities. How these three dimensions interact depends on the educational ecology in which they are situated.

Research on the use of educational technology traditionally emphasizes the iterational dimension and to a lesser extent the practical-evaluative dimension. The projective dimension receives the least attention. Within educational technology research, the iterational dimension is closely connected to teachers' Technological Pedagogical Content Knowledge (TPACK) [22], their pedagogical beliefs [23], and key constructs from the Technology Acceptance Model by Davis et al. [24]. All these focus on professional competence to use technology. These competencies support the exercise of agency in actual teaching situations. Research and practice need to pay greater attention to the projective dimension that concerns the short-term and long-term purposes of education [4,5].

2.3. Technological strain in the educational ecosystem

The technologies used in classrooms worldwide are diverse, as are the outcomes for students' learning and development (e.g., [25]). In many schools, technology use partly reflects the systemic strains described above, as these strains often translate into a push for automation of teaching and testing through the use of adaptive learning systems [26]. We understand automation as minimizing the role of the teacher and maximizing the role of technology in deciding what, when and how to teach and to test. Technologies have even been expected to replace teachers, if not entirely, at least partly (e.g., [27,28]). This contrasts with the finding that the quality of students' learning with technology primarily depends on teachers' pedagogies [29,30].

Politicians, policy makers [26], and commercial technology firms promote educational automation with several promises. Examples include promises of reduced teacher workload, personalized and efficient testing and learning, and solutions to teacher shortages [11,13,31]. In marketing statements, generative AI is often enthusiastically recommended to fulfill these promises; however, its use in education is under scrutiny [13,32].

Automation of education carries significant risks [33,34]. Adaptive learning systems, for example, can restrict learning outcomes,

particularly for at-risk students [35]. Likewise, the use of AI in education may limit teachers' capacity to design learning activities and diminish their agency in responding to learners' needs [36]. Current debates about AI's role in education underscore the danger of eroding professional agency as AI becomes increasingly sophisticated ([37,38]). Järvelä et al. [28] stress that, as AI becomes more embedded in learning environments, safeguarding teacher agency becomes essential.

2.4. Technology and teacher agency

When considering the practical-evaluative dimension of agency [18,21], educational technology can both enhance and limit teachers' agency. According to Venkatesh et al. [39], the facilitating conditions provided by schools, such as the availability of technologies and support, affect technology use and the choices teachers can make. These themes align with the first-order barriers defined by Ertmer [23,40], suggesting that available technology and support set boundaries for how teachers can use technology and the decisions they can make. At the collegial level, peer support and the expectations of others in the school community also influence how technology is used and can be used for teaching [39], thereby affecting teacher agency. Similarly, Ertmer [23,40] acknowledges the role of colleagues and organizational aspects, especially peer collaboration, examples provided by other teachers, and administrative expectations, in technology-related decision-making.

Within the practical-evaluative dimension, the nature of the technologies available also influences teacher agency and pedagogical decision-making. Koschmann [41,42] outlined major paradigms within the field of educational technology research: Computer-Assisted Instruction (CAI), Intelligent Tutoring Systems (ITS), Logo-as-Latin and Computer-Supported Collaborative Learning (CSCL). These paradigms were built on different theoretical starting points. CAI was based on behaviorism, and learning was supported via stimulus-response conditioning. The ITS paradigm was built on cognitive psychology, with emphasis on modeling learners' mental processes. The Logo-as-Latin paradigm proposed constructivist approaches where students constructed tangible artifacts. Finally, CSCL positioned students in an active role, contributing to shared knowledge construction and the creation of shared artifacts, supported by various digital environments [43]. Although the paradigms described are thirty years old, they remain relevant. The different theoretical foundations continue to underpin current practice, even as the technologies designed to achieve those pedagogical goals have evolved [44].

