

# Collective Intelligence and Participatory Pedagogies for AI Integration in Education

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## ABSTRACT

This paper presents a participatory action-research pathway aimed at exploring the integration of artificial intelligence within educational contexts through active methodologies and shared laboratory-based environments. The project involved approximately 200 teachers from different levels of the Italian educational system, ranging from early childhood education to upper secondary school.

The experience was conceived not as a traditional technical training course on AI, but as a participatory pedagogical ecosystem grounded in dialogue, experimentation, and collective reflection. The pathway was structured through Diana Laurillard's Conversational Framework, adopted as a pedagogical architecture for organizing educational activities based on six fundamental learning modalities: appropriation, inquiry, discussion, collaboration, practice, and production.

Synchronous meetings, classroom experimentation, focus groups, and reflective surveys were conducted for each educational activity developed throughout the pathway. Teachers' attitudes, initially characterized by uncertainty and critical resistance, progressively evolved toward sharing, collaborative pedagogical construction, and dialogical engagement, fostering forms of collective intelligence around the pedagogical use of artificial intelligence.

The findings highlight high levels of participation retention (80% of the initial participants) together with a progressive reduction of resistance toward innovation and the transformation of the group into a reflective professional community.

The study suggests that educational innovation related to AI becomes more sustainable when supported by participatory methodologies and continuous dialogical infrastructures. Within this perspective, artificial intelligence does not merely represent a technological tool, but rather a mediating object capable of activating collaborative reflection, professional agency, and the shared construction of pedagogical meaning.

**Keywords:** Collective intelligence; Participatory action research; Artificial intelligence in education; Conversational Framework; Active pedagogies.

## INTRODUCTION

The rapid diffusion of generative artificial intelligence within educational contexts has generated increasing attention toward teacher professional development and the integration of technologies into educational practice. However, many initiatives aimed at introducing AI into schools continue to rely on transmissive approaches primarily focused on the acquisition of technical competencies and the adoption of tools, often overlooking the pedagogical, relational, and reflective dimensions of innovation.

This paper proposes an alternative perspective grounded in the idea that educational innovation becomes meaningful when it is co-constructed through active participation, shared experimentation, and dialogical reflection. Within this perspective, professional learning is interpreted not as the transmission of predefined knowledge, but as a participatory pedagogical process through which teachers collaboratively construct practices, meanings, and educational possibilities related to artificial intelligence.

The paper presents a participatory action-research experience involving approximately 200 teachers from different educational levels — from early childhood education to upper secondary school — distributed across several Italian regions and professional contexts throughout the entire pathway. The experience was not designed as a traditional AI training course, but rather as a distributed laboratory-based environment in which participants engaged in recursive cycles of training, experimentation, reflection, production, discussion, and evaluation.

The pedagogical architecture of the experience was built upon the Conversational Framework developed by Diana Laurillard, interpreted not simply as an instructional model, but as a mediating structure capable of supporting collective participation and reflective practice. The six learning modalities embedded in the framework — appropriation, inquiry, discussion, collaboration, practice, and production — became shared pedagogical spaces through which teachers collectively explored and reinterpreted the educational possibilities offered by artificial intelligence.

The study is grounded in the idea that collective intelligence emerges when innovation is experienced as a shared pedagogical process rather than as an individual adoption of technological tools. Within this perspective, AI does not represent the center of the pathway, but rather a mediating object around which collaborative reflection, professional experimentation, and the shared construction of educational meanings can emerge.

The contribution therefore explores how active methodologies and participatory environments may support more reflective, sustainable, and pedagogically grounded forms of educational innovation, transforming professional groups into communities capable of generating collective intelligence through continuous dialogical and laboratory-based practices.

Throughout the experimentation, teachers used different generative artificial intelligence tools selected according to the pedagogical objectives of the individually designed activities. Among the most frequently used tools were conversational language models for text production and revision, image-generation systems, applications for instructional design, and environments supporting the construction of assessment rubrics and formative feedback. In particular, the activities involved tools such as ChatGPT, Microsoft Copilot, Google Gemini, DALL·E, and applications integrated into educational and creative digital platforms.

