INCLUSIVE CO-DESIGN AND ARTIFICIAL INTELLIGENCE (AI) DEVICES: AN EXPERIMENTAL RESEARCH PROTOCOL FOR SCHOOLS

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ABSTRACT
This paper illustrates the conceptual and operational architecture of an Artificial Intelligence (AI)-based instructional co-design device. Placing itself at the intersection between Special Pedagogy, educational technologies and Universal Design for Learning (UDL), the contribution presents the design of a device capable of making the dialogue between curricular teachers and specialized teachers for support activities more functional in order to design inclusive teaching formats. The design of the device is divided into three interconnected phases: the "low-impact" micro-design (the Lesson Project File), the observation and description of the class context (Observation Matrix) and the generation of personalized teaching mediators through specific engineered prompts. The research protocol includes a within-subjects methodology divided into three phases: a control phase (traditional lesson), an experimental phase (lesson with the support of the AI device) and a qualitative phase (semi-structured interviews with teachers and students). The expected results foreshadow significant repercussions on the sustainability of inclusive teaching and on the culture of shared planning.

KEYWORDS
mediation device; inclusive co-design; Artificial Intelligence; teacher self-efficacy; Special Educational Needs.

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1. Introduction

The widespread diffusion of Artificial Intelligence (AI) systems in educational contexts represents one of the most significant and, at the same time, most problematic phenomena of Italian schools which, despite and at the same time, thanks to the events of the last five years and the measures adopted to contain and relaunch, has led to what is the current phase of digital transition. A phase that is being experienced at all levels. After the pandemic experience and the lockdown, teacher training has exploded in all schools of all levels with such a rich and heterogeneous offer that it has engaged both curricular and specialized teachers in support, in extensive training activities without adopting effective learning verification tools. Far from being a simple instrumental innovation, AI introduces a profound redefinition of the roles, relationships and processes that structure the educational experience and, in particular, as we will see in this article, of instructional design. International literature has progressively shifted its analytical axis from a predominantly techno-optimistic perspective towards a critical-reflective approach capable of questioning the ethical, pedagogical and political implications of such integration (Selwyn, 2019; Holmes et al., 2022). As Selwyn (2022) has effectively summarized, the adoption of educational technologies without a structural critique of the assumptions that animate them risks reproducing and amplifying existing inequalities, rather than reducing them.

Research on AI in education (AIED) has experienced exponential growth in recent years (Zawacki-Richter et al., 2019; Luckin et al., 2016). Large Language Models (LLMs) have opened up new scenarios for the generation of adaptive learning content, the production of personalized feedback, and support for curriculum design (Kasneci et al., 2023; Mollick & Mollick, 2023). Holmes et al. (2022) distinguish between a use of AI "for education", where the technology supports pedagogical goals defined by teachers, and a use "instead of education", where technology tends to replace the educational relationship. The device described here is explicitly placed in the first scenario.

In this scenario, the scientific community of Special Pedagogy addresses the impact of AI on teaching professionalism with several studies, with particular attention to teachers' perceptions (Giaconi et al, 2024; 2025, Fiorucci & Bevilacqua, 2026), to the different tools available to teachers for design, inclusive teaching and evaluation (Fiorucci & Bevilacqua, 2024; Ceccacci et al,.2024).

The central dimension that this contribution aims to explore is the co-design between curricular teachers and specialized teachers for support activities in the creation of inclusive teaching formats in classes where students with Special Educational Needs are inserted. The challenge of co-design takes into consideration several aspects: the disciplinary specialization of teachers, the fragmentation of schedules, the predominantly certification-based evaluation culture, and the tendency to interpret inclusion as the exclusive task of the specialized teacher for support activities (Ianes & Canevaro, 2015; Cottini, 2019; Giaconi, Rodrigues & Del Bianco, 2019; Giaconi et al., 2020; Amatori et al., 2021; Giaconi & Borsini, 2025; Fiorucci & Bevilacqua, 2026; Borsini et al., 2026). Therefore, the theme of co-planning between curricular teacher and specialized teacher for support activities emerges strongly as a critical node; the literature consistently documents how collaboration between these two professional figures is often hindered by asymmetries of symbolic power, differences in professional languages, the scarcity of institutional time dedicated to shared planning, and a school culture that still tends to separate, rather than integrate, specialized and disciplinary skills (Ainscow, 2020; Booth and Ainscow, 2014; D'Alessio, 2011).