These paradigms provide very different starting points for the use of technology and for how technologies are perceived from the perspective of teachers' decision-making and agency. In CAI, technology is positioned as a 'tireless teacher', emphasizing drill-and-practice-based individual work and delivering pre-defined contents and learning paths with assessments. ITS and other adaptive systems continued along similar lines, relying on algorithmic decision-making to control and tutor the learning processes and influencing pedagogical choices [42]. These paradigms align with instrumentalism, positivism and the wish to simplify, mechanize and control education [3,45]. In contrast, the Logo-as-Latin paradigm positioned technology not as a teacher or tutor, but more as a shared reference point for triggering students' discussion and collaboration [42]. Such technologies can be viewed as providing more space for teachers' decision-making, enabling certain student-centered pedagogical choices that would have been highly challenging without technology [46]. Similarly, CSCL reframed technology as a medium and environment for discourse and shared knowledge building, allowing teachers to orchestrate pedagogy and materials [47,43]. Across these paradigms, the changes reflect a shift from pre-defined activities and standardization toward openness, creating more room for teacher agency through pedagogical reasoning, informed decision making and action. In Table 1, the differences between these paradigms are outlined from five perspectives: decision making, control over pedagogy, control over resources, collaboration, and values & ethics.

Table 1
Domains that support or undermine teacher agency in digitalization of education.

	Support agency	Undermine agency
Decision making	Data from various sources to inform teacher decision making.	Algorithmic decision-making that overrides teacher agency and decision making.
Control over Pedagogy	Technologies to support teachers' pedagogies and pedagogical goals.	Automated systems prescribing lessons and assessments.
Control over Resources	Open educational resources and collaborative platforms as resources for knowledge building.	Pre-defined platforms limiting flexibility and locking teachers into fixed content.
Collaboration	Technologies enabling communication and collaboration face to face and online.	Isolation through personalized digital learning paths.
Values & Ethics	Technology aligned with long-term educational goals and democratic values.	Commercial agendas prioritizing efficiency or engagement metrics over pedagogy.

2.5. Teaching with technology through Biesta's lens

In times of strong pressures towards educational automation in the educational ecosystem, it is essential to clarify the main goals of education and the importance of agentic human teaching towards these goals. Technologies that can be used to automate education (often related to CAI and ITS paradigms) typically foreground rather narrow and individual learning goals. Careful consideration of the goals and methods of different educational technologies is warranted. Schools must prepare students for responsible thinking and action in the world [4]. This means that teaching should not be curriculum centered, nor data centered [48], nor technology centered, nor teacher centered, nor student centered, but world centered [4,49]. The world is our teacher, and teachers guide their students' development [4]. Mechanization, individualization and lower-order thinking are not the answer to the task ahead: supporting students' development as responsible subjects.

Biesta [50] acknowledges the presence of technology in education and underscores that there have been technologies in education for a very long time. Whether technologies are digital is irrelevant in his view. He argues that technologies are never neutral and that it is therefore important to analyze the specific affordances and limitations of each educational technology [50]. Through his three domains of educational purpose, Biesta [5] provides a pedagogical lens for choosing educational technology wisely. He distinguishes the following domains of educational purpose: subjectification, qualification and socialization. He sees subjectification as the central goal for world-centered education. Subjectification means becoming a responsible and critical individual who engages with the questions of the world. Central questions are: who do I want to be in the world, and what can I contribute to the world? To support students in this task, Biesta [4] stresses the importance of foregrounding the world in education. Not as an object to study, but as a subject that speaks to us and teaches us. Qualification and socialization have reciprocal relationships with subjectification. Qualification means acquiring knowledge, skills and dispositions. Socialization is about cultural transmission and development for social integration and community membership. In difficult times, communities and community membership are especially important for addressing the challenges that arise. It is important that teachers differentiate between technology that merely automates education and technology that serves the three domains of pedagogical purpose, and that they are empowered to decide what to use and how. Pedagogical decisions should not be outsourced to commercial firms and policymakers as their goals and values do not align with those of public education [2]. Solid teacher decision-making

depends on teacher agency towards the three domains of educational purpose [6].