## LITERATURE REVIEW

### Active Pedagogies and Laboratory-Based Learning

The concept of laboratory-based learning has historically been associated with experiential and participatory approaches to education, in which knowledge emerges through action, reflection, and interaction rather than through passive transmission. Within this perspective, learning is not conceived as the simple acquisition of information, but as an active process of meaning-making situated within social and relational contexts.

The pedagogical foundations of active methodologies can be traced back to John Dewey, who interpreted education as a process grounded in experience and inquiry. Dewey's principle of *learning by doing* emphasized participation, experimentation, and reflection as fundamental dimensions of meaningful learning. Similarly, Maria Montessori highlighted the role of the prepared environment as a pedagogical condition capable of fostering autonomy, exploration, and self-directed learning. Paulo Freire further developed the dialogical and participatory dimensions of education, criticizing transmissive models and proposing a conception of learning grounded in dialogue, critical reflection, and the co-construction of knowledge.

Within these theoretical traditions, laboratory-based pedagogy can be interpreted not simply as the use of practical activities, but as a pedagogical orientation in which experimentation, reflection, and participation become central to the construction of knowledge. The laboratory therefore does not necessarily coincide with a physical space, but rather with a relational and methodological condition that enables participants to engage collectively in processes of inquiry, interpretation, and problem-solving.

Recent educational research has also emphasized the importance of active methodologies in supporting teachers' professional learning, particularly in contexts characterized by rapid technological and social transformations.

In such scenarios, transmissive models of professional development often prove insufficient because they focus primarily on procedural knowledge rather than on the collaborative construction of pedagogical meaning.

### **Collective Intelligence and Learning Societies**

The growing complexity of contemporary educational environments has progressively shifted attention from individual forms of expertise toward collaborative and distributed processes of knowledge construction. Within this perspective, innovation is increasingly interpreted not as the result of isolated competencies, but as an emergent process generated through interaction, participation, and collective reflection.

The concept of collective intelligence was extensively developed by Pierre Lévy, who described it as a form of distributed intelligence continuously enhanced through collaboration and reciprocal recognition among individuals. According to Lévy, knowledge does not reside exclusively within individual subjects, but emerges dynamically through networks of interaction in which participants contribute different perspectives, competencies, and experiences.

A similar perspective is developed by Etienne Wenger through the concept of communities of practice. Wenger conceptualizes learning as a process of social participation occurring within communities in which individuals engage in shared activities, develop common repertoires, and progressively construct collective identities. Knowledge, in this perspective, is not simply transmitted but produced through participation in shared practices and continuous interaction among community members.

A particularly significant perspective for interpreting the collective dimension of learning is offered by the UNESCO Faure Report published in 1972, *Learning to Be: The World of Education Today and Tomorrow*, coordinated by Edgar Faure. The document represents one of the earliest systematic attempts to rethink education not as a process confined within school institutions, but as a permanent and distributed dimension of social life.

The Faure Report introduced the concept of the *learning society*, arguing that learning should become a shared collective responsibility supported through networks of relationships, institutions, experiences, and social participation. Within this perspective, the educational system does not coincide exclusively with schools, but includes the broader set of cultural, social, and relational conditions that enable individuals and communities to learn continuously throughout life.

Education is therefore interpreted as a democratic and social infrastructure capable of supporting participation, cooperation, and human development. The report also emphasizes how contemporary societies, characterized by increasing complexity and technological transformation, require educational models grounded less in the vertical transmission of knowledge and more in the collective capacity to construct understanding, interpret change, and generate shared adaptation.

Within contemporary contexts characterized by the diffusion of artificial intelligence, the perspective outlined in the Faure Report appears particularly relevant because it highlights the need to build participatory educational ecosystems capable of sustaining continuous learning, collective reflexivity, and shared responsibility within processes of technological transformation.

### **The Participatory Research Pathway**

#### **Methodological Design**

The research was developed through a six-month participatory action-research approach involving approximately 200 teachers from different levels of the Italian educational system who expressed their interest in participating by responding to a public call published by the Regional Territorial Offices of the Ministry of Education.