To address this challenge, we will present in this article the architecture of a pedagogical device, designed to make AI a facilitator for inclusive co-d

esign, preserving and enhancing the professional agency of the teacher.

2. Theoretical Framework

The theoretical reflection that supports the device is based on a conceptual framework that involves different levels. The first reference is the International Classification of Functioning, Disability and Health (ICF) developed by the World Health Organization (WHO, 2001; 2007). As is well known, the ICF marked that fundamental paradigm shift that focuses on the interaction between the characteristics of the person and the contextual factors that can be configured as facilitators or barriers.

The Universal Design for Learning (UDL) framework, progressively integrated into Italian legislation (MIUR, 2009; 2012; 2013), offers that fundamental operational reference for the design of the device. The UDL, in its three cardinal principles: the multiplicity of means of representation, the multiplicity of means of action and expression, and the multiplicity of means of involvement, represents in this sense, the challenge of its widespread adoption in Italian schools, which is therefore, to a large extent, a challenge of sustainability, that is, the principles are shared but their translation into concrete practices of daily planning is burdensome, especially for the curriculum teacher, who often lacks specific training in inclusive practices.

Didactic mediators, in the sense elaborated by Damiano (1993), are all those objects, tools, representations and modes of interaction that the teacher interposes between himself, the disciplinary contents and the students, in order to make knowledge accessible. Concept maps, glossaries, audio descriptions, spe ech synthesis, graphic diagrams, conceptual anticipators, are all mediators that the AI device, properly trained, is able to suggest in a contextualized and personalized way.

The concept of "systemic mediation" indicates a mode of interaction between AI and the school system that is not limited to a punctual action on a single student or task but involves the entire ecosystem of the classroom: the relationships between teachers, the processes of shared planning, the evaluative culture, and the perception that students have of their learning. In this sense, the device is not only a generator of personalized mediators: it is a catalyst for professional reflexivity and interdisciplinary collaboration.

Finally, Bandura's (1997) theory of self-efficacy is one of the most solid references for understanding the psychological conditions that favor or hinder the adoption of inclusive practices. Teacher self-efficacy is a robust predictor of engagement in differentiating teaching, adopting inclusive strategies, and constructively managing diverse classrooms (Gabriels & Van Hove, 2022; Sharma et al., 2012; Forlin et al., 2011). The literature documents how this perception is often low when teachers are faced with students with very specific needs and in the absence of adequate tools to support planning (Avramidis & Norwich, 2002). One of the explicit objectives of the AI device is to act on this perception, not through the rhetoric of empowerment, but through the concrete reduction of the cognitive load that accompanies the challenge of inclusive design.

3. The Design Of Ai Device For Inclusive Co-Design: A Research Protocol

The AI-based mediation device is, in this sense, much more than software or a prompt. Drawing on consolidated philosophical and pedagogical reflection, it is configured as a heterogeneous set of discourses, institutions, regulatory decisions and tools (Foucault, 1977; 1980) crossed by lines of force, enunciation and subjectivation (Deleuze, 1989). In this sense, the device models and orients the practices of the subjects involved (Agamben, 2006), structuring itself as a network of relationships, practices, roles and languages that connects the curricular teacher, the support teacher, the student with SEN, the researcher and the classroom system. AI is not the center of this device: it is one of its nodes, the computational node that processes and returns information, but whose action is entirely oriented and evaluated by the professional community that surrounds it. The choice of the specific LLM used is explicitly declared not to be decisive for the purposes of the research: what is of interest is the systemic effect of the device in its entirety.