3. Characteristics of technology practices that integrate all three of Biesta's educational domains of purpose

Biesta does not provide guidelines for choosing educational technology. In fact, he writes very little about it. In a blog post written during the COVID-19 pandemic, Biesta [50] cautions that education should not be driven primarily by questions of delivery or modality, but by considerations of pedagogy. Nevertheless, he finds it essential to analyze affordances and limitations of all types of educational technologies, including digital technologies. Given our focus on pedagogical use of digital technologies, we translate his domains of educational purpose to characteristics of educational technologies. We describe four characteristics that, together, help discern whether a specific technology can serve all three of Biesta's domains in the hands of a wise and agentic teacher within a truly democratic educational ecosystem. We argue that adherence to these characteristics is incompatible with the automation of education. Automation, as defined in Section 2.3, limits the scope for teacher decision making. Biesta's broad educational purposes, by contrast, require teachers to exercise professional judgment across all three domains with their students at the forefront of their mind. They need to do so to maximize synergy between the domains for their students' learning and development [5].

The first of these characteristics is that teachers can use the technology to bring real-world situations into the classroom [4,51]. The second characteristic is that technology elicits face-to-face interaction about the complexities of the world and supports face-to-face and online community and collaboration. The third characteristic calls for hearing the student voice in reaction to real-world problems. The fourth characteristic entails that the technology reflects ethical, inclusive and democratic design.

The first of these characteristics is that the technology does not reflect fragmented learning goals but helps the teacher to bring the authentic world into the classroom [4,51]. The internet provides access to many media that can help bring the world into school, provided the teacher has a well-developed agenda for students' development as responsible, active subjects (subjectification). Teachers have the responsibility to choose wisely from the internet. This is not easy as the internet is considered 'broken' by commercial and political interests [52]. It contains a lot of non- and false information that captures attention but does not connect students to the real world. Large-scale pollution of the internet with low-quality AI-generated content has made the selection of sources an even more difficult task. School-wide collaborative curation of rich, authentic sources around important themes is essential and should prioritize trustworthy sources.

The second characteristic concerns socialization: cultural transmission and development for social integration and community membership. The combination of pedagogy and technology must align with these goals. Rather than placing students individually behind screens for drill and practice, the majority of learning activities should reflect the domain of socialization. Teaching is a 'fundamentally human and relational practice' ([9], p.3) and the development of socialization depends on human interaction. Technology can serve as a shared point of reference through knowledge-building platforms that align with CSCL and the Logo-as-Latin paradigms. Around these platforms, collaboration takes place both face-to-face and online with pedagogical support from the teacher. Given the ubiquity of digital communication platforms, it is also important that students learn to build digital community and to interact in ways that benefit all participants [53].

Aligning with Biesta's domain of socialization means safeguarding the balance between face-to-face and online interaction. This means fostering human interaction and supporting concentration rather than exacerbating the negative effects of excessive screen time [54]. If children's development at home is already hindered by excessive screen time, it seems especially unwise to promote teaching automation related to CAI and ITS paradigms that reflect a computational and reductionist stance towards education [45]. The agentic teacher assesses and decides which technologies to use (or not) for the domain of socialization. In doing so, it is important to consider whether the technology fosters interaction and collaboration, given their significance for socialization and learning from others.

The third characteristic aligns with the domain of subjectification. Students are subjects in the world and need encouragement to voice their own responsible responses to what the world asks of them [4]. This calls for teachers who encourage discussion and independent thought, creating a space where students can explore ideas freely without fear of failure [55,56]. Technology can be used to create artifacts that communicate the student voice. This creative process should go hand in hand with open discussions in the classroom.

