BETWEEN SIMULATED EMPATHY AND EMBODIED CARE: A COMPARATIVE REVIEW OF THE AFFECTIVE, RELATION AND PEDAGOGICAL DIMENSIONS IN AI-MEDIATED EDUCATION

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Double Blind Peer Review

Citation

Messuri, I., Conte, M., Tedesco, I., & Monaco, G. (2026). Between simulated empathy and embodied care: A comparative review of the affective, relation and pedagogical dimensions in AI-mediated education. *Italian Journal of Health Education, Sport and Inclusive Didactics, 10*(3). https://doi.org/10.32043/gsd.v10i3.1724

Doi: https://doi.org/10.32043/gsd.v10i3.1724

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renpress.it/index.php/gsdj
ISSN: 3103-5744

ABSTRACT

This paper falls within the field of artificial intelligence studies in education, analysing the transformation of the affective and relational dimensions of learning in the era of generative systems. The research investigates how recent literature compares simulated empathy and embodied care through a comparative review of articles published between 2022 and 2026, selectedfrom Scopus, Web of Science and PsycINFO. The corpus includes empirical and theoretical studies, as well as reviews on the socio-emotional dimension. The analysis is structured on two levels: forms of affective support and emotional responsiveness in artificial systems, and care as an embodied educational practice, based onpresence and reciprocity. The comparison highlights convergences and discontinuities, bringing to light the limitations of simulation. The aim is to clarify the role of AI in the educational relationship and to guide hybrid environments and teacher training.

KEYWORDS

Artificial intelligence; simulated empathy; embodied care; educational relation; pedagogical mediation.

Received 2026-06-06
Accepted 2026-10-22
Published 2026-10-30

[1] This article is the result of a collaborative effort among all authors. For the purposes of academic attribution, Immacolata Messuri authored Sections 1; Matteo Conte authored Section 2 and 5; Gaetano Monaco authored Section 4 and 6; and Ines Tedesco authored Section 3.

1. Introduction

In recent years, artificial intelligence has sparked countless debates in the field of education, experiencing extremely rapid growth fueled by the spread of generative and conversational systems capable of producing text, simulating dialogues, providing personalized feedback, and adopting forms of interaction that increasingly resemble the language of listening, guidance, and emotional support. Today, reflecting on the use of artificial intelligence in education means recognizing that these tools are not used by young people exclusively to support learning, but increasingly also as resources to turn to for advice related to personal well-being, emotional management, and relationships with others. This progressive expansion of the functions attributed to AI has led the most recent international guidelines to emphasize the need to develop a human-centered vision of these technologies, capable of preserving, on the one hand, the role of the teacher and, on the other, the quality of the educational relationship and pedagogical responsibility in teaching and learning processes (UNESCO, 2023; OECD, 2026).

For a long time, the educational technologies were considered fundamental tools especially to facilitate the transmission of content, the organisation of teaching and the personalisation of learning pathways. The development of chatbots, conversational agents and emotional-AI systems has, however, significantly expanded the role of such devices, which today are increasingly influencing adolescents' communication, emotional, and relational dynamics. In fact, in many cases, these technologies are used as forms of affective support, emotional responsiveness and simulated empathy, since they offer immediate, personalised and linguistically reassuring responses capable of simulating discursive signals of attention, emotional validation and personalised encouragement (Zhang et al., 2025; Ortega-Ochoa et al., 2024).

If, from a pedagogical point of view, care is configured as attentiveness to the needs of the learner, the capacity to interpret them and responsibility towards the other within a reciprocal relationship, a central question emerges. Whether linguistic indicators of empathy amount to educational care depends on the adopted pedagogical definition and cannot be established solely from experimental measures of motivation, performance, or feedback perception. The caring relationship is the foundation of educational practice, since education is not merely a technical skill but involves recognizing the other person in their vulnerability, uniqueness, and irreducibility (Noddings, 2012). From this prospective, teaching takes on a relational value that exposes the individual to the world, to encounters with others, and to the possibility of being engaged in ways that are not entirely predictable or programmable (Biesta, 2019; Biesta, 2022). It is therefore necessary to move beyond a

reductionist interpretation of AI as merely a technological innovation and to initiate a broader pedagogical reflection capable of discerning between simulated affective relationship and embodied care, between personalized responses and educational mediation, and between the chatbot's constant availability and the teacher's genuine presence. Although AI can enhance functions of support, feedback, and emotional regulation, the question remains open as to whether such functions can be considered authentic practices of care in a pedagogical sense. Empirical findings concern specific measured outcomes, such as motivation, self-regulation and responses to AI-generated feedback; these outcomes do not independently establish either the absence of authentic educational relationships with AI or a student preference for teachers. For example, Ortega-Ochoa et al. (2024) found broadly comparable outcomes between empathic chatbot and teacher feedback on the measures examined, with differences restricted to individual indicators. Concerns about relational substitution and the normative meaning of educational care are instead discussed at a theoretical-pedagogical level (Alghamdi & Alghizzi, 2025; Noddings, 2012).

