BETWEEN INCLUSION AND INNOVATION: PRE-SERVICE SPECIAL EDUCATION TEACHERS' PEDAGOGICAL ATTITUDES AND PROFESSIONAL CO-AGENCY WITH GENERATIVE AI

Mariagrazia Verbicaro
Università degli Studi di Messina, Italy
mariagraziaverbicaro@gmail.com

Patrizia Oliva
University Catanzaro "Magna Graecia"
poliva@unicz.it

Double Blind Peer Review

Citation
Verbicaro, M., & Oliva, P. (2026). Between inclusion and innovation: Pre-service special education teachers' pedagogical attitudes and professional co-agency with generative AI. *Italian Journal of Health Education, Sport and Inclusive Didactics*, *10*(3).
https://doi.org/10.32043/gsd.v10i3.1753

Doi: https://doi.org/10.32043/gsd.v10i3.1753

Copyright notice:
© 2026 The Author(s). This is an open access, peer-reviewed article published by Cares S.r.l. – REN Press and distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

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

ABSTRACT
This study examines the relationship between inclusive education attitudes and professional co-agency with generative AI among pre-service special education teachers enrolled in the Italian TFA Sostegno program. Using the SACIE-R and the validated PAIR-S instrument, we conducted cluster analysis, Spearman correlations, hierarchical regressions, and bootstrap mediation analysis on a group of 451 participants. Four typological profiles emerged: Reflective Adopters, Disengaged, Frankenstein Complex, and Inclusive Non-Adopters. No significant correlation was found between inclusive orientation and AI co-agency, indicating that the two constructs operate independently. Age emerged as the strongest demographic predictor of AI adoption. Bootstrap testing of the hypothesized mediation revealed that Deprivation inhibits AI engagement when present, but is not activated by inclusive Concerns, disconfirming the proposed indirect mechanism. These findings challenge the assumption that inclusive values automatically transfer to AI engagement, providing a typological map for differentiated teacher education interventions.

KEYWORDS
Pre-service special education teachers; inclusive education; generative AI; SACIE-R; PAIR-S.

Received 2026-06-26
Accepted 2026-10-26
Published 2026-10-30

1. Introduction

The integration of generative artificial intelligence into educational systems has moved from speculative horizon to active institutional demand.

In Italy, the Ministry of Education and Merit (MIM, 2025) formalized AI as a structural dimension of school governance, calling for a governed, transparent, and human-centered approach, a move that places initial teacher education at a crossroads of particular significance, nowhere more acute than in the preparation of support teachers, whose professional identity is grounded in an ethics of care and the irreducible quality of the human educational encounter (Booth & Ainscow, 2008; d'Alonzo, 2017).

How pre-service special education teachers position themselves toward generative AI is therefore not merely a question of technological readiness and it is a question about the kind of professional self they are constructing.

International scholarship has organized around two competing orientations.

The Artificial Intelligence in Education paradigm positions AI as a lever for instructional enhancement, personalized learning, adaptive feedback, documentation efficiency (Gardner et al., 2021; Holmes, 2024; Panciroli & Rivoltella, 2023).

The Artificial Intelligence Literacy framework conceptualizes AI education as the cultivation of informed digital citizenship across cognitive, operational, critical, and ethical competencies (Allen & Kendeou, 2023; Ng et al., 2021; Ranieri et al., 2023). The present study operates within the AIL tradition, understanding professional co-agency with AI, the capacity to engage with generative technologies reflexively, contextually, and ethically (Adamoli et al., 2026) as irreducible to technical skill, demanding a professional identity

capable of holding the tension between technological innovation and the relational core of pedagogical practice.

This tension has been theorized as the Frankenstein Complex: resistance rooted not in the absence of digital competence but in the fear that the artificial might impoverish what is irreducibly human in teaching.

The opposite risk, uncritical adoption characteristic of what Chan & Lee (2023) identify as the D-Generation, generates technological dependency without the evaluative capacity to assess algorithmic outputs critically (Williamson, 2024).

Pre-service support teachers train with students whose vulnerability demands a human presence held to be non-substitutable, yet generative AI is producing tools that may represent significant resources for students with disabilities and Special Educational Needs (Alsudairy & Eltantawy, 2024; Borsini & Giaconi, 2025).

Whether trainees experience AI as amplifying or threatening their vocation has not yet received systematic empirical attention, and no study has jointly examined inclusive pedagogical attitudes and AI co-agency using validated instruments.

2. Research Objectives and Hypotheses

profiling the phenomenon, testing its linear structure, and examining whether an associative pathway connects inclusive concerns to AI engagement.

The general objective is to examine the extent to which inclusive pedagogical orientation among pre-service special education teachers predicts their professional relationship with generative AI, with particular attention to the tension between technological resistance and uncritical adoption as structural dimensions of initial support teacher training.

Three specific objectives articulate this general aim:

RO1- Descriptive: to profile inclusive education attitudes (SACIE-R: Sentiments, Attitudes, Concerns) and AI co-agency (PAIR-S: Affordance-in-practice, Capability, Deprivation, Positive Sentiment, Negative Sentiment) among TFA Sostegno trainees, and to identify typological profiles through cluster analysis.

This objective responds to the absence of descriptive empirical data on how the two constructs distribute and co-occur in this specific population , a prerequisite for any relational or causal claim.