The fourth characteristic entails ethical and inclusive design of the technology and thereby provides a good example of a responsible stance towards the world (subjectification). This means that only minimal data collection should take place and that teachers, students and parents retain ownership and control over the data [57]. It is highly problematic that students' data fall into the hands of commercial firms as this violates the privacy and safety of students, limits teacher agency and may lead to inequalities [58,59]. Designing for inclusion means thoroughly auditing for cultural bias, ensuring that the technology does not marginalize any group. This also requires systematic scaffolding to support different educational needs [60].

Technology use in education should support all three of Biesta's domains. We take this position because Biesta [5] argues that the three domains may work synergistically but may also be in conflict. Biesta [5] finds an important example of the latter in the current emphasis of many countries on performance in the domain of qualification. He warns that this emphasis may have serious negative consequences. He identifies the need to keep the three domains balanced. When technology only supports qualification (e.g., drill and practice, auto-grading systems, etc.), but not the other two domains, Biesta would say this is educationally imbalanced [61]. Technology becomes valuable in education when it fosters a balance between the three domains.

Illustrative examples of ways technology can support the three domains, while focusing on one of them, are given in Table 2.

4. Institutional and policy conditions to protect and promote teacher agency in technology implementation

Teacher agency is influenced by macro-level policies and meso-level school cultures and leadership. At the macro-level, national, international, and commercial narratives around technological solutions create systemic incentives for the use of technologies that narrow teacher agency [11,13]. Often, these problems arise because of extensive lobbying in national and international policymaking bodies by commercial actors and affiliated foundations [62]. This lobbying feeds into governmental agendas for cost reduction, innovation, digitalization and market growth [63]. However, the arguments involved in this lobbying are far removed from pedagogy and classroom reality. Often, technologies are treated as inherently positive artifacts, neglecting that the adoption of any educational technology will fundamentally influence classroom interaction, learning and development [64]. Kerssens [31] emphasizes that schools must make their own decisions, independently of commercial actors. He also calls on the public sector to develop and lead a democratic partnership strategy for technology use in education, bringing together public bodies, education professionals, students and edtech companies that can help create an open and democratic digital landscape.

At the meso-level of school culture and leadership, Wheeler [64] argues that digital policy should be reclaimed as pedagogical. Decisions about buying and using technologies are always a question of pedagogy, of values [2], and of agency and the future of learning [3]. Teachers

Table 2
Illustrative examples of ways technology can support the three domains of education.

Domain	Purpose	Focus	Teacher's agentic role	How technology can support this domain	Example of effective technology use
Qualification (skills & knowledge)	Developing knowledge, skills, and competencies	What students can do	The teacher selects content and technologies that align with curricular goals, sequences learning activities, judges when technology adds value over other approaches, and decides when not to use it.	Technology can provide tools and environments to introduce, simulate and discuss real-world situations.	Using a coding platform (e.g., Scratch) to learn programming concepts; using virtual labs for science experiments.
Socialization (community & participation)	Participating in social, cultural, and professional communities	How students belong	The teacher orchestrates the balance between face-to-face and online interaction, designs collaborative tasks around shared digital artifacts, and safeguards meaningful human connection.	Technology can support collaboration, communication, shared inquiry, and participation in authentic communities of practice.	Co-authoring documents in Google Workspace; participating in online classroom discussions; joining global STEM challenges.
Subjectification (student voice)	Developing identity, voice, and ethical agency	Who students become	The teacher creates conditions for students to use technology as a medium for their own voice, encourages critical reflection on technology itself, and protects space for independent thought.	Technology can provide spaces for self-expression, authorship, reflection, choice, and ethical decision-making, when used in ways that respect students as subjects in education.	Creating e-portfolios to represent personal growth; designing a digital advocacy campaign; choosing tools and media to express ideas; digital storytelling.

should not be the end-users forced to use technologies they did not invite [58]. Decisions should not be made by technocrats and managers alone as this risks normalizing technology that automates education and limits the pedagogical bandwidth of the teacher. Given the pedagogical character of the decision to buy a specific technology, teachers should have a formal and substantial voice in these decisions. What they bring to the table are debates about whether, how, and why such tools should shape teaching and learning at all [64].