The pathway was structured through recursive cycles of training, reflection, sharing, action, possible redesign, and self-evaluation, progressively leading participants toward the development of AI-supported educational activities. The research experience presented in this study evolved as a large-scale participatory initiative aimed



at exploring how artificial intelligence could be introduced into educational practice through pedagogically mediated methodologies capable of fostering individual engagement as members of a structured professional community.

## How the Project Was Conducted: The Participatory Cycle

A recursive process of learning, sharing and reflection

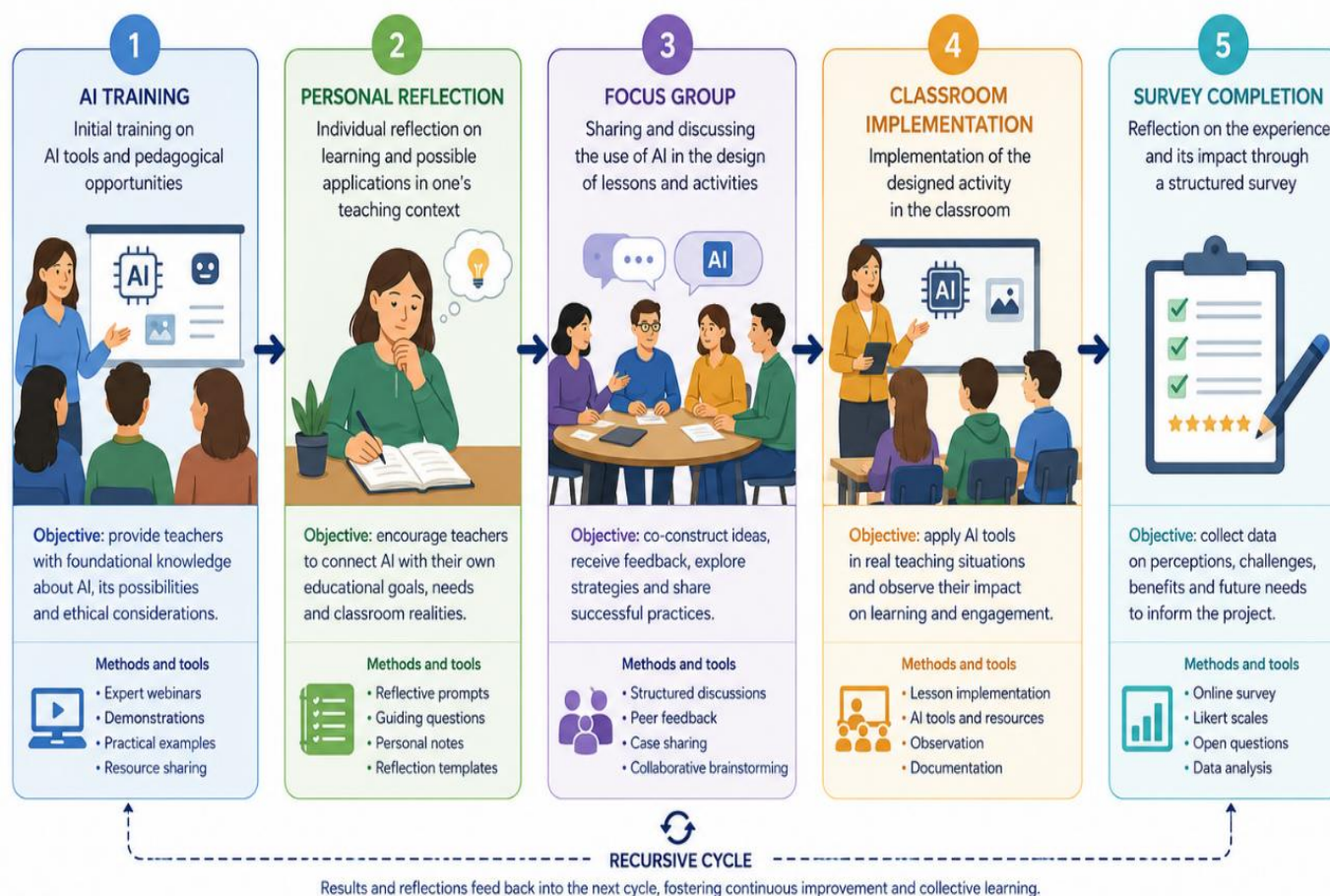


Figure 1: The Participation Cycle of the Action-Research Pathway

Data collection involving teachers was carried out through both qualitative methodologies — including observation and active listening — and quantitative methodologies through the administration of two surveys. The first survey aimed at describing the educational activities developed by participants and collecting the teaching materials produced by each teacher. The second survey, the *Educator Engagement Survey* based on the EMS Tools AI Educator Engagement Scale (AIEES), was designed to measure motivation and emotions (Chassignol et al.; Wan & Cheng; Ahmad et al.; Holmes & Tuomi), including acceptance, enthusiasm, and perceived usefulness; cognitive processes (Chen et al.; Zawacki-Richter et al.; Lameris & Arnab; Namatherdhal et al.), such as reflection, appropriation, and sense of agency; and behavioral engagement (Ouyang & Jiao; Huang et al.; Ahmad et al.; Wang et al.), including the effective integration of AI into teaching practices. The scale was adapted to Diana Laurillard's Conversational Framework.

Data collection took place *in itinere* throughout the implementation of each of the six cycles corresponding to the six teaching modalities proposed by the framework: during synchronous meetings, the ideation phase, reflective focus groups, shared observations on the dedicated online platform created to maintain relational continuity, the implementation of classroom activities, and structured surveys.

The reflections and subsequent analyses focused primarily on perceived obstacles and risks related to the introduction of AI into teaching practices — in compliance with existing regulations — as well as on the need

to create spaces for dialogue regarding collective processes of pedagogical construction with technology, the influence exerted by school environments, the awareness of the need for continuous professional development, and emerging evidence concerning both the school system and student learning.

