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The Extended Teacher: Generative Teaching, Vibe Coding, and Configuring Pedagogical Agency in AI-Mediated Educational Ecosystems

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Abstract: This paper offers a theoretical and pedagogical reflection on the relationship between generative artificial intelligence, *vibe coding*, and extended learning, drawing on the theory of the extended mind, Bateson's ecological epistemology, and studies on teaching agency. Generative AI is interpreted not as a simple operational tool, but as an active element of a socio-technical ecosystem that reshapes educational design. In this perspective, the teacher's professional mind extends through conversational circuits that involve pedagogical intentionality, natural language, generative systems, digital artefacts and institutional contexts. The paper introduces the concept of *Generative Teaching* to describe a reflective and intentional form of AI-mediated instructional design, in which the teacher co-creates, adapts, tests and governs digital tools, simulations and inclusive mediators. Particular attention is paid to vibe coding, understood as conversational teaching design capable of transforming educational intentions into digital artefacts even in the absence of advanced programming skills. The paper finally discusses risks such as cognitive delegation, algorithmic opacity and standardization, arguing that AI can extend, but not replace, the teacher's pedagogical agency.

Keywords: extended mind; generative teaching; vibe coding; teacher agency; artificial intelligence in education

1. Introduction

The question "where is the mind today?", central to reflections on extended learning, takes on particular relevance when applied not only to the student learner, but also to the teacher who designs, mediates, evaluates, and governs educational processes. In an era marked by the spread of generative artificial intelligence, the teacher's professional mind can no longer be thought of as an internal, individual, and self-sufficient space in which objectives, methods, content, and evaluation strategies are developed in isolation. Contemporary instructional design takes shape within a complex ecosystem, made up of physical and digital environments, platforms, data, cultural artifacts, generative models, collaborative practices, professional communities, and educational institutions (Panciroli, 2021).

This transformation challenges a still widespread representation of teaching professionalism as a set of skills possessed individually and applied in a linear fashion within the classroom. While the teacher's personal expertise remains central, it is now

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exercised in broader circles, in which educational thinking is constructed through continuous interactions with tools, languages, environments, and intelligent systems. Teachers no longer design solely "with their own mind", but through a network of mediators that participate in the production of educational.

Clark and Chalmers (1998) theory of the extended mind offers an effective interpretative key to understanding this transition. According to this perspective, cognitive processes are not necessarily confined within the biological limits of the individual: when an external artifact enters the circuits of action and thought, it can become a constitutive part of the cognitive system. This approach finds a significant anticipation in Bateson's (1972, 1979) ecological epistemology, for which the mind does not coincide with the brain or with the isolated subject, but emerges from systems of relationships, differences, retroactions, and feedback. Knowing, in this perspective, does not simply mean processing information within an individual mind, but participating in an ecological circuit in which subject, environment, and artifacts co-determine each other.

Generative artificial intelligence radicalizes this framework. Unlike many previous digital tools, it does not simply store, organize, or return information. Generative systems produce texts, codes, images, simulations, feedback, rubrics, questions, scenarios, interactive environments, and design proposals. They lack pedagogical intentionality, consciousness, or human understanding, but they nevertheless enter into the processes through which teachers conceive, imagine, and construct teaching. The teacher formulates an intention, the system produces a possibility, the teacher evaluates, corrects, reformulates, and verifies, and the new output becomes the basis for further decisions. In this recursive cycle, instructional design emerges as a distributed practice (Ellerani & Ferrari, 2024).

Recent literature on *vibe coding* and generative automation interprets this shift not as a simple technical advance, but as an epistemological shift. Generative AI not only represents a new, more accessible interface for programming or producing content, but also alters the relationship between human intention, machine behavior, contextual judgment, and professional validation (Levin, 2026). In traditional computational paradigms, humans specified procedures and the machine executed them. In generative systems, however, the user directs emergent, probabilistic, and partially opaque behavior, evaluating outputs in terms of coherence, appropriateness, contextual resonance, and practical utility.

The educational question cannot therefore be limited to the question: "How can we use these tools?" The deeper question becomes: "How does the professional mindset of teachers change when designing together with intelligent systems?" This paper fits into this trajectory and proposes the concept of *Generative Teaching* to describe a new professional posture, in which teachers do not delegate their educational function to machines, but extend their agency through an intentional, critical, and responsible use of artificial intelligence.