To support teachers in this kind of conversation, Adams and Groten [60] devised a TechnoEthical framework for teachers. The framework covers three different technoethical premises: instrumental, sociomaterial and existential. All three premises are relevant to teachers. The instrumental premise interprets technology as nothing more than a tool. It is the human responsibility to use it in ways that produce positive outcomes and prevent negative ones. The instrumental premise is primarily concerned with macro-level laws, rules, and codes of conduct that apply to the technology the teacher uses. An important question teachers could ask is: 'What policies and laws are in place to regulate my (or my learner's) use of a given technology to maximize the positive benefits and minimize negative impacts?' ([60], p. 6). The sociomaterial perspective rests on the premise that responsibility is not only human but also shared between the user and the technology used. From this perspective, software has inherent values and biases that may influence educational practice and may nudge teaching behavior by foregrounding specific ways of teaching. These values and biases need to be uncovered by the teacher who can decide not to use the technology, or to mitigate its problems through changing its use, thereby reclaiming agency. Existential technoethics considers the influence of technology on our way of being in the world. Example questions are: 'What perceptual frameworks or 'ways of knowing' the world (and others) does it privilege? Render obsolete?' ([60], p. 10).

An important question is how the meso-level can systematically protect the agency of teachers regarding the choice to (not) use available technologies. Given the sustained effort to market educational technology to schools, especially GenAI-driven technology, it seems important to explicitly protect teacher agency through a written policy that all teachers can fall back on. An instructive example comes from the Northern Gateway Public Schools [65] in Alberta. They produced a two-page policy document about the responsible use of generative artificial intelligence to support instruction. In that document, they protect teacher autonomy and professional judgment in the use of AI as "teachers are encouraged, but not mandated, to use AI systems and may opt out of using AI tools that don't align with their pedagogical goals." They also offer training on pedagogical and ethical implications of AI helping teachers critically assess the use of AI tools before, during and after implementation. More generally, school leadership should provide professional development that supports teachers' critical pedagogical-technological literacy so that they can effectively participate in the discourse on technology decision-making.

As teacher agency is context-dependent, agency must be protected at every ecological level. Macro-level policies should curb commercial lobbying and mandate participatory processes that give teachers a formal voice in technology decisions. Teachers hold the pedagogical voice that is of utmost importance in these discussions. At the meso-level, schools need explicit policies to establish teachers' right to accept, adapt, or reject tools based on pedagogical fit.

The conceptual framework developed across Sections 2–4 is synthesized in the TAPP model (Teacher Agency for Pedagogical Purpose), depicted in Fig. 1. The TAPP model situates educational technology within the broader ecosystem of teaching and learning. It foregrounds three interconnected elements: an ecosystemic perspective, teacher agency, and Biesta's purposes of education. The four technology characteristics offer teachers concrete criteria for evaluating whether a technology can serve qualification, socialization, and subjectification in a synergistic way. These characteristics can also be used for evaluating non-digital educational materials.

5. Discussion and recommendations

This paper set out to answer two research questions: first, what characteristics of technology practices demonstrate successful integration of all three of Biesta's domains of purpose; and second, what institutional and policy conditions are needed to protect teacher agency in technology implementation.

Regarding the first research question, we identified four characteristics that technology practices should meet to integrate qualification, socialization, and subjectification: bringing the authentic world into the classroom, eliciting face-to-face and online community and collaboration, hearing the student voice, and ensuring ethical and inclusive design. These characteristics offer a different orientation from the automation paradigm that currently exerts considerable commercial and political influence on educational technology. Watters [3] argues that the automation paradigm is rooted in a long tradition of mechanizing education that dates back to 1924 and is closely linked to the advent of standardized testing. Software that operates on 'right' or 'wrong' answers may appear technologically more complex but still adheres to the same behaviorist paradigm, closely related to the CAI and ITS paradigms. This type of software often prioritizes shallow, short-term goals that are the hallmark of fragmented education. Students become the object of such learning processes rather than the subject [4].