RO2 - Correlational: to test the relationship between SACIE-R subscales and PAIR-S factors, examining whether inclusive orientation predicts AI co-agency dimensions when controlling for sociodemographic variables.

The hierarchical regression design isolates the theoretical contribution of inclusive attitudes from the confounding effects of age, gender, school level, and prior professional experience.

extending the analysis toward a theoretically grounded associative account.

Three directional hypotheses were derived from the theoretical framework and from the evidence reviewed:

H1: SACIE-R Attitudes scores correlate positively with PAIR-S Capability and Affordance-in-practice. Trainees with stronger inclusive dispositions are expected to perceive AI as a professional resource rather than a relational threat, on the grounds that pro-inclusive beliefs signal a broader openness to pedagogical innovation.

This hypothesis draws on (Ertmer, 2005) distinction between first-order and second-order pedagogical beliefs, and on (Tondeur et al., 2017) systematic evidence that values-level orientations shape technology engagement through

belief-mediated pathways, albeit indirectly and through contextual moderators.

H2: SACIE-R Concerns scores correlate positively with PAIR-S Deprivation and negatively with Positive Sentiment. Trainees who experience greater practical anxiety about inclusive teaching, workload, resource adequacy, perceived competence, are expected to extend that anxiety to generative AI, perceiving it as a further source of relational and professional impoverishment rather than of support.

This hypothesis operationalizes the Frankenstein Complex at the empirical level: not as ideological opposition to technology, but as emotionally grounded resistance in a professional context already experienced as demanding.

H3: PAIR-S Deprivation mediates the relationship between SACIE-R Concerns and PAIR-S Affordance-in-practice.

a psychological pathway through which inclusive concerns may be associated with reduced AI engagement.

The indirect effect is estimated via bootstrap resampling (Preacher & Hayes, 2008), which quantifies the a × b product directly without requiring prior significance of the antecedent–mediator path and therefore provides a more conservative and informative test of mediation than the sequential causal steps procedure.

3. Method

3.1 Research Design

Cross-sectional quantitative correlational design: both instruments were embedded within a single digital questionnaire administered in one session

(April 16–21, 2026), and every record in the dataset corresponds to one individual's complete set of responses, with no matching or linkage procedure required or applied.

3.2 Participants

The study involved pre-service special education teachers enrolled in the TFA Sostegno, the Italian national qualification program for support teaching with students with disabilities and Special Educational Needs.

Participation was voluntary and anonymous; informed digital consent was obtained in line with EU Regulation 2016/679 (GDPR).

The group (N = 451) was characterized as follows:

- Gender: female 72.9% (n = 329), male 26.2% (n = 118), other/non-specified 0.9% (n = 4).
- Age: the most represented group was 25–30 years (n = 101), followed by 36–40 years (n = 86) and 31–35 years (n = 79); the remaining participants were distributed across older age bands up to over 55.
- TFA school level: secondary level II 65.9% (n = 297), secondary level I 29.0% (n = 131), primary school 5.1% (n = 23).
- Professional role: already employed as support teachers 41.2% (n = 186), as mainstream teachers 23.7% (n = 107), in initial training without contract 34.6% (n = 156).
- Prior support teaching experience: none 44.3% (n = 200), practicum only 36.4% (n = 164), substitute teacher 11.8% (n = 53), regular contract 7.5% (n = 34).

3.3 Instruments

3.3.1 *SACIE-R - Sentiments, Attitudes and Concerns about Inclusive Education*

The SACIE-R (Sharma et al., 2008) is an internationally validated instrument designed to measure teachers' attitudes toward inclusive education.

It consists of 15 items rated on a four-point Likert scale, organized into three subscales:

- Sentiments: five items measuring spontaneous emotional responses toward persons with disabilities, discomfort, avoidance, embarrassment.
  Higher scores indicate more negative emotional reactions. Cronbach's α on the present group: .869.
- Attitudes: five items measuring declared pro-inclusive beliefs about integrating students with disabilities in mainstream settings.
  Higher scores reflect stronger inclusive stances. α = .932.
- Concerns: five items measuring practical concerns about teaching in inclusive classrooms, workload, resource adequacy, perceived professional competence.
  α = .823.

Scoring involves computing the mean for each subscale on a range of one to four. The strong internal correlation between Sentiments and Concerns, together with the negative relationship between Attitudes and Sentiments, confirmed the theoretical structure of the instrument: the partial dissociation between declared inclusive values and emotional experience that the social desirability literature consistently identifies is also present in this group.

3.3.2 *PAIR-S- Participatory AI for Inclusive Relationships in School*

The PAIR-S (Adamoli et al., 2026) is a validated Italian instrument developed within the TEACH-AI project, adapting the PAIR questionnaire to school contexts (Rondonotti & Emanuel, in press).

Its theoretical architecture, ARISE-AI, integrates the theory of situated affordances (Costa, 2018), the capabilities approach (Nussbaum, 2011; Sen, 1985), and sentiment analysis (Bing, 2012).

National validation on over three thousand in-service Italian teachers confirmed a five-factor structure with strong fit indices (CFI = .922, RMSEA = .054).