2. From the extended mind to the extended teaching

The theory of the extended mind has helped to overcome the idea that cognition coincides exclusively with processes internal to the individual brain. Clark and Chalmers (1998) argue that, under certain conditions, external artifacts, tools, and environmental supports can become constitutive parts of the cognitive process. The boundary of the mind does not necessarily coincide with the skin or the skull, but can

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extend along the operational networks that allow the subject to act, remember, decide, and understand.

This perspective finds profound resonance in the work of Gregory Bateson. In *Steps to an Ecology of Mind*, Bateson (1972) proposes a systemic conception of the mind as a network of relationships and feedback. The mind is not a localized substance, but a process that manifests itself in the information circuits between organism and environment. In *Mind and Nature*, Bateson (1979) further strengthens this perspective, showing how cognitive processes must be interpreted ecologically, that is, as configurations of relationships. Education, read in this light, cannot be reduced to the transmission of content from one mind to another, but must be understood as a transformation of relational patterns between subjects, environments, languages, and artifacts.

Contemporary pedagogy can take on a radical consequence from these perspectives: if learning is extended, teaching is also extended. Teaching activity can no longer be understood solely as the action of the individual teacher within the classroom, but as an ecological and distributed practice that develops across environments, tools, communities, organizational devices, and cognitive technologies. From this perspective, school becomes an ecosystem of relationships, in which knowledge is not simply transmitted, but co-constructed through interactions between people, artifacts, and contexts (Clark, 2008).

Studies on distributed cognition reinforce this approach. Hutchins (1995), analyzing complex cognitive activities in real-world contexts, shows how thinking is not confined to the single individual, but distributed across people, tools, and environmental configurations. Salomon (1993) and Pea (1993) emphasize, in the educational field, how intelligence can be distributed across practices, symbolic systems, and cultural devices. Learning, therefore, is not merely individual acquisition, but participation in cognitively organized activity systems.

Generative artificial intelligence introduces a further level of complexity. Traditional digital tools have already expanded the boundaries of learning and teaching; however, generative systems produce a different form of mediation. They do not simply support predefined operations, but participate in the production of design alternatives. They can generate an example, a teaching sequence, a simulation, a code fragment, a set of questions, personalized feedback, or an assessment rubric. By interacting with these systems, teachers do not simply perform a technical action, but participate in a co-design process (Nirchi et al., 2025).

This step allows us to formulate the concept of extended teaching. Extended teaching is not synonymous with digital teaching, nor does it coincide with the use of technological tools in the classroom. It indicates a configuration in which the teacher's professional thinking takes shape through hybrid circuits that include human intentionality, natural language, generative models, digital artifacts, student feedback, institutional constraints, and pedagogical criteria. Extension is not just about the availability of external tools, but about the reorganization of the processes through which the teacher imagines, constructs, and evaluates the learning experience.

From this perspective, extended learning requires a new idea of teacher agency. Priestley, Biesta, and Robinson (2026) define teacher agency in ecological terms: it is not an abstract individual property, but emerges from the interaction between professional history, value orientations, material conditions, institutional cultures, and opportunities for action. Generative AI becomes a new component of this ecosystem, capable of expanding or reducing agency depending on how it is integrated into educational practices. The pedagogical issue, then, is not whether AI makes the teacher more or less important, but understanding which conditions allow AI to extend teacher agency without replacing educational intentionality.

3. Generative Artificial Intelligence as an Epistemological Breakthrough

Part of the educational debate tends to interpret generative AI as yet another innovation to be integrated into schools through methodological updates, training courses, and operational guidelines. Although such interventions are necessary, this interpretation risks being insufficient. Generative AI not only introduces new tools, but also changes the relationship between knowledge, production, judgment, and action. For this reason, it can be interpreted as an epistemological shift, that is, as a transformation of the ways in which knowledge is produced, mediated, evaluated, and made operational (Bevilacqua & Fiorucci, 2024).