The first component of the device is the Lesson Project File, a teaching microdesign tool designed according to a fundamental principle: the minimum impact on the workload of the curriculum teacher. The choice of "low-impact" terminology reflects a precise awareness of the barriers that hinder the adoption of inclusive practices, first of all the perception of professional overload. The model is divided into five essential fields:

1. Topic of the lesson: the disciplinary object, stated in summary form.
2. Key concepts (maximum five): the fundamental conceptual nuclei expressed in the list.
3. Text of the slides or outline of the speech: the textual material that the teacher will use, also in the form of notes or outline.
4. Difficult terms expected: technical words that the teacher anticipates may constitute an obstacle.
5. Expected activity: the synthetic structure of the lesson (e.g. frontal explanation, discussion, exercise).

The structural simplicity of this template is pedagogically motivated. The curricular teacher is not called upon to develop a complex inclusive design: he is only called upon to make explicit, in a structured form, the design that he or she already normally develops. The transparency of this ordinary design becomes, through the device, the raw material for the generation of customized mediators. An inclusion device that increases the workload to the point of unsustainability produces resistance and abandonment; one that fits fluidly into ordinary practices is much more likely to produce lasting cultural change.

The second component is the SEN Matrix, a tool for the systematic collection of functional information relating to students with SEN present in the class. The matrix is compiled by the support teacher, who has the clinical-functional skills necessary to interpret the diagnostic documentation. The structure of the matrix is organized by vertical fields, each corresponding to a functional dimension relevant for inclusive design: the anonymized identification code, gender and age, the type of SEN, possible comorbidities, the general functioning profile (anchored to the ICF descriptors), the functioning in reading, writing and calculation skills, facilitators and contextual barriers, the compensatory tools in use, the dispensatory measures envisaged, and a space for additional notes.

The anchoring to the ICF descriptors is not merely formal. It ensures that information is organized according to an internationally shared taxonomy, which distinguishes between body structures, bodily functions, activity and participation, and contextual factors. This structure allows the engineered prompt to process information consistently and generate suggestions that consider not only the deficit, but the student's complete ecological profile. From an operational standpoint, the Matrix is completed through a digital form, which enables standardized data collection and its conversion into a textual format that can be processed by the LLM.

The third and most innovative component of the device is the engineered prompt: the instruction text provided to the Large Language Model to guide its processing towards the generation of personalized teaching mediator suggestions. The prompt is the operational heart of the device, the place where the researcher's pedagogical knowledge is translated into computational language. The prompt design follows a role-prompting and chain-of-thought logic (Brown et al., 2020; Wei et al., 2022): the model is assigned a specific role (expert in inclusive teaching and UDL), the context is provided, the structure of the expected output is indicated, and the value coordinates that must guide the response are specified.

Structurally, the prompt consists of four sections:

1. Framing of the role and context: the model is trained to operate as an expert consultant in inclusive teaching, with deep knowledge of UDL, ICF and differentiation practices in secondary school.

2. Data input: the text of the Project File and the text of the BES Matrix, already anonymized, are inserted directly into the prompt.

3. Instructions for output: the model generates, for each identified student, a list of specific and contextualized mediators, briefly motivating each choice in relation to the functional profile and contents of the lesson.

4. Constraints and quality criteria: the model is explicitly instructed not to produce diagnoses, not to suggest mediators that imply symbolic separation, and to formulate each suggestion in a consultative form, leaving the final decision to the professional discretion of the teacher

It is crucial to emphasize that AI outputs are not prescriptive. The suggested mediators are subject to the evaluation of the teachers, who verify their relevance and compatibility with their skills and resources. Teachers retain full autonomy in the selection, reprocessing and implementation of suggestions: AI does not decide, it advises. The structuring of this architecture is aimed at preserving not only the professionalism of the teacher, but also the ethical responsibility that is intrinsic to it.

The device does not end in generating AI outputs. Its systemic effectiveness depends on a fourth, equally crucial moment: the reflective cycle that teachers go through in evaluating the suggestions received, in deciding which ones to adopt, in adapting them to their own teaching style and in returning to the researcher a critical evaluation of the experience. This cycle activates in teachers processes of professional metacognition that are hardly triggered by daily practice: it forces them to make explicit their representations of students with SEN, to confront different design perspectives, to reflect on their teaching choices in the light of non-judgmental external feedback.