If the educational relationship is reduced to the speed of response, conversational adaptability, and automated emotional validation, there is a risk of reducing pedagogical work to an exclusively performance-based and functional logic. Such a perspective tends, in fact, to overlook that conception of care, which is built upon physicality, shared temporality, contextual understanding, the memory of the relationship, and the teacher's asymmetrical responsibility, as well as the ability to grasp and interpret what is not immediately expressible or quantifiable. Educational action thus takes the form of a situated process of accompaniment that cannot be reduced to a mere linguistic simulation of empathy (Noddings, 2012; Biesta, 2019; OECD, 2026).

Despite the significant increase in publications dedicated to AI in education, the literature still appears fragmented across very different approaches: some studies focus on system performance, the quality of feedback, adaptability, and motivational effects; others, more critical, question the authenticity of the relationship, the risk of emotional delegation, the standardization of empathy, and the erosion of educational presence. However, there is still a lack, especially on the pedagogical level, of a perspective capable of systematically comparing these two approaches, namely simulated empathy and embodied care, avoiding both technocentric enthusiasm and a priori rejection. Hence the need for a comparative review capable of moving beyond a merely descriptive analysis of AI's uses in educational contexts and explicitly addressing the pedagogical implications of the issue. Through an analysis of studies published between 2022 and 2026 and indexed in the Scopus, Web of Science, and PsycINFO databases, this paper examines how educational research interprets

the potential and limitations of artificial intelligence in the affective sphere. In particular, the comparison examines how empirical findings, secondary syntheses, and pedagogical arguments describe technological support, human care, possible overlap, and hybrid forms of educational mediation, without presupposing an absolute opposition.

Based on these premises, this study aims to:

1. Examine how recent literature defines and uses concepts such as simulated empathy, affective support, emotional responsiveness, embodied care, educational relationship, and pedagogical mediation.
2. Compare the different roles attributed to AI systems and teachers in managing the affective dimension of educational processes.
3. Analyse the advantages, limitations, and ambivalences of forms of algorithmic emotional support in teaching and learning contexts.
4. Identify convergences, divergences, counterexamples and hybrid configurations in the literature, examining where AI-mediated affective support and human educational care may overlap or differ and distinguishing observed outcomes from normative arguments.
5. Propose directions useful for the design of hybrid environments and teacher education, in light of the transformations introduced by artificial intelligence in the relational sphere of education.

From this perspective, the research question underlying this study can be formulated as follows: “How do empirical studies, research syntheses, and theoretical contributions conceptualize AI-mediated affective support and embodied educational care, and what convergences, divergences, counterexamples, and possibilities for hybrid pedagogical mediation emerge from their comparison?”

2. Methodological Framework of the Comparative Review. Search Strategy and Study Selection

This comparative review critically analyses the international literature on the affective and relational dimensions of education mediated by artificial intelligence, examining their distinct characteristics, areas of overlap, and possible complementarity rather than treating them as mutually exclusive categories from the outset.

The choice of a comparative review responds to the need to construct an interpretive and conceptual synthesis, rather than a measurement of the effectiveness of interventions or a quantitative generalization of results. Therefore, the review does not aim to produce an aggregate estimate of the effects of AI on the affective dimension of learning, but rather to critically compare the ways in which the literature represents the relationship between

algorithmic affective support, simulated empathy, and embodied educational care.

The literature search was conducted between January and April 2026 using three international academic databases selected for their disciplinary complementarity: Scopus, Web of Science, and PsycINFO. Scopus was used for its broad multidisciplinary coverage, Web of Science for its relevance in identifying high-impact contributions in the social and pedagogical sciences, while PsycINFO was used to identify studies specifically focused on the affective, socio-emotional, and relational dimensions.

The search strings were constructed by combining terms related to technology (“artificial intelligence,” “generative AI,” “chatbot,” “conversational agent,” “pedagogical agent,” “social robot,” “emotional AI,” “affective computing”), the educational context (“education,” “school,” “classroom,” “teaching,” “learning”), and the affective-relational dimension (“simulated empathy,” “affective support,” “emotional support,” “care,” “teacher-student relationship,” “relational mediation,” “embodied care,” “human presence”), using the Boolean operators AND and OR.

To make the retrieval logic explicit and reproducible, database-specific syntax was reconstructed from the documented conceptual framework and adapted to the indexing conventions of each database. Scopus: TITLE-ABS-KEY(("artificial intelligence" OR "generative AI" OR chatbot OR "conversational agent" OR "pedagogical agent" OR "social robot" OR "emotional AI" OR "affective computing") AND (education OR school OR classroom OR teaching OR learning) AND ("simulated empathy" OR "affective support" OR "emotional support" OR care OR "teacher-student relationship" OR "relational mediation" OR "embodied care" OR "human presence")) AND PUBYEAR > 2021 AND PUBYEAR < 2027 AND (LIMIT-TO(LANGUAGE, "English")). Web of Science: TS=(("artificial intelligence" OR "generative AI" OR chatbot OR "conversational agent" OR "pedagogical agent" OR "social robot" OR "emotional AI" OR "affective computing") AND (education OR school OR classroom OR teaching OR learning) AND ("simulated empathy" OR "affective support" OR "emotional support" OR care OR "teacher-student relationship" OR "relational mediation" OR "embodied care" OR "human presence")); Timespan = 2022-2026; Language = English; Document types = Article OR Review. PsycINFO: (("artificial intelligence" OR "generative AI" OR chatbot OR "conversational agent" OR "pedagogical agent" OR "social robot" OR "emotional AI" OR "affective computing") AND (education OR school OR classroom OR teaching OR learning) AND ("simulated empathy" OR "affective support" OR "emotional support" OR