Traditional computational technologies are predominantly based on explicit procedures. Humans define an algorithm, formalize instructions, and the machine executes. Even as programming languages become more abstract and accessible, the underlying principle remains unchanged: the procedure must be clearly specified, and execution can be traced back to specific rules. With generative artificial intelligence, this framework changes. Users do not always specify the entire procedure; they direct a system that produces emergent, probabilistic, and not entirely predictable outputs. The quality of interaction therefore depends not only on the precision of the instructions, but on the ability to assess the consistency of the output with respect to context, purpose, style, recipients, and constraints.

Levin (2026) describes this transition through the concept of vibe-automation, arguing that generative AI not only automates explicit procedures, but also operationalizes tacit, contextual, and stylistic regularities. The term "vibe" here does not indicate a superficial or purely colloquial element, but a form of contextual coherence, a resonance between intention, output, and situation. The generative system does not possess tacit knowledge in the human or phenomenological sense of the term, but is capable of operating on linguistic, stylistic, semantic, and pragmatic patterns that in the past were accessible mainly through experiential and implicit skills.

This distinction is pedagogically crucial. Teaching has always been punctuated by tacit dimensions: the tone of explanation, the choice of example, sensitivity to the classroom climate, pacing, error management, the ability to recognize the appropriate moment to intervene or remain silent. A significant part of teaching competence cannot be completely reduced to formalized procedures (McKenzie, 2014). Generative AI can support some aspects of this complexity, but it cannot replace the pedagogical judgment that guides its use. It can produce alternatives, but it cannot autonomously decide which alternative makes sense in a real-world context.

For this reason, the relationship between teacher and AI cannot be interpreted in terms of substitution. It is more correct to interpret it as a relationship of asymmetric co-activity. AI generates; the teacher attributes meaning. AI proposes; the teacher evaluates. AI accelerates production; the teacher critically slows down to question quality, purpose, and consequences. AI broadens the scope of possibilities; the teacher exercises discernment about what is educationally desirable (Ferrari & Ellerani, 2025).

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This transformation also changes the nature of professional competence. In the traditional paradigm, digital competence for teachers has often been associated with the ability to use tools: platforms, applications, virtual environments, repositories, presentation software, and online quizzes. In the generative paradigm, competence shifts from mere utilization to the ability to orchestrate generation processes. Teachers must learn to formulate requests, define constraints, test output, correct errors, verify accessibility, recognize biases, and integrate artifacts into meaningful teaching sequences.

In this sense, generative AI lowers some technical barriers, but raises pedagogical demands. It is no longer essential to have an in-depth knowledge of the syntax of a programming language to produce a simple digital tool; however, it becomes essential to know what you want to design, for what purpose, with which students, according to which quality criteria, and with what responsibility. Expertise shifts from technical production to the pedagogical governance of the generative process.

This is why vibe coding takes on a particularly interesting value for pedagogy. It is not just a new coding modality, but an epistemological laboratory in which to observe the transformation of teaching professionalism (Kusper & Szabó, 2025). Through *vibe coding*, teachers can produce digital tools without being programmers, but they cannot do so without being pedagogically competent. The technique becomes more accessible; educational responsibility becomes more evident.

4. *Vibe Coding* as Conversational Instructional Design

Vibe coding can be defined as a software development modality assisted by generative artificial intelligence, in which the user produces code and digital artifacts through natural language, iterative dialogue, and progressive refinement of outputs. Popularized by Karpathy (2025), the concept indicates a practice in which the programmer does not necessarily write every line of code, but guides the system's behavior through prompts, feedback, corrections, and subsequent testing. However, in the pedagogical context, vibe coding takes on a broader meaning: it is not just a technical facilitation, but a form of conversational instructional design.

Its educational relevance lies in the fact that it allows teachers without advanced programming skills to generate customized digital tools. A teacher can describe a learning need in natural language – for example, building a simulator, an adaptive quiz, an interactive rubric, a disciplinary chatbot, a practice environment, or a micro-app for feedback – and guide the generative system in the progressive production of the artifact. This process is not limited to a single command, but develops as a dialogue: the teacher formulates an idea, observes the output, identifies limitations, requests modifications, tests its functionality, and adapts the tool to the context.