The instrument comprises 36 items on a six-point Likert scale across five subscales:

- Affordance-in-practice: sixteen items measuring the frequency of AI use across specific professional activities, materials creation, documentation, tutoring, learning personalization.
  Response format: never to always. $\alpha = .973$.
- Capability: six items measuring the perception of AI as a professional amplifier, saving time, accessing resources, enabling collaboration, providing immediate feedback. $\alpha = .890$.
- Deprivation: five items measuring the perception of AI as an impoverishing factor, inhibiting creativity, reducing expressive richness, threatening privacy, reproducing bias, weakening interpersonal exchange. $\alpha = .836$.
- Positive Sentiment: five items measuring fascination, curiosity, enthusiasm, trust, and hope toward AI. $\alpha = .895$.

- Negative Sentiment: four items measuring distrust, frustration, fear, and skepticism. α = .803.

3.4 Procedure and Data Analysis

during a single administration session,

All analyses were performed using IBM SPSS Statistics. Demographic variables were coded as follows: gender (female = 1, male = 0; nine participants identifying outside this binary excluded from regression models, n = 442); age (ordinal, 1 = under 25 to 8 = over 55); TFA school level (ordinal, 1 = early childhood to 4 = upper secondary); prior support experience (ordinal, 1 = none to 4 = regular contract).

Cluster analysis followed Ward's hierarchical method to identify the optimal number of clusters, confirmed by K-means, yielding a four-cluster solution. Hierarchical regressions entered demographic variables in Block 1 and SACIE-R subscales in Block 2 via forced entry, isolating the incremental contribution of inclusive orientation over background characteristics.

Multicollinearity diagnostics were satisfactory. Mediation was tested via bootstrap estimation of the indirect effect (Preacher & Hayes, 2008).

4. Results

4.1 Descriptive Profile

The overall portrait of the group is one of declared inclusive commitment accompanied by cautious and limited engagement with generative AI.

On the inclusive education side, Attitudes scores were clearly above the scale midpoint, expressing strong pro-inclusive beliefs; Sentiments scores remained

well below, indicating positive emotional responses toward persons with disabilities; Concerns settled at a moderate level, reflecting neither indifference to the practical demands of inclusive teaching nor a sense of crisis.

These profiles confirm that TFA Sostegno trainees enter the program with a relatively coherent inclusive value orientation, a pedagogical resource that, as this study will show, does not automatically translate into technological openness.

On the AI side, practical use of generative tools sat below the scale midpoint, while Deprivation was the most elevated PAIR-S dimension, above the midpoint across the entire group: a structurally shared concern about what AI might diminish rather than augment, foreshadowing the typological analysis that follows (Figure 1, Table 1).

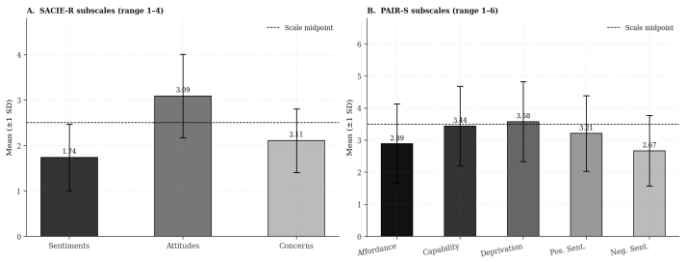


Figure 1. Descriptive statistics of SACIE-R and PAIR-S subscales (N = 451). Error bars represent ±1 SD. Dashed lines indicate scale midpoints.

Subscale (range)	**M**	**SD**	**Min**	**Max**	**Skewness**	**Cronbach's α**
SACIE-R Sentiments (1–4)	1.74	0.73	1.00	4.00	1.13**	.869

SACIE-R Attitudes (1–4)	3.09	0.92	1.00	4.00	−0.77**	.932
SACIE-R Concerns (1–4)	2.11	0.70	1.00	4.00	0.51**	.823
PAIR-S Affordance (1–6)	2.89	1.24	1.00	6.00	0.50**	.973
PAIR-S Capability (1–6)	3.44	1.24	1.00	6.00	−0.11	.890
PAIR-S Deprivation (1–6)	3.58	1.25	1.00	6.00	−0.12	.836
PAIR-S Positive Sentiment (1–6)	3.21	1.18	1.00	6.00	0.08	.895
PAIR-S Negative Sentiment (1–6)	2.67	1.10	1.00	6.00	0.60**	.803

*** substantial skewness (|value| > 0.50). All Shapiro-Wilk tests: p < .001.*

Table 1. Descriptive statistics and reliability of subscales (N = 451)

4.2 Four Typological Profiles

Ward's hierarchical cluster analysis confirmed by K-means yielded a four-cluster solution in which all subscale means differed significantly across groups.

The two-stage procedure, hierarchical first, to identify the optimal number of clusters through agglomeration coefficient inspection, then iterative K-means to refine centroid allocation was chosen to reduce sensitivity to local optima. The optimal k = 4 was supported by the agglomeration schedule: the most pronounced relative increase in the coefficient occurred at the transition from five to four clusters ($\Delta = 2.52$). A silhouette analysis confirmed acceptable cluster cohesion (mean silhouette = .18 for the K-means solution).

No cluster differed from the others in gender, school level, or prior support teaching experience, a finding that is not merely null but theoretically important.

It establishes that the profiles are psychologically distinct configurations, not artifacts of demographic differences: knowing that a trainee is female, enrolled for secondary school, or without prior classroom experience provides no information about which of the four profiles they inhabit.

The pedagogical consequence is direct, any formative differentiation strategy organized around these background characteristics would systematically miss the psychological structure that actually organizes the group.

Attitudinal and affective dimensions, not demographic proxies, are what distinguish one formative trajectory from another.