care OR "teacher-student relationship" OR "relational mediation" OR "embodied care" OR "human presence")); limits: English language, publication years 2022-2026, peer-reviewed journal articles/reviews. These database-adapted expressions operationalise the three documented concept blocks and provide a transparent syntax for replication of the retrieval logic.

The application of this strategy led to the identification of 214 records dated between 2022 and 2026, of which 89 were on Scopus, 71 on Web of Science, and 54 on PsycINFO. After removing 39 duplicate records, 175 studies were screened through an analysis of titles and abstracts, followed by a full-text review of the articles deemed relevant.

Records retrieved from the three databases were consolidated before screening. Duplicate publications were removed at record level so that the same contribution retrieved from more than one database was retained only once in the eligibility process and counted as a single analytical unit.

The review included peer-reviewed studies in English that explicitly focused on the affective and relational dimensions of AI in educational contexts. Consistent with the nature of a comparative review, the corpus comprised empirical studies, theoretical contributions, and reviews relevant to the conceptual clarification of the comparison between simulated empathy and embodied care.

The following were excluded: a) exclusively technical or computational studies lacking explicit educational implications; b) contributions not related to educational or training contexts; c) works focused solely on cognitive performance, achievement, or learning analytics without attention to the affective-relational dimension; d) non-peer-reviewed studies, editorials, short commentaries, or contributions lacking a recognizable theoretical/methodological framework; e) articles in which AI was mentioned only marginally and did not constitute a substantial object of analysis.

The screening phase led to the exclusion of 115 records. The remaining 60 contributions underwent full-text eligibility assessment; 46 publications did not meet the predefined eligibility criteria, leaving a final analytical corpus of 14 studies.

Study selection was conducted through independent screening by multiple authors, who assessed the same records against the predefined eligibility criteria. Disagreements concerning eligibility were discussed until consensus was reached. No formal inter-reviewer agreement coefficient was calculated. This consensus-based procedure was used to support consistent application of the inclusion and exclusion criteria.

The final analytical corpus consisted of 14 unique publications. Database retrieval sources were not treated as mutually exclusive study categories, because the same publication could be indexed in more than one database; each publication therefore contributed only once to the synthesis.

The final selection prioritised relevance to the research question and consistency with the affective-relational focus. Because the corpus comprised primary empirical studies, research syntheses, and conceptual or policy contributions, methodological appraisal was differentiated by source type rather than reduced to a single numerical score. Primary empirical studies were considered in relation to research design, comparator or intervention, outcome definition, and correspondence between findings and conclusions; reviews were considered in relation to search and synthesis transparency and the scope of the evidence summarised; conceptual contributions were considered in relation to conceptual clarity, argumentative coherence, and the relevance of the literature used to support their claims. Appraisal informed the evidential weight attributed to each contribution in the thematic synthesis rather than serving as an exclusion score (Figure 1).

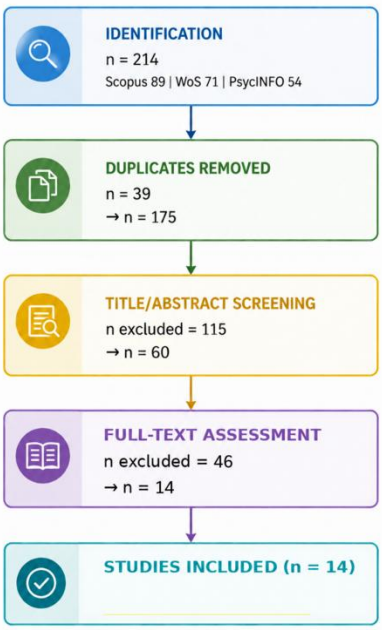


Figure 1: Flowchart of the study selection process for the comparative review.

3. Unit of Analysis and Construction of the Comparative Matrix

Once the corpus was defined, an analysis was conducted to extract and organize the information relevant to the comparison. For each study, data were collected regarding the author and year of publication, type of study, educational context, artificial intelligence technology involved, affective-relational concepts used, the role attributed to the artificial system, and the role attributed to the teacher.

For each of the 14 publications, extraction distinguished the evidential unit as a primary empirical finding, a review-level synthesis, or a conceptual/policy argument. Where applicable, research design, population, intervention or comparator, measured outcomes, and stated limitations were recorded. Measures of motivation, emotional response, learning, or feedback perception were not treated as direct measures of authentic educational care, teacher preference, or relational substitution unless those constructs were explicitly operationalised.