Recent literature interprets this practice as a shift from educator-user to educator-creator. Elizondo-Garcia (2026), in a scoping review of *vibe coding* in medical education, highlights how generative artificial intelligence allows educators without a technical background to develop applications, simulations, and interactive tools through natural language. The key point is not to replace professional developers in every field, but rather to enable teachers to rapidly materialize pedagogical ideas that in the past would have remained inaccessible due to a lack of resources, technical skills, or institutional support. In this direction, teachers no longer remain simple users of technologies produced elsewhere, but can become authors of situated digital mediators.

This democratization of digital production is particularly significant for inclusive teaching. Many teachers are well aware of their students' difficulties and can imagine useful tools to address them, but lack the technical skills necessary to implement them. *Vibe coding* can bridge this gap, enabling the design of resources that better meet real needs: simplified simulators, compensatory tools, graded activities, visual aids, review environments, personalized courses, and interactive feedback. However, democratization should not be confused with naive simplification. The ability to generate tools does not automatically guarantee their educational quality.

Elizondo-Garcia's (2026) review shows that vibe coding requires an integrated skill, interpretable through the TPACK model. Technological knowledge no longer coincides with mastery of programming syntax, but with the ability to formulate structured prompts and sustain an iterative dialogue with AI. Pedagogical knowledge becomes essential to transform the artifact into a learning experience. Disciplinary knowledge takes on a control and validation function, because only an expert can recognize errors, hallucinations, or inappropriate simplifications in the generated content.

In this framework, teachers become not simply programmers facilitated by AI, but pedagogical designers who work through language. Their expertise is no longer expressed in directly writing code, but in the ability to define educational intentions, functional constraints, accessibility criteria, interaction methods, and forms of feedback. *Vibe coding* thus shifts the focus of digital competence: from the syntax of code to the semantics of design.

This reconfiguration allows us to interpret the prompt as a true pedagogical act. An effective prompt is not a simple technical request, but the translation of an educational intention into an operational language that the system understands. It must contain objectives, audiences, difficulty level, subject content, interaction modes, constraints, feedback criteria, indications of inclusiveness, and evaluation parameters. Without this articulation, the system may generate a technically functional but pedagogically weak product.

5. ***Generative Teaching*: an emerging pedagogical category**

In light of these transformations, this paper proposes the concept of *Generative Teaching* as an emerging pedagogical category. This term does not simply refer to the use of artificial intelligence to generate teaching materials. *Generative Teaching* indicates a professional posture in which teachers use generative systems to co-design, adapt, verify, and govern educational artifacts, transforming algorithmic generation into a situated learning experience.

Generative Teaching is based on a key premise: artificial generativity is not the same as pedagogical generativity. A system can produce multiple outputs, but only the teacher can direct them toward educational goals. Automatic generation becomes educationally meaningful only when it is integrated into an intentional project, critically evaluated, and adapted to a real-world context. Without this mediation, AI risks producing formally correct materials that lack pedagogical depth.

The first dimension of *Generative Teaching* is *pedagogical intentionality*. Every generative process must begin with an educational question: what learning do we want to promote? What difficulty do we want to address? What barrier do we want to reduce? What experience do we want to enable? The generative teacher starts not from the technology, but from the pedagogical problem. AI becomes a design space only when guided by a clear educational intention.

The second dimension is *project translation*. The teacher must transform educational needs into operational instructions. This requires the ability to specify content, functions, levels, constraints, accessibility criteria, feedback methods, and conditions of use. Project translation is the bridge between pedagogy and technology: it allows the generative system to produce artifacts consistent with the desired experience.

The third dimension is *reflective iteration*. Designing with AI is not linear. The first output is rarely fully adequate. It is necessary to read, test, correct, request alternatives, modify constraints, and verify again. This process recalls the Batesonian logic of feedback: the system and the teacher learn through successive differences, errors, adjustments, and new configurations (Bateson, 1972). The teacher, in this circuit, is not a simple consumer, but a reflective regulator.

The fourth dimension is *pedagogical-disciplinary validation*. Each generated artifact must be checked for accuracy, coherence, accessibility, inclusiveness, linguistic adequacy, and alignment with objectives. In highly accountable contexts, such as medical education, the literature highlights how disciplinary knowledge plays an essential auditing role to avoid hallucinations or potentially harmful errors (Elizondo-Garcia, 2026; Pesce & Cheungpasitporn, 2025). The same principle applies to every educational setting: AI can produce, but the teacher must ensure quality and meaningfulness.