The project was therefore structured as a distributed collaborative environment in which teachers progressively engaged in cycles of appropriation, experimentation, discussion, reflective analysis, self-evaluation, and redesign. Within this perspective, the environment was interpreted not as a physical space, but as a pedagogical and relational condition capable of fostering active participation and collective intelligence. The initiative was designed as a shared pedagogical pathway whose central objective was not merely to familiarize teachers with AI tools, but to create the conditions for the collaborative construction of educational meanings and practices related to technological innovation capable of generating potentially stable relationships.

A central element of the pathway was the continuity of dialogical interaction maintained throughout the entire research experience. The project was intentionally designed to sustain an ongoing collective conversation among participants, transforming professional learning into a continuous process of shared reflection, negotiation, and pedagogical reinterpretation.

This dialogical continuity was supported through multiple interconnected dimensions of participation. Regular synchronous meetings allowed teachers to share new perspectives, address specific emerging issues, exchange experiences, reflect on difficulties, and progressively construct common interpretative frameworks regarding the pedagogical use of AI. The spaces created within the action-research pathway, where dialogue progressively fostered increasing engagement among teachers and generated forms of collective knowledge, were multiple and interconnected. Alongside synchronous meetings, participants were actively involved in the design and implementation of educational activities connected to the six learning modalities of the Conversational Framework. Teachers were encouraged to adapt experimentation to their own educational contexts, generating diverse practices and reflections that subsequently became objects of collective discussion and analysis.

In particular, the focus group represented a moment of openness and narration of personal pedagogical choices in which judgment was intentionally absent. This dimension played a crucial role in reducing initial anxiety and fear related to professional comparison and experimentation.

Discussions emerging during the focus groups highlighted the progressive transformation of teachers' relationships with technological innovation. As one participating teacher stated:

"At the beginning, I was afraid of using artificial intelligence. Discussing it with other teachers made the experimentation feel more legitimate and supported."

A second participant emphasized:

"The most important aspect was not learning the tool itself, but reflecting together on how to use it pedagogically."