The reflective cycle is divided into three moments (Fig.1)

1. Reception and evaluation: teachers receive the AI's suggestions and examine them individually and in pairs, comparing their own interpretations of the students' functional profile with the reading proposed by the model.
2. Selection and adaptation: teachers select the mediators they intend to implement, rework them according to their skills and resources, and produce the materials for Phase B.
3. Feedback and reflection: at the end of Phase B, teachers evaluate the relevance of the suggestions received, the perceived impact on their self-efficacy, and their perception of the effectiveness of the mediators adopted.

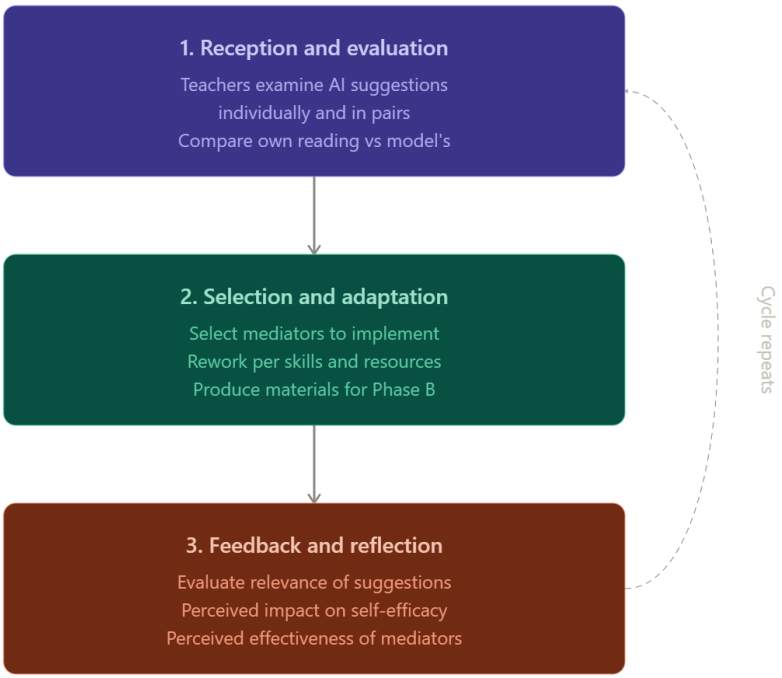


Fig.1

This cycle transforms the device itself from a technical tool to a dialogic device: its intelligence does not lie in the algorithm, but in the quality of the professional relationship that it makes possible between teachers, and between teachers and researcher (Zurru, 2015; Ghedin & Aquario, 2023; Dainese, 2026; Travaglini, 2026).

4. Research Protocol

The experimental protocol has an exploratory nature and sets objectives at two distinct but interconnected levels. At an empirical level, it aims to collect preliminary evidence on the effectiveness of the device in improving the accessibility of content for students with SEN and in supporting co-design between curricular and support teachers. On a theoretical level, it aims to contribute to pedagogical reflection on the conditions of possibility of a critical and responsible integration of AI in special education for inclusion. The architecture of the research protocol is structured around pedagogical questions that call into question methodology, teaching professionalism, micro-design and technology. In the first instance, the investigation intends to verify how much the implementation of the device can increase the quality and degree of personalization of the educational mediators used, making a systematic comparison between the experimental condition and the control condition. At the same time, the research protocol is aimed at exploring the repercussions of this technological mediation on the perception of professional self-efficacy of teachers, both curricular and specialized, in the context of co-design dynamics. A priority analytical focus is dedicated to the subjective experience of students with SEN and SLD, in order to investigate the level of cognitive accessibility to knowledge and the consolidation of the sense of belonging to the classroom ecosystem. Ultimately, the research aims to decode whether artificial intelligence is really necessary for the actors involved as a facilitating factor or whether, on the other hand, it can be configured as a symbolic barrier or potential element of stigmatization.

Given the peculiarities of research in pedagogy and special education, a within-subjects design was opted for. This approach, widely validated in the international literature on Special Education (Gast & Ledford, 2018; 2024; Horner et al., 2005), allows each participant to be used as a control of himself, monitoring the evolution of learning in response to the introduction of the independent variable (Kazdin, 2011).