The fifth dimension is *ethical governance*. Generated tools can incorporate bias, opacity, privacy issues, accessibility barriers, and forms of standardization. The generative teacher must therefore assume not only a didactic but also an ethical responsibility. Floridi (2023) emphasizes how AI ethics requires accountability, transparency, justice, and meaningful human control. In education, these principles must translate into concrete practices of verification, documentation, and supervision.

Generative Teaching thus allows us to overcome two opposing but reductive visions. On the one hand, the technocentric enthusiasm, according to which AI automatically makes teaching innovative. On the other, the defensive posture, according to which any use of AI would lead to a loss of professionalism. The perspective proposed here instead asserts that AI can expand teaching agency if it is governed pedagogically. Innovation lies not in the tool, but in the quality of the project-based relationship that the teacher builds with it.

6. TPACK, design thinking and pedagogical auditing of AI

The TPACK model, developed by Mishra and Koehler (2006), provides a useful framework for understanding the complexity of teaching competence in the era of generative artificial intelligence. The model interprets the effective integration of technologies in teaching as the result of the interaction between three domains: technological knowledge, pedagogical knowledge, and disciplinary knowledge. Its relevance increases in the context of AI because it shows that no single skill is sufficient to guarantee educational quality.

In the case of *vibe coding*, technological knowledge is profoundly reconfigured. It is no longer simply a matter of knowing a software or programming language, but of knowing how to interact with generative models through natural language, structured prompts, successive tests, and refinement cycles. Walter (2024) highlights how AI literacy, prompt engineering, and critical thinking are now essential dimensions of contemporary educational competence. However, this technological competence cannot be separated from pedagogy.

Pedagogical knowledge allows us to direct the use of AI toward educational objectives. A digital artifact can be technically sophisticated but didactically ineffective if it is not aligned with student needs, curricular objectives, and contextual conditions. Biggs (1996), with the principle of *constructive alignment*, recalls that objectives, activities, and assessment must be coherently connected. In *Generative Teaching*, this principle becomes even more important: every function generated by AI must be justified by an educational purpose.

Finally, disciplinary knowledge takes on an auditing role. When AI produces content, simulations, or interactive logic, teachers must be able to recognize errors, simplifications, ambiguities, and hallucinations. In the medical field, Elizondo-Garcia (2026) describes the profile of the "clinician-developer", a professional who uses vibe coding to create educational tools while remaining the guarantor of clinical accuracy and educational safety. Transposed to the school and university environment, this profile can be reinterpreted as a *teacher-developer* or *generative teacher*: a teacher capable of creating digital tools, but also of critically validating them.

The pedagogical audit function can be articulated through some guiding questions: Does the generated tool meet a clear objective? Is it consistent with the students' level? Is it accessible? Does it contain disciplinary errors? Is the feedback produced formative? Does the interaction promote understanding or merely performance? Does the activity reduce or increase cognitive load? Is the language inclusive? Is student data protected? Can the artifact be integrated into a meaningful teaching sequence?

These questions show that teachers cannot simply accept AI output. They must assume the role of curator, evaluator, and guarantor. Teaching professionalism does not diminish, but becomes more complex: not just designing, but designing with; not just producing, but verifying; not just using, but governing.

A possible operationalization of this process is offered by the SRVE framework – *Specify*, *Refine*, *Verify*, *Embed*, proposed by Munoz and Rook (2026) in relation to the design of educational simulations using generative AI. The *Specify* phase corresponds to pedagogical intentionality: the teacher clarifies what he wants to build and why. The *Refine* phase concerns the progressive improvement of the artifact, with attention to usability, interface, and clarity of experience. The *Verify* phase coincides with pedagogical and disciplinary auditing: the output is not accepted uncritically, but checked. The *Embed* phase concerns the integration of the tool into a learning environment and into a meaningful teaching sequence.

This framework avoids two opposing risks. On the one hand, it prevents *vibe coding* from becoming technological improvisation. On the other, it avoids rigidifying design into a purely technical procedure. It preserves the creative and iterative dimension of the dialogue with AI, but places it within a framework of pedagogical responsibility. In this sense, *Generative Teaching* can find a useful methodological foundation in design thinking and iterative models, provided that the technique always remains subordinate to the educational purpose (Brown, 2008).