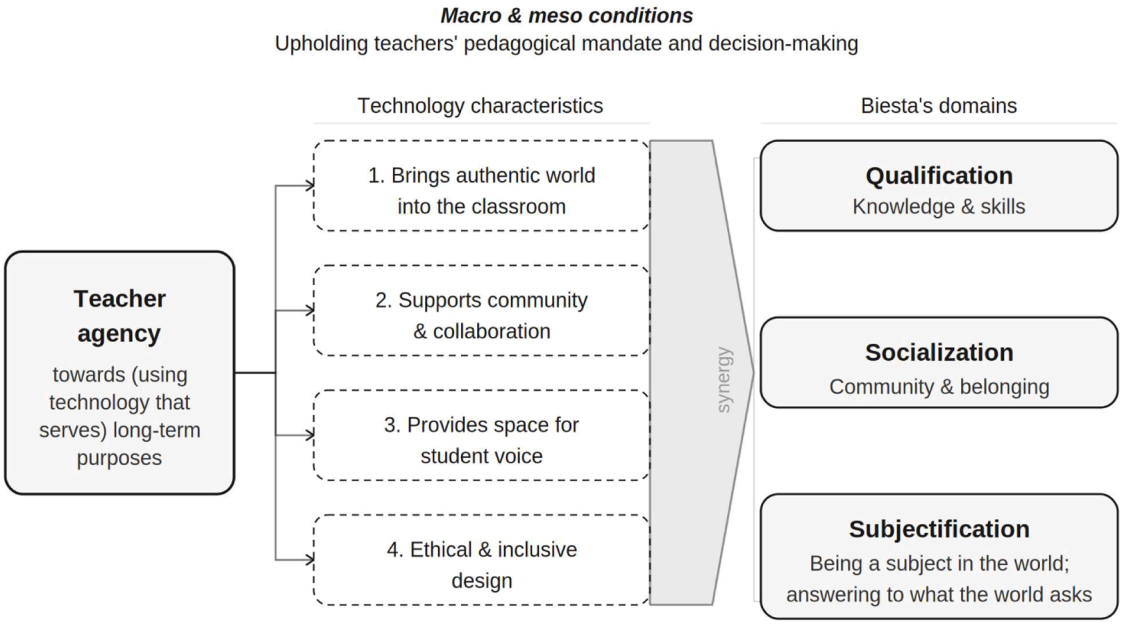

Fig. 1. The TAPP model: Teacher Agency for Pedagogical Purpose.

The characteristics we propose offer an alternative orientation. They foreground subjectification and socialization alongside qualification, ensuring that technology serves the well-rounded development of students rather than reducing education to measurable outputs. Subjectification, in particular, requires pedagogical reasoning and action. The teacher, not a set of opaque algorithms [60], should be responsible for teaching. Biesta [5] posits that long-term goals are essential for student learning and development. Striving for these goals depends on teacher agency.

Regarding the second research question, our analysis reveals that protecting teacher agency requires attention to both macro-level policy and meso-level school culture. This ecological perspective is significant because current models of technology integration tend to overemphasize teacher knowledge, attitudes and beliefs while underemphasizing the role of the wider educational ecosystem [66]. When analyzed through the ecological model of agency formation [5,20], a deeper picture emerges of this imbalance. Knowledge, attitudes and beliefs map onto the iterational dimension that is well developed in technology integration models and subsequent research. This may indicate a vulnerability in this body of research. The large research base around these models often attributes shortcomings to teachers when educational technologies fail to fulfill their promises, while failing to account for teacher agency towards technology use, and for the influences of the meso- and macro-level on that agency.