Particular attention was paid to the presence or absence of explicit references to the embodied dimension of the educational relationship, to corporeality, to the temporality of interaction, and to situated pedagogical mediation. The collected data were organized into a comparative matrix, which allowed us to relate the various approaches present in the literature and to highlight convergences, divergences, and interpretive tensions among the analysed models.

The analytical pathway was made explicit as follows: publication → reported finding or theoretical proposition → short descriptive code → interpretive configuration (C1-C4). Codes were attached to specific claims rather than automatically to an entire publication. Review articles were treated as secondary syntheses rather than as new independent participant samples, and repeated appearance of similar primary evidence across reviews was not interpreted as independent confirmation. The 14-row evidence-to-configuration mapping following Table 1 makes these associations inspectable.

The units of analysis were structured along six main dimensions:

1.The definitional dimension, which concerned the way in which the studies conceptualize empathy, affective support, and care.

2. The functional dimension, which examined the functions attributed to AI and the teacher in managing the emotional dimension.

3. The relational dimension, which considered the type of interaction: whether produced, mediated, or simulated.
4. The embodied dimension, which analysed the role of the body, context, proximity, and situated presence.
5. The pedagogical dimension, which examined the concept of education underlying the various contributions, with reference to the distinction between facilitation, accompaniment, and care.
6. The critical dimension, which examined reported limitations, favourable or contradictory findings, possible benefits, uncertainties, and risks (including emotional delegation and possible relational substitution), without presuming that negative consequences have been observed.

The six dimensions are descriptive lenses, whereas C1 (algorithmic affective support), C2 (affective/adaptive personalisation), C3 (critical and human-centred interpretations) and C4 (pedagogically mediated integration) are higher-order, non-exclusive interpretive configurations. C1–C2 chiefly concern technological functions; C3–C4 chiefly concern pedagogical interpretations or implementation arrangements. Their coexistence within a single publication is analytically possible and does not imply four measured stages or four mutually exclusive study groups.

4. Analysis Procedure and Interpretive Criteria

The comparison grouped statements according to evidential status and meaning. Source-to-code links were retained in the evidence-to-configuration matrix so that each higher-order configuration could be traced back to an empirical finding, a review-level synthesis, or a theoretical proposition.

Data extraction and thematic coding were distributed among the authors. Unlike the independent screening phase, coding was not performed independently by all authors on the entire corpus. After the individual analytical work, the authors collectively compared the extracted evidence, discussed the descriptive codes, examined counterexamples and null or mixed findings, and refined the four interpretive configurations until a shared interpretation was reached. The configurations were treated as non-mutually exclusive higher-order categories: a publication could inform more than one configuration when different claims or findings addressed different dimensions of AI-mediated affective support and pedagogical mediation.

Table 1: Evidence-to-configuration audit of the 14 publications included in Table 1.

Included publication	Evidence type	Claim/evidence → descriptive code	Configuration(s)
Holmes & Tuomi (2022)	Review / secondary synthesis	AI roles and teacher's pedagogical role → HUMAN OVERSIGHT	C3; C4
Ortega-Ochoa et al. (2024)	Quasi-experiment; teacher comparator	Broadly similar measured outcomes; isolated item-level differences → COMPARABLE FEEDBACK / NULL CONTRAST	C1; C4
Liu et al. (2024)	Systematic review / secondary synthesis	Emotional and cognitive support in language learning → AFFECTIVE-COGNITIVE CO-SUPPORT	C1; C2
Lai & Lee (2024)	Systematic review / secondary synthesis	Conversational tools in English-language teaching → CONVERSATIONAL SUPPORT	C1; C4
Du & Daniel (2024)	Systematic review / secondary synthesis	Chatbots for foreign-language speaking practice → COMMUNICATION SUPPORT	C1
Chen & Delaney (2025)	Theoretical / policy argument	Equity, ethics and teacher guidance → PEDAGOGICAL GOVERNANCE	C3; C4
Henriksen et al. (2025)	Critical review / conceptual framework	Generative AI and teacher social-emotional learning → RELATIONAL SAFEGUARDS	C3; C4
Garzón et al. (2025)	Systematic review / secondary synthesis	AI educational benefits and implementation challenges → BENEFIT–RISK AMBIVALENCE	C1; C3
Xia et al. (2025)	Systematic review/meta-analysis	Measured student motivation and engagement → MEASURED ENGAGEMENT (not teacher preference)	C1
Zhang et al. (2025)	Systematic review/meta-analysis	Emotional AI outcomes across education → AFFECTIVE-OUTCOME SYNTHESIS	C1; C2
Alghamdi & Alghizzi (2025)	Integrative review / interpretive synthesis	Educators' reflections on AI feedback, ethics → RESPONSIBLE FEEDBACK USE	C3; C4
Alsaiari et al. (2025)	Controlled study / primary empirical	Reduced negative emotion, no detected improvement in engagement/revised work → LIMITED AFFECTIVE BENEFIT	C1; C4
Banihashem	Systematic mapping /	AI applications and self-regulated learning → SELF-REGULATION SUPPORT	C1

et al. (2025)	secondary synthesis		
Wibool yasarin et al. (2025)	Systematic review / secondary synthesis	AI chatbots in second-language education → LANGUAGE-LEARNING SUPPORT	C1; C4

The four interpretive configurations identified in the analysis concern algorithmic affective support (C1), affective and adaptive personalisation (C2), critical and human-centred interpretations (C3), and pedagogically mediated integration (C4). The associations reported in the table indicate the evidential or argumentative basis supporting each coding choice, without assuming that all configurations correspond to directly tested empirical effects.