These profiles call for pedagogically calibrated responses grounded in the specific value tensions, emotional registers, and relational orientations each configuration embodies.

The normalized profile of each cluster is shown in (Figure 2), the within-cluster variability in (Figure 3), and raw means with standard deviations in (Table 2).

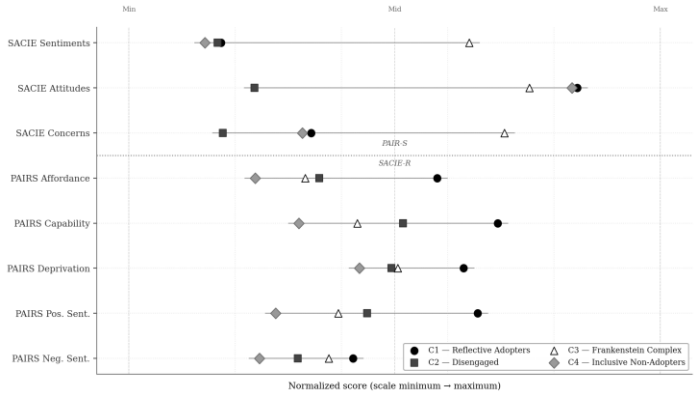


Figure 2. Cluster profiles on SACIE-R and PAIR-S subscales (normalized scores, 0–1, N = 451).

Marker shapes distinguish clusters; horizontal segments span the inter-cluster range per subscale. The dotted horizontal line separates PAIR-S from SACIE-R subscales.

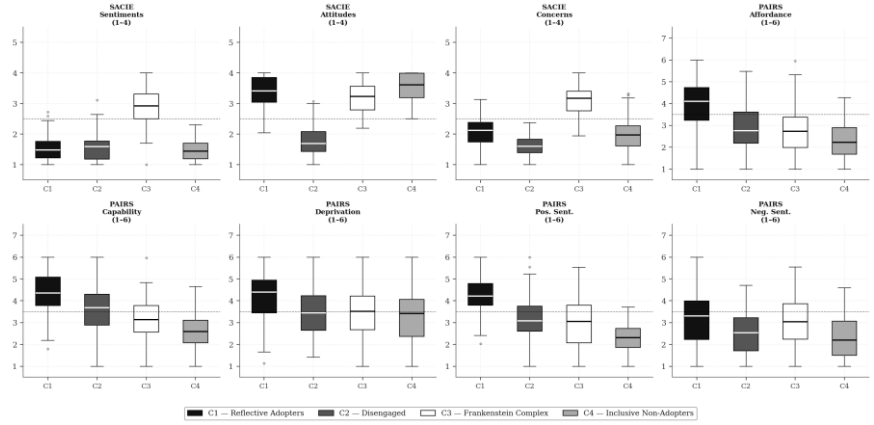


Figure 3. Box plots of all subscales by cluster (N = 451).

Dashed lines indicate scale midpoints. All ANOVA F values: p < .001.

Subscale	C1 Reflective Adopters (28.4%)	C2 Disengaged (21.1%)	C3 Frankenstein Complex (18.0%)	C4 Inclusive Non-Adopters (32.6%)
SACIE Sentiments (1–4)	1.52 (0.49)	1.50 (0.42)	2.92 (0.60) †	1.43 (0.40)
SACIE Attitudes (1–4)	3.53 (0.60)	1.71 (0.53) †	3.26 (0.51)	3.50 (0.60)
SACIE Concerns (1–4)	2.03 (0.51)	1.53 (0.35)	3.12 (0.47) †	1.98 (0.52)
PAIRS Affordance (1–6)	3.90 (1.14) †	2.79 (1.05)	2.66 (1.03)	2.19 (0.96)
PAIRS Capability (1–6)	4.47 (1.06) †	3.58 (1.10)	3.15 (1.02)	2.60 (0.85)
PAIRS Deprivation (1–6)	4.15 (1.16) †	3.47 (1.11)	3.53 (1.20)	3.17 (1.27)
PAIRS Pos. Sentiment (1–6)	4.28 (0.89) †	3.24 (1.04)	2.97 (1.06)	2.38 (0.73)

PAIRS Neg. Sentiment (1–6)	3.11 (1.14)	2.59 (0.91)	2.88 (1.17)	2.23 (0.94)

† highest value on that variable across the four clusters. N: C1 = 128, C2 = 95, C3 = 81, C4 = 147. All ANOVA F values: p < .001.

Table 2. Cluster profiles: means (SD) by subscale

4.3 Correlational Structure

The correlation matrix presents two internally cohesive blocks, one encompassing the SACIE-R subscales, the other the PAIR-S factors, with no significant cross-instrument associations (Figure 4).

The two-block structure carries interpretive weight beyond the individual coefficients: it confirms that each instrument is measuring a genuine psychological unity, a domain of professional experience with its own internal architecture and developmental logic, not a loose collection of loosely related items.

Within the SACIE-R, the strong co-variation of Sentiments and Concerns (ρ = .654, $p < .01$) indicates that emotional discomfort toward disability and practical anxieties about inclusive teaching tend to travel together; the negative relationship between Attitudes and Sentiments ($\rho = -.199$, $p < .01$) documents the partial dissociation between declared values and affective experience, a formative phenomenon that inclusive education pedagogy has long theorized and that initial teacher training must address directly, rather than assuming that declarative alignment with inclusive principles is sufficient to resolve emotional ambivalence.

