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Reflection and collaborative curriculum design for inclusion: the role of artificial intelligence in initial teacher training

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Abstract: This study explores how reflexivity and perceived planning competence change among future teachers following a training program on the critical use of AI for inclusion. The study employs a mixed-methods design with pre- and post-tests administered via an anonymous questionnaire (pre-test n = 130; post-test n = 129) among future teachers. Participants developed a teaching proposal, submitted it to the chatbot they were most familiar with using targeted prompts to obtain a critical analysis, and reviewed the outputs to redesign the activity. In the post-test, the perception of AI as a support for inclusion increased (d = 0.73), while the perception of a threat to decision-making autonomy remained stable; at the same time, the perceived readiness to recognize the limitations of one's own design increased (d = 0.97) and, to a lesser extent, the evaluation of collaborative methodologies (d = 0.32). Analysis of the open-ended responses, conducted using IRaMuTeQ software, shows that reflections on the risk of delegation characterized the initial survey, whereas in the post-test, terms defining AI as a support tool that does not replace the teacher became prominent. The results suggest that a guided reflection process can help transform the use of AI from an executive tool into a catalyst for future teachers' reflection on inclusive design, without relieving teachers of responsibility for their choices.

Keywords: Artificial Intelligence; Training for Future Teachers; Reflectiveness; Inclusive Design; Universal Design for Learning.

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1. From an executive function to a reflective and critical approach to outputs

In educational contexts, an approach to Artificial Intelligence focused primarily on efficiency, the automation of design processes and, above all, the generation of specific teaching materials (van den Berg & du Plessis, 2023) risks reducing its function to mere execution and neglecting its potential for cognitive mediation and formative assessment (Vinci et al., 2026). Van den Berg and du Plessis (2023), whilst acknowledging AI's contribution to lesson preparation, emphasise the need to critically evaluate its limitations and to consider its role in supporting teaching and learning. When queried using specific prompting strategies, AI can support the analysis of instructional design, bringing to light otherwise unnoticed barriers to learning and guiding the rethinking of educational practice, including from the perspective of accessibility and inclusion (Vinci et al., 2026). A critical and informed approach to Artificial Intelligence, however, requires pedagogical intent in the use of emerging technologies (Perla et al., 2025). The pervasiveness of AI in educational

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contexts (Pedro et al., 2019; Grassini, 2023) calls for teacher training that encourages reflection on the critical skills required to use the tool effectively, with a view to enhancing their interaction with it and their assessment of its outputs (Jurenka et al., 2024). This research aims to sit at the intersection of AI literacy and initial teacher training, adopting the principles of reflective practice (Machost & Stains, 2023) and Universal Design for Learning (UDL) (CAST, 2024) as its theoretical framework. From this perspective, reflectivity is understood as an opportunity to analyse one's own design choices (Perla & Agrati, 2020), recognise their limitations, rethink them and redesign. Interaction with AI-based conversational systems (Bilbao-Quintana et al., 2026) can play a central role in identifying barriers to learning (CAST, 2024) and in redesigning more accessible and inclusive learning environments (Stefaniak & Moore, 2024). The research aims to explore whether AI can act as a reflective collaborator and cognitive partner capable of supporting future teachers in generative mediation (Vinci et al., 2025).

The design activity is conceived as co-design with AI: during the workshop, the trainee teachers developed a proposal, submitted it to the tool and decided which suggestions to adopt. The question, therefore, is whether the chatbot, through intentional prompting practices (Dourvas et al., 2026), can support metacognitive processes aimed at identifying barriers to universal accessibility (Vinci et al., 2025). Three aspects remain to be clarified: whether the use of AI during the design phase can enhance the reflective capacity of trainee teachers or, conversely, reduce their decision-making autonomy; whether engagement with the tool alters the way in which course participants recognise the limitations of their own design and understand inclusion; whether the experience with AI also influences the choice of teaching methodologies, particularly collaborative ones, which, according to UDL (CAST, 2024), are fundamental for the participation of all. Finally, how do trainee teachers describe their relationship with AI and what doubts emerge regarding their own lesson planning.

The aim of the research is to explore how future teachers' critical awareness of AI, their reflection on their own lesson planning, and their perception of competence in accessibility and inclusion change at the end of a training programme centred on the critical use of AI. The research therefore seeks to answer three questions:

- RQ1. How does the perception of AI as a tool for inclusive design and as a potential threat to professional autonomy change by the end of the programme?
- RQ2. To what extent do participants' perceived ability to recognise the limitations of their own design work, their understanding of what constitutes an inclusive activity, and their assessment of collaborative methodologies change?
- RQ3. How does the way in which future teachers discuss their relationship with AI change, and what questions regarding their own design work emerge following the course?

2. Research design and methodology

The study adopts a mixed-methods approach (Creswell & Plano Clark, 2018), based on a pre-test/post-test design without a control group. The participants were

first-year students on the Bachelor's Degree Programme in Primary Education at the University of Foggia (academic year 2025–2026) enrolled on the General Didactics Workshop: 130 completed the initial survey and 129 the final one. The sample consists almost entirely of female students (95.4 per cent) and is concentrated in the younger age groups (under 20 years of age). In the final survey, the composition by gender and age remained essentially unchanged (Table 1).