The analysis ultimately resulted in the development of a comprehensive thematic framework, which shaped the presentation of the findings and the discussion of the main pedagogical implications. The proposed mapping links each included publication to an identifiable evidential unit, descriptive code and potentially more than one interpretive configuration; the resulting synthesis therefore considers empirical findings, secondary syntheses and theoretical propositions without counting them as equivalent forms of direct evidence. In particular, the analysis made it possible to draw a distinction between studies that attribute to AI a predominantly functional role in affective support and studies that, conversely, highlight its limitations in relation to the situated and relational complexity of educational care. The adoption of a comparative perspective allowed us to go beyond a simple description of the results, highlighting the theoretical tensions that run through contemporary literature: between simulation and embodiment, between algorithmic response and pedagogical mediation, and between automated personalization and situated educational relationships. In this perspective, Thematic Analysis was not used solely as a descriptive tool, but as an interpretive device capable of bringing to light the underlying logics of the various models of educational relationships mediated by artificial intelligence.

This procedure strengthened transparency, interpretive consistency, and traceability by linking each included publication to its evidential status, descriptive code, and one or more higher-order configurations, while preserving the distinction between empirical outcomes and pedagogical interpretation. Finally, the methodological framework outlined above serves as the basis for analysing the results that will be presented in the following section through a comparative examination of the various models of educational relationships mediated by artificial intelligence.

5. Result of the comparative review

Following on from the above, this section summarizes the main findings that emerged from the comparative analysis of the selected corpus, consisting of the 14 publications listed in Table 1 published between 2022 and 2026, on the affective and relational dimensions of education mediated by artificial intelligence. The corpus combines two primary empirical investigations with secondary syntheses and conceptual contributions. Its findings support a differentiated discussion of measured feedback-related and motivational outcomes, review-level descriptions of AI applications, and pedagogical arguments about human responsibility; the corpus does not provide a common direct measure of educational care or students' preference for human teachers. The configurations that have emerged represent interpretive models constructed from recurring trends in the analysed corpus. Four non-exclusive interpretive configurations organise the reported findings and arguments; they vary in analytical focus rather than constituting an empirically validated scale of substitution or integration. Individual contributions may inform more than one configuration (Table 1a). A first configuration is represented by models of algorithmic affective support, in which chatbots, conversational agents, and intelligent feedback systems are used to provide immediate, personalized responses that are linguistically oriented toward emotional validation. These publications address motivational, emotional or self-regulatory support at different evidential levels (Ortega-Ochoa et al., 2024; Alsaiari et al., 2025; Banihashem et al., 2025; Lai & Lee, 2024; Du & Daniel, 2024; Wiboolyasarin et al., 2025). The presence and magnitude of any benefit depend on the specific outcome and study design. The rationale behind this approach is one of constant availability and immediate responsiveness, which helps to bridge temporal and relational gaps in educational contexts, particularly in online or large-scale settings.

For Configuration 1 (C1), Ortega-Ochoa et al. (2024) contributes evidence from measured outcomes under chatbot versus teacher feedback, with mostly non-significant between-group differences, coded as COMPARABLE FEEDBACK / NULL CONTRAST. Alsaiari et al. (2025) contributes evidence of reduced negative emotions without observed gains in engagement or revised-work quality, coded as LIMITED AFFECTIVE BENEFIT. The remaining cited reviews provide secondary or context-specific syntheses rather than independent confirmation that AI improves authentic relational care.

The two primary studies report outcome-specific findings: Ortega-Ochoa et al. (2024) did not identify broad differences between chatbot and teacher

feedback in the measured learning, motivational and self-regulatory outcomes, whereas Alsaiari et al. (2025) reported reduced negative emotional responses without improvements in engagement or the quality of revised work. These results cannot be generalised to a universal reduction in anxiety or to a sustained sense of relational support. However, from a pedagogical perspective, critical and theoretical contributions question whether discursively responsive systems satisfy pedagogical definitions of reciprocity, situated responsibility and care (Alghamdi & Alghizzi, 2025; Henriksen et al., 2025; Noddings, 2012). This is a conceptual question, not an inference established by experiments measuring motivation, engagement or feedback quality.

A second configuration is represented by affective and adaptive personalisation models, in which affective computing systems and intelligent tutors integrate cognitive and emotional data to adapt content, pace and modes of interaction to the student's characteristics. In these contexts, AI does not merely respond, but anticipates, regulates and modulates the learning experience based on detected or inferred emotional signals. The present 14-publication corpus offers mainly review-level discussion of emotion-related adaptation and language-learning support (Liu et al., 2024; Zhang et al., 2025), rather than a direct primary test of a fully adaptive, emotion-sensing learning pathway. Shingjergji et al. (2025) and Sedighi and Sritharakumar (2026) are not listed in the 14-publication matrix and should not be presented as included evidence.