Within the PAIR-S, Capability and Positive Sentiment showed the strongest coupling (ρ = .699, p < .01); Deprivation co-varied positively with Affordance (ρ = .152, p < .01), indicating that greater AI use is associated with sharper awareness of its relational risks, a pattern that challenges the assumption that resistance to AI simply dissolves with familiarity, and that foreshadows the Reflective Adopter profile.

Between the two instruments, no coefficient reached significance (all ρ < .08, all p > .10), systematically disconfirming H1 and H2 at the bivariate level.

This absence is the finding that most directly shapes the study's practical implications: it confirms that inclusive orientation and AI co-agency require independent, not integrated, formative attention.

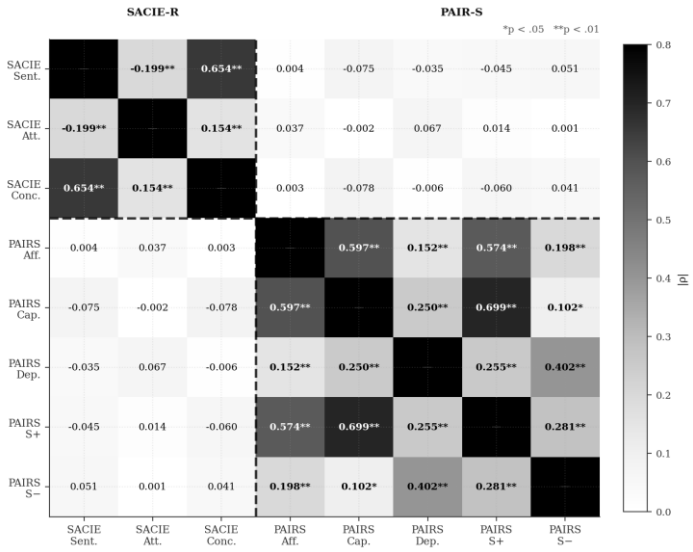


Figure 4. Spearman's ρ correlation matrix (N = 451).

*Darker shading indicates higher absolute correlation. The dashed line separates the SACIE-R block (upper left) from the PAIR-S block (lower right). *p < .05; **p < .01.*

4.4 Hierarchical Regression

Hierarchical regression across all five PAIR-S outcomes confirmed the same structural independence observed in the correlations.

The SACIE-R subscales added no significant incremental variance to any model once demographic predictors were accounted for: increments ranged from negligible to trivial, all non-significant, and no individual SACIE-R beta coefficient approached significance in any equation (Table 3).

DV PAIR-S	**ΔR² B1**	**p B1**	**ΔR² B2**	**p B2**	**β Sent.**	**β Att.**	**β Conc.**
Affordance	.037	.002*	.002	.773	.026	.047	−.059
Capability	.031	.007*	.007	.335	−.029	.003	−.063
Deprivation	.005	.674	.007	.348	−.073	.057	.032
Positive Sentiment	.043	.001*	.005	.546	.042	.022	−.099
Negative Sentiment	.013	.196	.004	.618	.067	.026	−.010

*B1 = Block 1 (gender, age group, school level, support experience); B2 = Block 2 (SACIE-R Sentiments, Attitudes, Concerns). *p < .05. No Block 2 beta coefficient reached significance. Maximum VIF = 2.790.*

Table 3. Hierarchical regressions: Block-level ΔR² and Block 2 standardized β (N = 451)

What did predict AI co-agency was demographic in character, specifically age. Younger trainees showed significantly higher practical AI use and more positive emotional engagement, independently of their inclusive orientation (β = −.139, p = .003 for Affordance; β = −.095, p = .044 for Positive Sentiment).

Gender predicted Capability and Positive Sentiment (β = −.140, p = .003 for both), with male trainees scoring higher , a pattern requiring cautious interpretation given the marked gender imbalance in the group.

Most pedagogically significant: Deprivation was not predicted by any demographic variable, confirming that the perception of AI as a relational and creative risk is a diffuse and structural feature of the entire group's professional imagination, not a property of any specific subgroup (Figure 5).

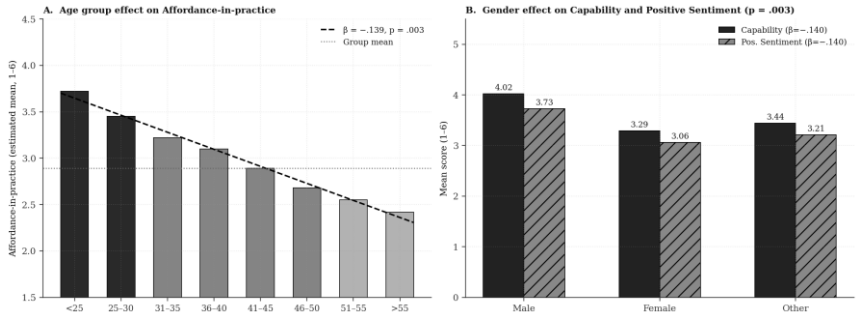


Figure 5. Significant demographic predictors (Block 1). A: Age group gradient on Affordance-in-practice (β = −.139, p = .003). B: Gender effect on Capability and Positive Sentiment (β = −.140, p = .003 for both).

4.5 Mediation Analysis

The mediation model specified in H3 was tested using bootstrap estimation of the indirect effect (Preacher & Hayes, 2008; 5,000 resamples), a procedure that quantifies the a × b product path directly and does not impose sequential significance requirements on individual paths.