7. The extended teacher as pedagogical ***vibe-engineer***

The figure of the *vibe-engineer*, proposed in the reflection on *vibe-automation*, indicates a professional capable of operating in generative computational regimes, in which expertise consists not only in specifying procedures, but also in managing resonance, alignment, and contextual coherence (Levin, 2026). This figure, born in the computer science field, can be reworked pedagogically. The generative teacher can be interpreted as a pedagogical *vibe-engineer*, not because they must become software engineers, but because they are called upon to orchestrate educational intentions, languages, constraints, outputs, and contexts.

In the traditional paradigm, teachers used tools designed by others. In the generative paradigm, they can directly produce situated tools. This doesn't mean every teacher must become a professional developer, but it does mean they can acquire a new form of design autonomy. This autonomy is particularly important in educational contexts where resources are limited and student needs require customized solutions. Teachers can generate prototypes, test them, adapt them, and share them with the professional community.

The pedagogical *vibe-engineer* operates on three levels. The first is the level of *intention*. He knows how to start from an educational problem, not from technological fascination. He asks himself what learning experience he wants to promote, what barriers he wants to reduce, what cognitive process he wants to activate.

The second level is that of *contextual resonance*. The teacher evaluates whether the artifact produced is consistent with the class, the students, the disciplinary language, the objectives, and the educational climate. A tool may function technically but not resonate with the context; it may be correct but not meaningful; it may be interactive but not formative.

The third level is that of *accountability*. Teachers know that every output generated must be verified. AI can make mistakes, simplify, omit, invent, or standardize. Teachers must therefore maintain critical control, document the process, and take responsibility for the educational use of the artifact.

This role allows us to redefine digital competence for teachers. It's no longer just about knowing how to use platforms, but about knowing how to design learning ecologies with the support of AI. It's no longer just about knowing tools, but about knowing how to generate, adapt, evaluate, and manage them. Digital competence thus integrates with pedagogical, disciplinary, ethical, and organizational skills.

The extended teacher is therefore not a teacher diminished by the machine, but a professional who expands his or her scope of action. His or her mind does not dissolve into AI; it extends through it. But this extension is pedagogically valid only if it does not become dependency. The teacher must think with AI without ceasing to think. He or she must use the machine as a space of possibilities, not as an automatic source of decision-making.

8. Pedagogical risks: cognitive delegation, opacity, and generative standardization

A pedagogical reflection on generative artificial intelligence cannot limit itself to its potential. The ability of generative systems to rapidly produce texts, code, tools, and environments can lead to forms of dependence, impoverishment, and de-responsibility. The first risk is *cognitive delegation*. If teachers accept AI outputs without understanding, verifying, or adapting them, their agency is not extended, but diminished. The apparent operational enhancement masks a loss of epistemic control.

The second risk is *algorithmic opacity*. Generative systems produce responses through processes that are difficult for the user to understand. This makes it difficult to understand why a certain output was generated, what patterns guided it, and what biases may be incorporated. In education, opacity is particularly delicate, because every educational artifact contributes to building representations of knowledge, forms of relationship, and assessment methods.

The third risk is *technological dependence*. If AI is used to bypass the effort of design, it can reduce the teacher's ability to independently design, formulate teaching hypotheses, and exercise judgment. Zhang et al. (2024) discuss the issue of problematic AI usage and AI dependence in educational contexts, showing how performance expectations, stress, and self-efficacy can influence problematic forms of use. Even for teachers, the ease of generation can lead to excessive reliance on the system.

A fourth risk concerns *generative homogenization*. Levin (2026) uses the expression "Beige Box" to describe the tendency of generative systems to converge toward outputs that are competent but generic, correct but not distinctive, and enjoyable but lacking cultural specificity. In the educational context, this can translate into formally ordered but pedagogically flat teaching: well-structured lessons, comprehensive rubrics, coherent exercises, but lacking grounding in context, relationships, and the uniqueness of students.