For Configuration 2 (C2), Liu et al. (2024) provides a review-level synthesis on emotional AI in language education, coded as AFFECTIVE-COGNITIVE CO-SUPPORT, while Zhang et al. (2025) provides a review and meta-analytic synthesis of emotional-AI outcomes, coded as AFFECTIVE-OUTCOME SYNTHESIS. Both are secondary sources; the corpus does not independently establish the efficacy of anticipatory emotion detection or a causal pathway from affective data processing to embodied care.

In the analysed corpus, several contributions highlight potential benefits in terms of persistence, self-regulation and the perceived quality of the learning experience; however, this evidence is heterogeneous and does not allow for generalisable conclusions to be drawn regarding the effectiveness of AI systems. Nevertheless, some significant critical issues emerge: the tendency to reduce the emotional dimension to a measurable and optimisable variable, with the risk of a progressive standardisation of affectivity and its translation into functional and performative terms. From a theoretical-pedagogical perspective, reducing emotional experience to measurable variables may

neglect situated interpretation; this is a possible design risk, rather than a demonstrated effect of the systems examined in the included studies (Henriksen et al., 2025; Alghamdi & Alghizzi, 2025).

A third configuration concerns critical and human-centred models, in which the literature highlights the risk of the educational relationship being progressively reduced to a functional and adaptive interaction. In these studies, AI is interpreted as a tool that is potentially useful in terms of support, personalisation and accessibility, while asking how responsibility, human oversight and situated pedagogical judgement can be retained (Holmes & Tuomi, 2022; Henriksen et al., 2025; Alghamdi & Alghizzi, 2025). Concerns about emotional delegation, standardized expressions of empathy or loss of educational presence are treated here as interpretive and ethical arguments, not as longitudinally demonstrated outcomes in the selected empirical studies.

For Configuration 3 (C3), Holmes and Tuomi (2022) contributes a discussion of AI and the teacher's role, coded as HUMAN OVERSIGHT; Henriksen et al. (2025) contributes a critical review of generative AI and social-emotional learning in teacher education, coded as RELATIONAL SAFEGUARDS; and Alghamdi and Alghizzi (2025) contributes an integrative ethical discussion of AI feedback, coded as RESPONSIBLE FEEDBACK USE. These are interpretive contributions rather than experiments establishing the impossibility of AI-mediated educational relationships.

Finally, a fourth configuration is represented by integrative and pedagogically mediated models, in which AI is explicitly conceived as a support to the educational relationship rather than as an alternative to it.

In these approaches, the artificial system is used to amplify certain functions, such as feedback, personalisation and process monitoring, while pedagogical decision-making and accountability are explicitly located with human educators in the relevant conceptual and policy-oriented contributions (Chen & Delaney, 2025; Henriksen et al., 2025; Holmes & Tuomi, 2022). This configuration is a proposed model for hybrid practice, not a demonstrated causal result of the two primary experiments.

For Configuration 4 (C4), Chen and Delaney (2025) contributes an equity- and ethics-oriented policy discussion, coded as PEDAGOGICAL GOVERNANCE; Henriksen et al. (2025) contributes a teacher-education framework, coded as RELATIONAL SAFEGUARDS; and Holmes and Tuomi (2022) contributes an analysis of the teacher's role, coded as HUMAN OVERSIGHT. The comparable measured feedback outcomes reported by Ortega-Ochoa et al. (2024) serve as a counterexample to any claim that AI feedback is necessarily inferior to

teacher feedback, but do not establish equivalence between AI and human care as pedagogical constructs.

This configuration is one pedagogical proposal discussed in the corpus; its comparative effectiveness and applicability require direct testing rather than being inferred from the conceptual synthesis.

Collectively, these four configurations outline a framework in which the affective dimension of education appears increasingly traversed by algorithmic devices yet cannot be entirely reduced to them. The empirical evidence addresses selected affective and educational outcomes, whereas arguments about presence, reciprocity and situated responsibility arise primarily from pedagogical theory. Whether hybrid arrangements enhance these dimensions remains an open empirical question.

From the perspective of pedagogical implications, it is clear that the distinction between simulated empathy and embodied care is not merely theoretical but translates into concrete effects on the educational experience. Students can benefit from forms of immediate and personalised support, but they continue to recognise in the relationship with the teacher a qualitatively different space, characterised by authenticity, trust and meaning (Ortega-Ochoa et al., 2024;

The pedagogical distinction between simulated empathy and embodied care generates testable questions but is not itself an outcome measured by the two primary empirical studies. Ortega-Ochoa et al. (2024) compared chatbot and teacher feedback on specified performance and self-regulatory measures without establishing a general student preference for teachers; Alsaiari et al. (2025) examined emotionally enriched AI feedback rather than the authenticity of teacher–student relationships. The meta-analysis by Xia et al. (2025) concerns motivation and engagement, not direct comparisons of embodied care.