SACIE-R Concerns did not predict PAIR-S Deprivation at a meaningful level (Path a: β = .032, p = .684), confirming that practical anxieties about inclusive teaching do not generate, in a direct and detectable form, the perception that AI impoverishes relational and creative dimensions of teaching.

indicating that, contrary to the direction hypothesized, higher Deprivation is associated with higher Affordance-in-practice, consistent with the Reflective Adopter profile of critical co-agency rather than avoidance.

The direct effect of Concerns on Affordance remained non-significant after controlling for the mediator (Path c': β = −.059, p = .450).

H3 is therefore disconfirmed on two grounds: Path a was non-significant (β = .063, p = .490), and Path b operated in the direction opposite to that hypothesized , positively, not negatively, associated with Affordance. The bootstrap indirect effect (a × b = .014; 95% CI [−.026, .060]) contains zero.

The causal structure connecting these two dimensions, if it exists, is more distributed and contextually embedded than a single-mediator model can capture (Figure 6).

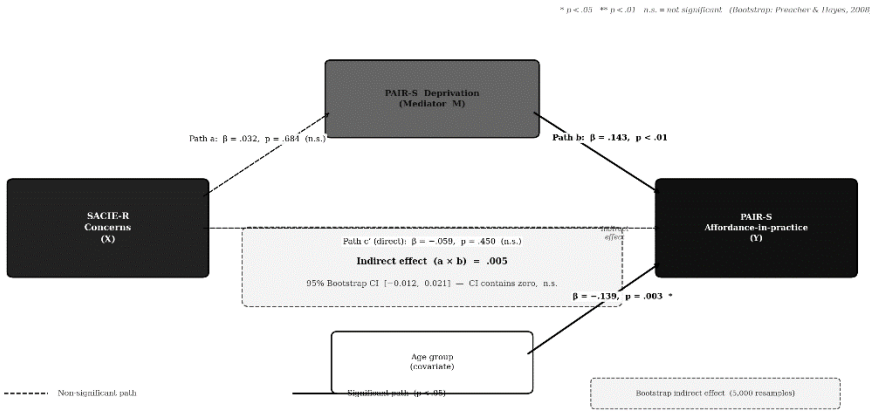


Figure 6. Bootstrap mediation model (H3): SACIE-R Concerns → PAIR-S Deprivation → PAIR-S Affordance-in-practice (N = 451; 5,000 resamples).

5. Discussion

The systematic absence of significant associations between inclusive orientation and AI co-agency, across the full correlation matrix and all five regression equations, is the most pervasive and theoretically productive finding of this study. It is a precise empirical claim: the psychological territory of inclusive education commitment and that of professional AI engagement do not share a common developmental logic and are not bridged automatically by training contexts that cultivate one without attending to the other.

This independence is robust across all analytical levels and is not attributable to matching noise, given that both instruments were administered within a single integrated questionnaire.

consistent with (Ertmer, 2005) distinction between first-order pedagogical beliefs, practical conditions, resources, competences — and second-order beliefs, values, identity, professional vocation.

Tondeur et al. (2017) showed in a systematic review that teachers integrate technology through chains of contextual mediators , available tools, collegial support, perceived self-efficacy, that this study was not designed to capture, and that technology self-efficacy (Scherer et al., 2019), facilitating conditions (Venkatesh et al., 2012), and prior digital exposure (Galindo-Domínguez et al., 2024) represent the most compelling candidates for future mediational investigation.

The bootstrap test of H3 adds a theoretically significant nuance to this picture: Deprivation does inhibit Affordance-in-practice when present , Path b was significant but inclusive Concerns do not activate Deprivation at a detectable level. The mechanism hypothesized in H3 therefore exists and operates in one direction, but its trigger is not pedagogical anxiety about inclusive teaching.

This finding reframes the Frankenstein Complex empirically: the fear of relational impoverishment reduces AI engagement when it arises, but it is not generated by the practical concerns that define the experience of inclusive teaching.

What activates it, then, is an open question, one that the cluster profiles begin to answer by showing that heightened Deprivation is characteristic of the group with the highest AI use, not the lowest.

The cluster analysis discloses a structure that the correlational analysis obscures. The Frankenstein Complex cluster shows the highest emotional discomfort toward disability, the highest practical concerns about inclusive teaching, and the lowest practical engagement with AI tools.

The coexistence of relatively acceptable declared Attitudes with markedly elevated Sentiments is not a contradiction but a dissociation that special education pedagogy recognizes as a central formation challenge (d'Alonzo, 2017): these trainees endorse inclusive principles declaratively while experiencing them with emotional strain, and that unresolved tension migrates into the relationship with AI not as ideological resistance but as emotional overload, there is no room in a professional self already under pressure to absorb a further layer of complexity.

For this cluster, formative intervention must address the quality of emotional processing of disability experience before any AI literacy work can take root.

The Inclusive Non-Adopters, the largest cluster, show the strongest inclusive profile alongside the lowest AI engagement across every dimension; their negative affect toward AI is also the lowest in the group, meaning they do not fear or distrust it but simply do not perceive it as professionally relevant.

When interpreting Affordance-in-practice scores across clusters, an ecological validity question deserves acknowledgment: the PAIR-S was validated on experienced in-service teachers, and nearly half of this group had no prior support classroom experience.