These testimonies confirm how the dialogical and collaborative dimension of the pathway contributed to transforming innovation from an individual experience into a collective process of professional construction. These moments enabled participants to elaborate emotional responses, uncertainties, resistances, and emerging pedagogical awareness related to the integration of AI into teaching practices.

The creation of a Padlet platform, together with the possibility of accessing it at any time to ask educational or organizational questions, also played a significant supportive role throughout the pathway.

## Participatory Pedagogical Ecosystem for AI Integration

Based on Diana Laurillard's Conversational Framework

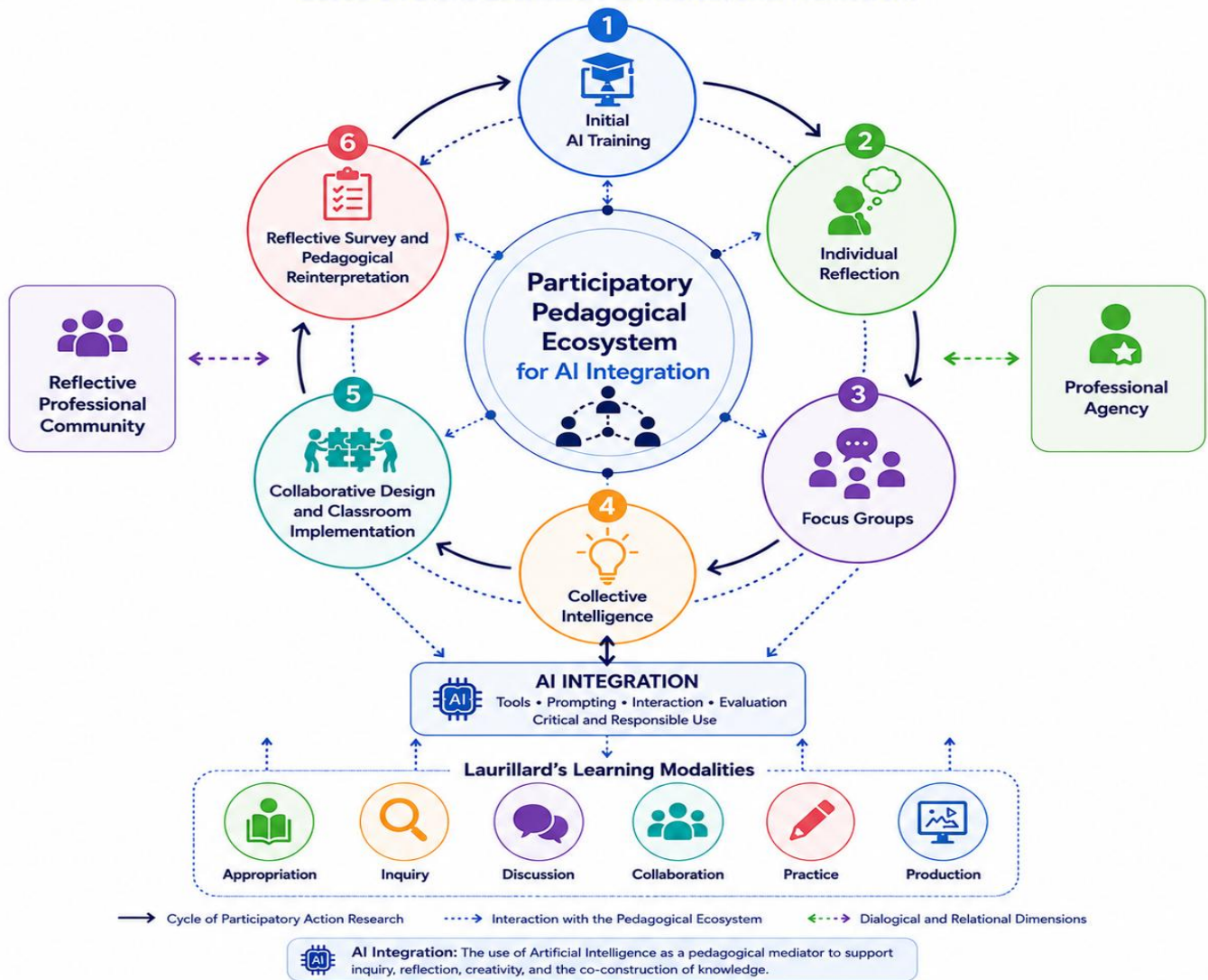


Figure 2: Participatory Pedagogical Ecosystem (Graphic Representation)