The following diagram (Figure 2) is a hypothetical conceptual pathway proposed for subsequent empirical examination, not an observed causal or mediation model established by the 14 publications: algorithmic affective support → modulation of the learning experience → mediated educational relationship → quality of the educational experience.

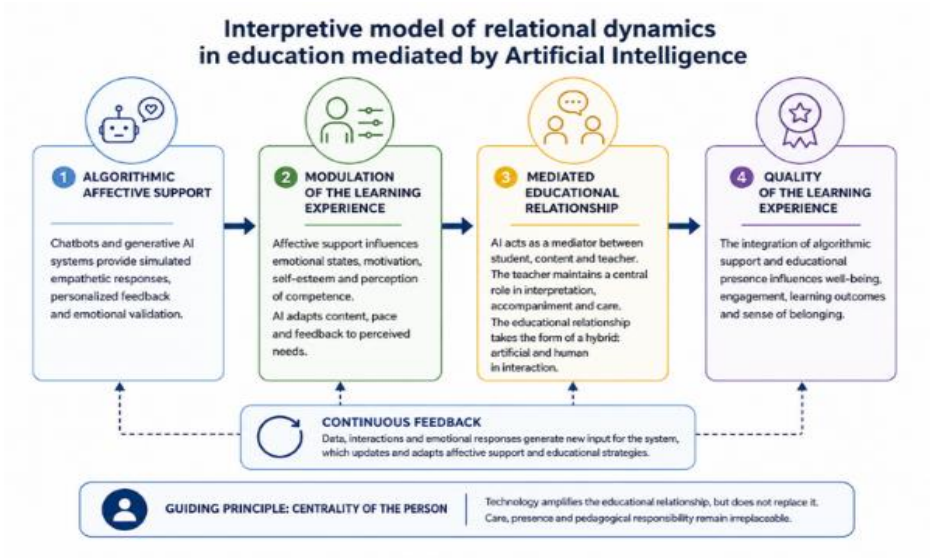


Figure 2: Interpretive model of the educational relationship mediated by Artificial Intelligence: from algorithmic affective support to the quality of the learning experience through pedagogical mediation.

The arrows express a provisional conceptual sequence and must not be read as statistically established effects, demonstrated mediation, or an empirically tested superiority of human educational care (fig.2).

In this proposed framework, pedagogical mediation is hypothesised to contextualise technological support; neither mediation nor moderation has been statistically tested within this review. The quality of learning, in fact, does not depend solely on the availability of feedback or the personalisation of content, but on the ability to embed these elements within an educational relationship capable of interpreting, accompanying and giving meaning to the student's experience. The synthesis therefore raises the possibility of educational arrangements in which AI-mediated support and human relational practices coexist, while leaving open how different arrangements affect students' outcomes over time. From this perspective, investing in teacher training and pedagogical awareness of AI use emerges as a fundamental condition for avoiding reductionist drifts and for building truly integrated educational environments, in which technology and relationships do not exclude one another, but rather reconfigure one another.

6. Conclusions

The comparative review of the literature published between 2022 and 2026, conducted on a selected corpus of 14 publications documented in Table 1, provides a detailed and increasingly coherent picture of the role of artificial intelligence in transforming the affective and relational aspects of education. The included primary studies address specific feedback-related, emotional, motivational and learning outcomes, whereas the reviews provide broader secondary syntheses and the conceptual contributions discuss pedagogical implications. This mixed body of literature cannot by itself establish a general causal effect of AI on the quality of teacher–student relationships (Ortega-Ochoa et al., 2024; Alsaiari et al., 2025; Garzón et al., 2025; Zhang et al., 2025). The comparative analysis highlights how AI can support certain aspects of the educational relationship, particularly through forms of algorithmic emotional support, personalised feedback and high communicative responsiveness. Effects on engagement, negative emotions and self-regulation vary by intervention and outcome; in particular, the two included primary investigations do not demonstrate a general reduction in isolation or a consistent advantage over human feedback. The question of whether linguistic empathy constitutes educational care must be discussed separately as a theoretical-pedagogical issue (Ortega-Ochoa et al., 2024; Alsaiari et al., 2025; Noddings, 2012; Henriksen et al., 2025). Simulated empathy, while effective on a functional level, remains rooted in a logic of response and adaptation, while embodied care takes the form of a situated relational practice, founded on interpretation, responsibility and reciprocity. Artificial intelligence can amplify and support certain aspects of the educational experience; however, the quality of the relationship is not limited to the presence of affective signals, nor to their algorithmic optimisation. The educational relationship points to a dimension that goes beyond mere function, rooted in the teacher's presence, in the ability to interpret the context, to make situated decisions and to respond in a non-predefined manner to students' needs. From this pedagogical perspective, decisions about delegating relational responsibilities to AI require explicit conceptual and ethical criteria, as well as evidence from studies that directly measure the quality of educational relationships. The configurations that have emerged should not, however, be interpreted as absolute oppositions, but as polarities through which recent literature attempts to describe hybrid and progressive forms of educational mediation.