Lower Affordance scores may therefore partly reflect the absence of a professional context in which to apply AI rather than a genuinely lower disposition toward it, a confound that future designs should address by screening for active classroom experience.

The ethics of care, however well internalized, does not generate technological openness on its own, and the formative bridge must be made visible and explicit: showing how generative tools can amplify inclusive values rather than

compete with relational care requires concrete disciplinary examples grounded in the specific pedagogical challenges these trainees will face.

The Reflective Adopters embody the target disposition for AI-era teacher education: strong inclusive orientation, the highest practical AI use, and the highest Deprivation scores in the group.

They hold risk and resource in productive tension, and their elevated Deprivation is not anxiety but discernment, the empirical signature of the critical co-agency that the ARISE-AI framework (Adamoli et al., 2026) identifies as the hallmark of human-centered AI engagement.

The Disengaged, who show the weakest inclusive attitudes and engage with AI at average levels without meaningful investment in either domain, represent the most structurally demanding challenge: for this group, the formative priority lies before any AI literacy work and concerns the construction of professional identity as a support teacher and the activation of ethical responsibility toward the students they will serve.

The age gradient, the only consistent demographic predictor of AI co-agency, points to a generational dimension that does not reduce to pedagogical orientation. Younger trainees show systematically higher practical AI use and more positive affective engagement regardless of their inclusive values, consistent with what (Chan & Lee, 2023) identify as the AI generation gap: the difference is not primarily motivational but epistemic and habitual, rooted in a different relationship to algorithmically mediated knowledge production.

Older trainees need formative pathways that connect AI's possibilities to the pedagogical expertise they already possess, honoring their experience as an asset rather than framing it as a deficit to overcome.

A further boundary concerns the SACIE-R Attitudes subscale, whose negative skewness, attributable to social desirability in a pro-inclusive formation context , reduces effective variance in the key predictor and may have attenuated its predictive power in the regression models; future work should consider implicit measures of inclusive orientation alongside self-report instruments to address this structural ceiling.

Deprivation, elevated above the scale midpoint across the entire group, uncorrelated with any SACIE-R subscale, and unpredicted by any demographic variable is the most pedagogically telling result of all.

The concern that AI might impoverish teaching's creativity, relational texture, and interpersonal quality traverses all clusters, age groups, and professional roles; it is not the property of any sociodemographic subgroup but a structurally shared feature of the group's professional imagination.

when Deprivation is present it is associated with lower AI engagement.

Cultivated rather than dismissed, it becomes the critical discernment that separates reflective co-agency from uncritical compliance, the form of professional intelligence that teacher education for the AI era most urgently needs to develop.

6. Conclusions

This study provides the first systematic empirical evidence on the relationship between inclusive pedagogical orientation and professional co-agency with generative AI among Italian pre-service special education teachers.

Three empirical propositions condense its findings, each carrying direct implications for the design of initial teacher education in the AI era.

Inclusive orientation and AI co-agency are psychologically independent constructs. This independence is not a transitional phenomenon that will dissolve as generative tools become more familiar in educational contexts: it reflects a structural difference in the developmental logic of the two competencies, one rooted in relational ethics and identity formation, the other in technological access and generational habituation.

The practical implication is precise, programs that assume inclusive values will automatically convert into AI engagement will fail to reach the Inclusive Non-Adopters, the largest cluster observed in this study, who need explicitly constructed bridges between care ethics and technological possibility, not implicit transfers that never materialize.

The structure of the phenomenon is typological, not dimensional. A standardized AI literacy curriculum addressed uniformly to all pre-service support teachers is effectively suited only to the Reflective Adopters, a minority of the observed group and even for them, the appropriate task is critical deepening, not introduction.

For the Frankenstein Complex group, whose resistance is affective rather than ideological, the formative priority is the emotional processing of inclusive experience, which must precede any encounter with AI tools if that encounter is to be productive rather than further destabilizing.

For the Disengaged, the intervention must begin earlier still, at the level of professional identity formation and the cultivation of ethical responsibility toward the students they will serve.

For the Inclusive Non-Adopters, the task is making the connection between care ethics and technological possibility explicit, grounded, and pedagogically

specific, showing through disciplinary examples how generative AI can amplify relational practice rather than displace it.

The most stable predictor of AI co-agency in this group is generational, not pedagogical. Teacher education programs must differentiate their AI introductory pathways by generational cohort, resisting the temptation to frame older trainees' greater hesitation as a competence deficit to be corrected. Their pedagogical experience is a resource to connect to AI's possibilities, not a barrier to overcome.

The question that structures the broader field of teacher education and AI, whether generative technologies can be understood as amplifiers of what is irreducibly human in teaching rather than as replacements for it, finds in the data of this study a precise and differentiated answer: the capacity for reflective AI co-agency is not automatic, not uniformly distributed, and not a byproduct of inclusive commitment.

Deprivation, the shared, demographic-invariant concern about what AI might diminish in the act of teaching, is not the obstacle to resolve.

References

Adamoli, M., Emanuel, F., Marangi, M., & Rondonotti, M. (2026). ARISE-AI: Mapping and guiding AI-mediated teaching practices in a human-centered perspective. Research Trends in Humanities, 13, 35–50.

Adamoli, M., Marangi, M., Rondonotti, M., & Raviolo, P. (2025a). AI literacy: An explorative analysis of Italian university students' perceptions of AI skills. Italian Journal of Health Education, Sport and Inclusive Didactics, 9(1).