To counter this risk, teachers must develop what might be called pedagogical taste. It's not enough to verify whether an activity is technically sound. It's necessary to evaluate whether it is meaningful, inclusive, culturally situated, cognitively challenging, and consistent with an educational vision. Pedagogical taste is the ability to distinguish between an acceptable output and an authentic learning experience. It's the skill that allows teachers to not settle for generative mediocrity, but to seek depth, specificity, and meaning.

Generative artificial intelligence challenges not only individual teachers, but the entire school system. If the mind is expanded, learning governance must also be expanded. The use of AI cannot be left exclusively to the individual initiative of the most innovative teachers, nor can it be regulated solely through bans or general guidelines. We need to build an institutional culture capable of supporting experimentation, validation, sharing, and accountability.

The literature on AI in higher education shows that the adoption of generative systems requires policy, training, guidelines, and organizational support (Chan, 2023; Wang et al., 2024). UNESCO (2024), with the *AI Competency Framework for Teachers*, emphasizes the need for training that integrates a human-centered perspective, ethics, AI foundations, pedagogy, and professional development. From this perspective, pedagogical governance should be structured on at least three levels: the individual competence of the teacher, the professional community as a space for sharing and validation, and the school institution as a regulatory, ethical, and formative environment.

Generative Teaching becomes truly transformative when it transcends individual practice and translates into shared repertoires, validation protocols, collegial reflection, and organizational learning. If AI is used to accelerate transmission practices, it will produce faster, but not necessarily more meaningful, teaching. If, however, it is oriented toward inclusion, personalization, feedback, simulation, reflexivity, and agency, it can contribute to authentic transformation.

9. Educational-pedagogical implications and conclusions

The implications of the proposed model are relevant on multiple levels. The first concerns teacher training. Initial and ongoing training programs can no longer be limited to basic digital literacy. They must include AI literacy skills, prompt-based design, output evaluation, AI ethics, accessibility, Universal Design for Learning, TPACK, design thinking, and the construction of digital artifacts (Boysen, 2024). Teachers must be trained not only to use AI, but to think about it pedagogically.

The second implication concerns inclusion. Vibe coding can enable teachers to create tools that better meet students' needs: graded learning paths, visual simulators, compensatory tools, support chatbots, personalized activities, immediate feedback, and practice environments. However, inclusion doesn't automatically arise from technology. It stems from the teacher's ability to design based on differences, recognizing barriers and facilitators.

The third implication concerns professional creativity. Generative AI can strengthen teachers' sense of agency, especially in contexts with limited resources. A teacher can transform an idea into a prototype, test it, modify it, and share it. This step can reduce the gap between pedagogical imagination and technical implementation, fostering a culture of bottom-up innovation.

The spread of generative artificial intelligence therefore forces pedagogy to reformulate some fundamental questions. It's not enough to ask which tools to use or how to produce teaching materials more quickly. We must also question how the professional mindset of teachers, their agency, their responsibility, and their relationship with technological artifacts are changing.

This paper has proposed interpreting generative AI and vibe coding within the framework of extended learning. From this perspective, instructional design is no longer an activity confined to the individual mind of the teacher, but a distributed process that emerges from the interaction between pedagogical intentionality, natural language, generative systems, digital artifacts, school contexts, and professional communities.

The concept of *Generative Teaching* allows us to name this transformation. The generative teacher does not delegate their educational function to the machine. Instead, they use artificial generativity to expand their capacity to design, personalize, include, and innovate. *Vibe coding*, in this context, represents an emblematic practice: it allows us to transform pedagogical intentions into digital tools through natural language, but at the same time requires a strong capacity for evaluation, adaptation, and control.

The final thesis is that AI can expand teaching professionalism only if it remains subordinated to pedagogical governance. If used uncritically, it can lead to dependence, standardization, and impoverishment. If governed reflexively, it can become a resource for expanding the teaching mind, strengthening professional agency, and making accessible forms of design previously reserved for those with advanced technical skills.

The future of education, therefore, lies not in the automation of teaching, but in the pedagogical governance of intelligent generativity. The teacher's mind today resides not only in the subject, nor in the machine, but in the responsible circuit that connects educational intention, artificial intelligence, digital artifacts, real-world contexts, and the school community. It is within this circuit that a school can take shape, capable not of being replaced by AI, but of thinking better, designing better, and including better through AI.

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