The protocol is divided into three phases:

Phase A (Control): the curriculum teacher conducts a traditional frontal lesson, without any support from the AI device. At the end, after about a week, a standard test is administered which constitutes the baseline data for quantitative comparison.

Phase B (Experimental): before the lesson, the teacher filled in the Project File and the support teacher filled in the BES Matrix. The researcher elaborated the prompt and obtained suggestions from mediators from the LLM. The teachers selected and produced the materials to be used. The lesson takes place with the support of selected mediators. At the end, after about a week, a parallel test is administered to the previous one.

Phase C (Qualitative): at the end of Phase B, the researcher conducts separate semi-structured interviews with teachers and students with SEN. The interviews explore the participants' subjective perceptions of the experience lived in the two phases.

The architecture of the research protocol requires the identification of an exploratory sample capable of reflecting the intrinsic heterogeneity that characterizes the national school system. The recruitment trajectory aims at the active involvement of institutions of all levels, located transversally throughout the territory, with a view to armoring the ecological validity of the device and enhancing its effective possibilities of pedagogical transferability.

In this phase of the design of the protocol, thanks to the heterogeneity of origin of the research group and the network of professional relationships between the researchers and professors

involved in the research group, three strategic geographical areas have been identified — Como, in Lombardy; Macerata, in the Marche and Benevento, in Campania — as poles for experimentation. In these territorial scenarios, the ideal sample is defined by the presence of class groups characterized by significant complexity, with a specific focus on the inclusion of at least two students with Special Educational Needs, with disabilities (L.104/1992) and/or with SLD (L.170/2010). The survey solicits the voluntary participation of professional couples formed by the curriculum teacher and the teacher specialized in support, whose operational dialogue represents the backbone of co-design with people with disabilities/learning disorders. The choice of diversified contexts responds to the need to test the replicability of the system in heterogeneous organizational and socio-economic ecosystems, allowing an evaluation of the resilience and validity of the device beyond the contingencies of individual local micro-contexts.

For the quantitative dimension, the main tool is the comparison of the results of the tests administered at the end of Phase A and Phase B. The analysis includes a qualitative exploration of errors, distinguishing between errors attributable to lack of study and errors attributable to difficulties in understanding the text or explanation, since the latter type is the one on which the device is most likely to intervene.

For the qualitative dimension, the tool consists of a semi-structured interview conducted by the researcher according to a phenomenological approach. For teachers, the questions explore: the perceived impact on workload, the observed changes in the attention of students with SEN, the congruence between the suggested mediators and their own teaching style, and reflections on the role of AI in co-design. For students with SEN, the questions explore the sense of inclusion in the lesson, the comparative perception of study fatigue, and the sense of perceived fairness compared to peers without SEN.

The qualitative data produced by the interviews will be analyzed through Content Analysis (Krippendorff, 2004; Mayring, 2000). The process involves the full transcription of the interviews (with the elimination of all identifying references), the codification of the emerging themes through a system of both deductive and abductive categories, and the verification of the agreement between coders. Among the topics of analysis envisaged are the semantic areas of 'anxiety', 'ease', 'speed' and 'clarity', identified as significant indicators of the subjective learning experience with and without the support of the device.

Quantitative data are analyzed through descriptive statistics, with the understanding that the sample sizes of an exploratory protocol do not allow statistically robust inferences. The value of these data is essentially indicative and serves to contextualize and triangulate the qualitative results.

The ethical profile of the protocol has been designed with particular care, in consideration of the vulnerability of the participants (underage students with SEN) and the delicacy of the information processed. The protocol guarantees: systematic anonymization, whereby the data of the BES Matrix are processed exclusively in anonymized form, through identification codes that do not allow the recognition of students; informed consent, which requires a specific signature for participation by both parents or legal guardian, with audio recordings stored in encrypted form; a protected setting, where interviews take place in a neutral classroom and in a non-evaluative climate to encourage the free expression of subjective experience. Finally, the entire system ensures an authentic task of inclusion: the student with SEN participates in the same lesson as his classmates through the tools most congenial to him, without any physical or symbolic separation being envisaged.