The pedagogical architecture of the pathway, as illustrated in Figure 1, was built upon Diana Laurillard's Conversational Framework. The framework was selected because of its ability to provide a structure that is both simplified and comprehensive, capable of encompassing the principal modalities of formal teaching and learning. The framework already incorporated a dialogical, cyclical, and strongly relational organization of the teaching and learning process, facilitating the pedagogical appropriation of the action-research cycle in ways that were fully coherent with the foundational principles of the Conversational Framework.

The six learning modalities embedded in the framework — appropriation, inquiry, discussion, collaboration, practice, and production — were adopted as organizational dimensions of the pathway and translated into concrete educational activities connected to the pedagogical use of artificial intelligence.

A central element of the pathway was the continuity of dialogical interaction maintained throughout the entire research experience. The project was intentionally designed to sustain an ongoing collective conversation among participants, transforming professional learning into a continuous process of shared reflection, negotiation, and pedagogical reinterpretation.

Within the action-research pathway, this dialogical continuity was supported through multiple interconnected dimensions of participation. Regular synchronous meetings allowed teachers to collectively discuss emerging



issues, share experiences, reflect on difficulties, and progressively construct common interpretative frameworks regarding the pedagogical use of AI.

The space within the action-research pathway that particularly fostered increasing engagement among teachers and generated forms of collective knowledge was the focus group. This moment of openness and narration of personal choices, in which judgment was generally absent, played a crucial role in reducing anxiety and encouraging participation. Equally important was the creation of a Padlet platform, together with the possibility of accessing it at any time to ask educational or organizational questions, which contributed significantly to supporting participants throughout the process.

Alongside synchronous meetings, participants were actively involved in the design and implementation of educational activities connected to the six learning modalities of the Conversational Framework. Teachers were encouraged to adapt experimentation to their own educational contexts, generating diverse practices and reflections that subsequently became objects of collective discussion and analysis.

The discussions emerging from the focus groups highlighted the progressive transformation of teachers' relationships with technological innovation. As one participating teacher stated:

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### **Preliminary Findings**

Preliminary findings highlight the strong potential of participatory and laboratory-based methodologies in supporting educational innovation processes related to artificial intelligence. Rather than generating merely procedural or technical forms of learning, the pathway progressively fostered collaborative reflection, professional engagement, and the collective construction of pedagogical meaning.

The findings presented in this contribution should be considered part of a broader ongoing analysis. The results discussed here specifically refer to the analysis of data collected during the appropriation and inquiry cycles.

From a quantitative perspective, the pathway registered high levels of continuity in participation throughout the entire experimentation. Most of the teachers involved consistently attended the synchronous meetings, which were also recorded and uploaded onto a website specifically created for the research project in order to support teachers and allow asynchronous access to the materials. Participation in the surveys also remained constant, and teachers who were unable to complete them within the expected timeframe were allowed to do so at a later stage.

A significant number of participants (close to 80%) completed and shared all the AI-supported educational activities and filled in the surveys related to the six learning modalities proposed by the Framework, contributing to the progressive construction of shared pedagogical repertoires and distributed collaborative practices. In this case as well, additional time was provided to teachers who expressed the need to complete the work after the scheduled deadlines.

The continuity of participation appears particularly significant considering both the heterogeneity of the school contexts involved and the voluntary nature of participation in the project.

The dialogical structure of the pathway appears to have played a crucial role in strengthening the sense of belonging to the group and reducing the uncertainty associated with the introduction of AI into educational contexts. Continuous interaction with peers enabled teachers to normalize doubts and create space for experimentation. It also “authorized” teachers to openly discuss and share their beliefs, difficulties, and collectively reinterpret emerging challenges.