Allen, L. K., & Kendeou, P. (2023). ED-AI Lit: An interdisciplinary framework for AI literacy in education. Policy Insights from the Behavioral and Brain Sciences, 11(1), 3–10. https://doi.org/10.1177/23727322221141764z

Alsudairy, N. A., & Eltantawy, M. M. (2024). Special education teachers' perceptions of using AI in educating students with disabilities. Journal of Intellectual Disability-Diagnosis and Treatment, 12(2), 92–102.

Bing, L. (2012). Sentiment analysis and opinion mining. Morgan & Claypool Publishers.

Booth, T., & Ainscow, M. (2008). Index for inclusion: Developing learning and participation in schools (2nd ed.). Centre for Studies on Inclusive Education.

Borsini, L., & Giaconi, C. (2025). New challenges for Special Pedagogy: A study on training teachers' perceptions of the role of AI. Italian Journal of Special Education for Inclusion, 13(1), 34–46.

Chan, C. K. Y., & Lee, K. K. (2023). The AI generation gap: Are Gen Z students more interested in adopting generative AI than their Gen X and Millennial teachers? Smart Learning Environments, 10(1), 60.

Costa, E. (2018). Affordances-in-practice: An ethnographic critique of social media logic and context collapse. New Media & Society, 20(10), 3641–3656.

Creswell, J. W., & Creswell, D. (2018). Research design: Qualitative, quantitative and mixed methods approaches (5th ed.). SAGE.

d'Alonzo, L. (2017). La differenziazione didattica per l'inclusione. Erickson.

Di Martino, V. (2024). L'Intelligenza Artificiale in ambito educativo: Percezioni dei docenti in formazione iniziale. Education Sciences & Society, (2), 88–104.

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? Educational Technology Research and Development, 53(4), 25–39.

Field, A. (2018). Discovering statistics using IBM SPSS Statistics (5th ed.). SAGE.

Fiorucci, A., & Bevilacqua, A. (2024). Un matrimonio quasi felice: L'intelligenza artificiale nell'ambito della pedagogia e della didattica speciale. Italian Journal of Special Education for Inclusion, 12(2), 73–83.

Fiorucci, A., & Bevilacqua, A. (2025). Rethinking Artificial Intelligence for inclusion and disability support. Journal of Inclusive Methodology and Technology in Learning and Teaching, 5(1).

Galindo-Domínguez, H., Delgado, N., Campo, L., & Losada, D. (2024). Relationship between teachers' digital competence and attitudes towards AI in education. International Journal of Educational Research, 126, 102381.

Gardner, J., O'Leary, M., & Yuan, L. (2021). Artificial intelligence in educational assessment. Journal of Computer Assisted Learning, 37(5), 1207–1216.

Holmes, W. (2024). AIED coming of age? International Journal of Artificial Intelligence in Education, 34(1), 1–11.

Holmes, W., & Tuomi, I. (2022). State of the art and practice in AI in education. European Journal of Education, 57(4), 542–570.

Ministero dell'Istruzione e del Merito. (2025). Linee guida per l'introduzione dell'Intelligenza Artificiale nelle Istituzioni scolastiche, V. 1.0 (D.M. n. 166, 09/08/2025). MIM.

Ng, D. T. K., Leung, J. K. L., Chu, S. K. W., & Qiao, M. S. (2021). Conceptualizing AI literacy: An exploratory review. Computers and Education: Artificial Intelligence, 2, 100041.

Nirchi, S., Mangione, G. R. J., De Vincenzo, C., & Pettenati, M. C. (2025). Indagine esplorativa sulla percezione dei docenti neoassunti circa l'impiego dell'IA nella didattica. ECPS Journal, (30), 151–180.

Nunnally, J. C. (1978). Psychometric theory (2nd ed.). McGraw-Hill.

Nussbaum, M. C. (2011). Creating capabilities: The human development approach. Harvard University Press.

Panciroli, C., & Rivoltella, P. C. (2023). Pedagogia algoritmica. Scholé — Morcelliana.

Ranieri, M., Cuomo, S., & Biagini, G. (2023). Intelligenza artificiale e formazione docenti. Rivista di Storia dell'Educazione, 10(1), 23–35.

Rondonotti, M., & Emanuel, F. (in press). Il questionario PAIR: Uno strumento per indagare l'integrazione dell'AI nei servizi socio-educativi. Atti del Convegno SIRD 2025.

Scherer, R., Siddiq, F., & Tondeur, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology. Computers & Education, 128, 13–35.

Selwyn, N. (2019). Should robots replace teachers? AI and the future of education. Polity Press.

Sen, A. (1985). Commodities and capabilities. Oxford University Press India.

Sharma, U., Forlin, C., & Loreman, T. (2008). Impact of training on pre-service teachers' attitudes and concerns about inclusive education and sentiments about persons with disabilities. Disability & Society, 23(7), 773–785.

Tondeur, J., Van Braak, J., Ertmer, P. A., & Ottenbreit-Leftwich, A. (2017). Understanding the relationship between teachers' pedagogical beliefs and

technology use: A systematic review. Educational Technology Research and Development, 65, 555–575.

UNESCO. (2024). AI Competency Framework for Teachers. UNESCO Publishing.

Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: Extending the UTAUT. MIS Quarterly, 36(1), 157–178.

Williamson, B. (2024). The social life of AI in education. International Journal of Artificial Intelligence in Education, 34, 97–104.