5. Pedagogical Reflections

The distinction between AI as a mediator and AI as a substitute is not a technical issue: it is an exquisite pedagogical issue. It refers to the fundamental question about the irreducibility of the human factor in the act of teaching and about what can be entrusted, without loss of meaning, to a computational system. What can be entrusted to AI is the ability to process large amounts of structured information, to recognize patterns related to special educational needs and to suggest contextualized didactic responses: operations, these, that require computational power, not ethical judgment. What cannot be entrusted to AI is the responsibility of the educational relationship, the evaluation of the meaning that a learning experience has for a specific person, the ability to change one's behavior in real time in response to non-verbal or emotional cues.

In this perspective, the above device does not have a substitute function for the teacher, it does not threaten his professional identity, on the contrary, it proposes a reinforcement. By freeing the teacher from the computational burden of the cross-referencing of data between information on the functioning of students, their respective facilitators and barriers, compensatory tools, dispensatory measures and didactic choices, the device is aimed at restoring the time and energy necessary to exercise that part of the work that is genuinely irreducible: the care of the relationship, the pedagogical discernment, the human presence in the classroom.

The concept of "reflective ecosystem" indicates an educational system in which the analytical and predictive feedback produced by AI is not simple raw data, but stimuli for professional reflexivity: it activates processes in teachers to review their practices, compare themselves with colleagues, and realign their teaching intentions with the real learning conditions of students. This ecosystem is configured as the context within which the teaching agency can fully express itself. Agency, understood in the Senian sense as the effective ability to act according to one's own values (Sen, 1999), requires not only the formal freedom to choose, but the availability of resources, information and supports that make that choice possible. This enabling perspective, translated by Nussbaum (2011) in terms of social and human justice, is decisive in the field of Special Pedagogy. As amply demonstrated by Terzi (2005) and Mitra (2006), the Capability Approach makes it possible to overcome the reductionism of the purely medical or merely social model, focusing on the real possibilities of the person's "functioning" in relation to the challenges of learning. The dimension of educational justice emerges as the ultimate normative horizon of the device. A just education system is not one that treats all students equally: it is one that provides everyone with the necessary conditions to develop their abilities to their full potential. The AI device, designed to generate personalized mediators in response to the specific functional profiles of each student, is a tool at the service of this differential justice: not the equality of conditions, but the fairness of outcomes.

The protocol presented is exploratory in nature and has methodological limitations that must be recognized. The small sample size does not allow statistically robust generalizations. The within-subjects design is exposed to the risk of learning effects between the two experimental conditions. Voluntary participation introduces a possible selection bias. These limitations define the boundaries within which the results can be interpreted, without affecting the exploratory value of the protocol.

Among the most promising development prospects are: the exploration of variants of the prompt for different disciplines and school levels; the development of a version of the Project File integrated into the teaching management systems already in use; the longitudinal evaluation of the effects of the device on the school culture of inclusive design; and the analysis of the institutional conditions (training, organizational support, school leadership) that favor or hinder the sustainable adoption of the device.

This paper described the conceptual and operational architecture of an Artificial Intelligence-based educational mediation device, designed to enhance inclusive co-design in upper secondary school. The analysis conducted showed how the device is not reduced to a set of technical tools, but constitutes a systemic pedagogical construct capable of operating on several levels simultaneously: the micro-design of the curricular teacher, the enhancement of the clinical-functional knowledge of the support teacher, the generation of personalized didactic mediators, and the promotion of a reflective culture of shared planning.

The implications for teacher education are significant. The scheme suggests an embedded model of professional development, integrated into mainstream teaching practices, which does not require participation in separate courses, but which produces professional learning through action itself. This model is consistent with the most recent findings of teacher education research (Timperley, 2011; Darling-Hammond et al., 2017), which emphasize that the most effective professional development is one that is grounded in practice, data-driven, and carried out in collaborative communities.

The device described here is an experimental protocol in the construction of a relationship between human intelligence and artificial intelligence based on complementarity, not substitution. In this protocol, AI is not the answer to the challenges of school inclusion: it is a tool at the service of the response, which remains, irreducibly, in the hands of teachers, families, students, and the educational communities around them.

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