The findings suggest a progressive transformation in teachers’ mental representations of artificial intelligence. Initial perceptions, frequently characterized by fear, uncertainty, or technical curiosity, gradually evolved toward more reflective and pedagogically mediated interpretations.

One early childhood teacher from Calabria created, together with her students and under their supervision, a song describing autumn:

“The lyrics emerged from the students’ reflections on colours, sounds, habits, emotions, and memories related to this season. The text was then reworked through ChatGPT, and with Suno we transformed everything into a pop song that the children learned by heart.”

The teacher reported that several students repeatedly corrected the AI-generated reformulations because they did not fully correspond to their own reflections and interpretations.

A second activity presented here as an example was developed within a Civic Education and Italian Literature pathway aimed at introducing students to a critical and conscious use of generative artificial intelligence. The teacher designed a laboratory-based experience intended not only to promote the technical use of the tool, but above all to foster critical thinking, argumentative reflection, and the ability to interpret and evaluate AI-generated content.



Figure 3: Beatrice and Dante in an “Impossible Dialogue” — Third-Year Scientific High School, Sicily

“In an initial phase, students were introduced to the general functioning of generative artificial intelligence systems and to the importance of prompts in shaping AI-generated responses.”

Subsequently, students, organized into working groups, developed prompts to be submitted to the artificial intelligence system. The activity focused on the study of fourteenth-century authors and, in particular, on the



figure of Beatrice within Dante's literary production. One of the prompts developed by the students asked the AI system to:

"Generate a dialogue in which Beatrice is not represented as Dante's miracle woman." (see Figure 3)

Starting from this request, students initiated a recursive conversation with the AI system: each response generated new questions, deeper explorations, reformulations, or critical challenges. The activity therefore transformed interaction with AI into a dialogical process of interpretative exploration and collective reflection.

During the experience, the teacher reported maintaining a role of pedagogical guidance and critical mediation, observing students' reasoning processes, encouraging discussion among different interpretations, and helping the class reflect on the limitations of artificial intelligence.

The findings suggest that active and collaborative ecosystems may become particularly effective when supported by clear organizational infrastructures and relational conditions capable of sustaining pedagogical dialogue throughout the entire innovation process. Within this perspective, participation may progressively evolve into a form of co-authorship of each educational pathway.

## CONCLUSIONS

The research pathway presented in this study highlights how the introduction of artificial intelligence into educational contexts can become pedagogically effective and meaningful when supported by participatory environments, active methodologies, and shared dialogical structures.

Preliminary findings suggest that continuity of professional dialogue, active participation, and the presence of a clear and pedagogically coherent organizational structure represent fundamental conditions for supporting sustainable processes of educational change. Collaborative ecosystems built through synchronous meetings (recorded to avoid excluding participants), open discussions free from judgment, focus groups, and a permanently accessible digital environment fostered the emergence of a professional community capable of transforming individual experiences into shared knowledge and stronger professional practices within classrooms.

Within the pathway, artificial intelligence assumed the role of a pedagogical mediator around which teachers were able to negotiate practices, critically reflect on the educational implications of innovation, and develop new forms of professional agency.

The experience suggests that technologies such as AI can become genuinely transformative not because of their intrinsic technical characteristics, but because of the quality of the pedagogical relationships and collective processes activated in accordance with the principles described throughout this study.

Finally, the findings reveal how these collective experiences can become spaces in which shared professional languages and collective interpretative frameworks emerge. Through recurring dialogue and collaborative experimentation, participants progressively developed common ways of discussing pedagogical uses, ethical issues, methodological limitations, and educational opportunities related to AI. This process facilitates communication and generates a virtuous cycle for the continuous production of collective intelligence.

Within this perspective, the paper proposes a reinterpretation of "laboratory-based" pedagogy as a participatory ecosystem capable of generating collective intelligence and supporting educational innovation through reflective, collaborative, and culturally shared forms. The pathway also suggests the need to rethink teacher professional development not as training in the use of tools, but as the collective construction of professional environments within which contemporary educational and social transformations can be interpreted together.

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