Figure 2 proposes, rather than empirically demonstrates, a pathway connecting algorithmic support, learning experience, human pedagogical mediation and

perceived educational quality. The present comparative review neither estimates causal effects nor tests mediation along this proposed pathway. In other words, the quality of learning does not depend solely on the availability of intelligent systems, but on their integration within educational relationships capable of interpreting, guiding and giving meaning to processes.

This shift signals a paradigm shift in the way we think about education in the age of artificial intelligence. It is no longer sufficient to ask how much AI can improve the efficiency or personalisation of learning processes; it is necessary to understand how it affects the very nature of the educational relationship. The question is therefore not whether AI can be 'empathetic', but what conception of education emerges when the affective dimension is mediated by algorithmic systems. From this perspective, the risk lies not so much in the use of AI, but in its reductive interpretation as a substitute for the relationship, rather than as a tool to be integrated within a broader pedagogical framework. Designing truly effective educational environments therefore requires a deliberate and systematic rethinking of teaching practices, in which AI is positioned as a resource that supports the relationship rather than as a substitute for it. This requires a significant investment in teacher training, so that teachers develop not only technical skills in using the tools, but also a deep pedagogical awareness of the relational and ethical implications of artificial intelligence (Henriksen et al., 2025; Chen & Delaney, 2025). In an increasingly hybrid educational context, teachers are called upon to play an advanced mediating role, capable of integrating technology and human relationships in a coherent and responsible manner. At the same time, there is a clear need to develop assessment tools that are sensitive to the affective and relational dimensions of the AI-mediated educational experience. Whilst cognitive performance can be easily measured using standardised indicators, aspects related to relationships, care and the quality of interaction require more articulated approaches, capable of combining quantitative and qualitative methodologies and capturing the complexity of educational processes.

Despite the consistency of the findings, the review highlights some significant gaps in the current literature. Firstly, there is a need for longitudinal studies to understand the long-term effects of interaction with AI systems on the development of the educational relationship and on students' socio-emotional development. Secondly, empirical reflection on the dynamics of integration between AI and teaching practice remains limited, with particular reference to the ways in which teachers reinterpret their role in technologically mediated contexts. Further developments concern the need to investigate in greater

depth the risks associated with the standardisation of affectivity, emotional delegation and the possible redefinition of educational responsibility.

This study has a few limitations. Firstly, the decision to include empirical studies, theoretical contributions and reviews has allowed for a broad understanding of the phenomenon but has also resulted in a methodologically heterogeneous body of work, which is not always comparable in terms of outcomes. Furthermore, a significant proportion of the body of work consists of reviews and theoretical contributions, a factor that reflects the current exploratory phase of the scientific debate on educational AI. Secondly, the selection of studies focused on English-language contributions indexed in Scopus, Web of Science and PsycINFO, potentially excluding relevant works published in other databases or in different languages. Furthermore, the interpretative nature of the comparative review does not allow us to establish the effectiveness of AI systems on the affective-relational dimension of learning, but it does enable us to critically reconstruct the main conceptual frameworks through which the literature addresses the relationship between simulated empathy and embodied care. Finally, the extremely rapid evolution of generative and conversational systems means that the framework outlined here is necessarily provisional and will need to be updated considering further empirical evidence.

An additional interpretive limitation concerns the possibility that the initial distinction between simulated empathy and embodied care may have sensitised the analysis toward contrast. To reduce this risk, the synthesis explicitly considered convergent findings, null or mixed outcomes, counterexamples, and hybrid configurations. Moreover, because several included contributions are reviews, some overlap among the primary studies synthesised by different reviews is possible; repeated review-level findings were therefore treated as convergent secondary evidence rather than as independent replications.

The evidence that has emerged allows us to outline some practical guidelines for the design of educational environments in the age of artificial intelligence:

- integrate the use of AI within explicit pedagogical frameworks, avoiding merely technical approaches.
- emphasise the relational dimension as the core of the educational experience, even in digital contexts.
- train teachers in the critical and informed management of intelligent systems.
- promote hybrid models in which AI supports, but does not replace, pedagogical mediation.

- develop assessment tools capable of capturing the quality of the technologically mediated educational relationship.

Overall, the findings of the comparative review suggest that artificial intelligence is a powerful yet inherently ambivalent resource. It can enhance certain aspects of the educational experience, but at the same time risks reducing the relationship to a functional interaction if it is not situated within a conscious pedagogical framework. The distinction between simulated empathy and embodied care is thus a provisional analytical lens whose value should be assessed against both supportive and disconfirming empirical findings and against mixed or hybrid educational arrangements. In the final analysis, the challenge does not lie in a replacement of the educational relationship with intelligent systems, but in rethinking it in the light of new technological possibilities, whilst preserving what remains irreducible within it: the capacity to generate meaning, to build bonds and to accompany individuals in their growth processes. It is in the comparison between affective simulation and educational presence that one of the decisive issues of contemporary pedagogy emerges: integrating the possibilities offered by artificial intelligence without reducing the educational relationship to a functional interaction or losing sight of its embodied, responsible and interpretative dimension.

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