Biesta's three domains of educational purpose and the contrasts outlined in Table 1 between technology practices that support and undermine teacher agency can serve as a reference point for teachers when exercising their agency. These frameworks can help them articulate their pedagogical reasoning in discussions about (not) buying and using technology. Moreover, school leadership should provide professional development that equips teachers with critical technology literacy so they can evaluate affordances, anticipate unintended consequences, and redesign technology use to foster synergy between Biesta's three domains. We argue that safeguarding teachers' right to accept, adapt, or reject technologies is the linchpin that allows educational technology to enrich, rather than impoverish, learning towards Biesta's long-term purposes of schooling.

Taken together, our answers to the two research questions point toward a fundamental reorientation. We argue that it is time to restore trust in teachers, the holders of the pedagogical mandate. This is not straightforward, as the situation is historically and culturally shaped and embedded in complex ecosystems. Having and expressing high expectations of teachers, at all levels of the educational ecosystem, may help improve both education and student development.

This paper is not without limitations. First, as a conceptual contribution, the proposed perspective on technology integration needs empirical exploration and validation. Second, the argument draws primarily on Western educational theory and policy contexts, which may constrain its applicability in settings where different pedagogical traditions, values, or infrastructural realities shape the relationship between technology and teaching. Third, the critique of automation-oriented technologies is necessarily broad and may not fully account for the variation in how such technologies are implemented and experienced in specific classrooms.

6. Conclusion

We propose to use Biesta's framework of three educational goal domains, qualification, socialization, and subjectification, and preferably their intersection, as a reference point for technology integration. This approach ensures that digital tools support the well-rounded development of students. Biesta's framework moves us away from using adaptive software that isolates learners in front of screens for lower-order tasks. Instead, it guides educators towards using technology pedagogically to support collaborative engagement with complex problems. Technology thus supports, rather than replaces, meaningful human interaction and teacher agency.

In response to our first research question, we identify four characteristics of technology practices that can serve all three of Biesta's educational domains. Together, these characteristics offer a pedagogical reference point for distinguishing technology that serves Biesta's broad educational purposes from technology that merely automates narrow learning goals. In response to our second research question, we argue that teacher agency must be protected at every ecological level. At the macro-level, this requires curbing commercial lobbying and mandating teacher participation in technology decisions. At the meso-level, schools need explicit policies that establish teachers' right to decide to (not) use technologies based on pedagogical fit, supported by professional development in critical technology literacy.

The first contribution of this study is its application of Biesta's three

domains of educational purpose to shift discussions about technology integration away from a focus on teacher competencies and tool effectiveness, and toward a balanced consideration of educational aims. The second contribution is that teachers' agency is essential for this shift towards anchoring technology integration in broad educational purposes. Thirdly, by adopting an ecological perspective, the paper highlights how policy and leadership contexts can either enable or constrain teacher agency towards technology use. The TAPP model offers teachers, school leaders, and policymakers a concise framework for evaluating whether the conditions are met for technology to serve long-term educational purposes.

Declaration of generative AI and AI-assisted technologies in the manuscript preparation process

The authors used Claude Opus 4.6 following peer review. It was employed to suggest where specific improvements recommended by the peer reviewers could be made, to enhance language quality (addressing issues arising from English as a second language), to check the article for repetition, grammar, spelling, APA7 compliance, and consistency and to improve the lay-out of Fig. 1. After using this tool, the authors carefully reviewed and edited all content as needed and take full responsibility for the published article.

CRediT authorship contribution statement

Anneke Smits: Writing – review & editing, Writing – original draft, Supervision, Conceptualization. **Teemu Valtonen:** Writing – original draft, Conceptualization. **Satu Piispa-Hakala:** Writing – review & editing, Writing – original draft, Software, Data curation. **Alona Forkosh-Baruch:** Writing – original draft, Conceptualization. **Ferial Khaddage:** Writing – original draft, Conceptualization. **Thérèse Laferrière:** Writing – review & editing, Writing – original draft, Conceptualization. **Hiroshi Ueda:** Writing – original draft, Conceptualization. **Shirley Yeung:** Writing – original draft, Conceptualization.

Declaration of competing 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.

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