	PRE (n=130) PNG	**POST (n=129) PNG**
Gender		
Female	124 (95.4%)	123 (95.3%)
Male	5 (3.8%)	4 (3.1%)
Prefer not to say	1 (0.8%)	2 (1.6%)
Age		
Up to 20 years	65 (50.0%)	66 (51.2%)
21–24 years	25 (19.2%)	23 (17.8%)
25–29 years	16 (12.3%)	16 (12.4%)
30–34 years	10 (7.7%)	10 (7.8%)
35–39 years	11 (8.5%)	11 (8.5%)
40–44 years	3 (2.3%)	3 (2.3%)

Table 1. Analytical distribution of the sample

Participants were asked to develop, on an individual basis, an inclusive and accessible teaching proposal for primary schools, aimed at promoting local heritage both tangible and intangible through active methodologies such as gamification (Zeybek & Saygı, 2024), outdoor education (Gilbertson et al., 2022) and peer tutoring (Falchikov, 2003). In a second phase, they queried a chatbot (ChatGPT, Gemini) using a sequence of prompts prepared specifically for the course, with the aim of identifying the proposal's limitations in terms of accessibility and inclusion. The chatbot's responses were discussed during a debriefing session, in which

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participants assessed the relevance of the suggestions and decided which ones to take into account; based on this reflection, they finally redesigned the activity.

The data were collected using an online questionnaire in CAWI mode, administered at the start of the programme (pre-survey) and at its conclusion (post-survey). Participation was voluntary and anonymous. The questionnaire was specifically designed to gauge general attitudes towards algorithmic technologies and to facilitate a critical meta-evaluation of inclusive and territorial design processes mediated by Artificial Intelligence. The questionnaire begins with sociodemographic data and three contextual questions on teaching experiences and the use of AI, and is then structured around four pedagogical macro-constructs (Value of territorial and inclusive design; self-efficacy and attitudes towards AI in teaching; AI for inclusion and reflection on barriers; critical mindset, transparency and algorithmic debriefing). The instrument comprises 15 items on a 10-point Likert scale (from 1 = Not at all / Strongly disagree to 10 = Very much / Strongly agree) in order to ensure greater measurement sensitivity. It also includes two assessment grids for innovative methodologies (on a scale of 1 to 10), one multiple-choice question, one single-choice question and four open-ended questions. The two surveys share most of the items: the three items relating to preparation, digital competence and confidence in the use of AI, and the question on the use of AI for design, were included only in the initial survey, whilst the question on concerns arising from the use of AI was included only in the final survey.

The statistical analyses were carried out using the Jamovi software (version 2.7). As the questionnaire was anonymous and did not include any identification codes, the two data sets were treated as independent samples. The reliability of the scales was estimated using McDonald's ω coefficient, separately for the pre-test and post-test. The index of the perception of AI as a support for inclusion, calculated as the mean of the four items of the relevant construct, recorded values of $\omega = .83$ and $\omega = .86$. The assessments of peer tutoring and cooperative learning, relating to both community-based projects and those focused on inclusion, were summarised in an index of collaborative methodologies ($\omega = .91$ and .94); using the same criterion, an index of immersive methodologies was constructed, comprising virtual reality and augmented reality ($\omega = .91$ and .93). The items concerning the potential reduction in decision-making autonomy and concerns about the opacity of algorithms were analysed individually to indicate the perception of threat. Items present only in the pre-test (preparation for using AI, digital competence and trust) and the two items on the importance of community-based design were excluded from the comparison, as they had the same value for all participants in the final survey.

The distribution of scores is not normal in either survey (Shapiro-Wilk test: $p < .05$ for all variables). Given the size of the samples, comparisons between pre-test and post-test were carried out using Welch's t-test, which is robust to unequal variances across groups. The effect size was estimated using Cohen's d. Responses to the multiple-choice question regarding the design phases in which AI is considered useful were converted into dichotomous variables (yes/no) for each option and compared between pre-test and post-test using the chi-squared test. Three associations were examined using Spearman's correlation coefficient, calculated separately for the pre-test and post-test: between AI as a support and as a threat; between the two forms of threat (autonomy and opacity); and between AI as

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a support for inclusion and the evaluation of collaborative and immersive methodologies. The open-ended responses to the three questions present in both the pre- and post-surveys were subjected to lexical analysis using the IRaMuTeQ software (Ratinaud, 2009), which identifies lexical classes. The corpus comprises 509 texts (8,811 occurrences; 1,179 lemmas). For each text, two descriptive variables were specified: the survey and the question from which it was taken. The χ^2 test ($p < .05$) enabled the identification of the words and variables typical of each class.

3. Results

In the post-test, the IA-inclusion index was significantly higher ($M = 7.00$ in the pre-test; $M = 7.87$ in the post-test; $t(256.3) = 5.84$, $p < .001$, $d = 0.73$). The increase is observed across all items of the index and is most evident in the IA's ability to encourage reflection on accessibility ($d = 0.76$); there is also an increase in the perceived usefulness of the IA's critical analysis of one's own project ($M = 7.19$ vs 7.74; $t(250.6) = 2.98$, $p = .003$, $d = 0.37$). Between the pre- and post-measurements, there was an increase both in the perception of AI as a tool to improve design ($d = 0.49$, $p < .001$) and in the belief that AI can influence the teacher's work ($d = 0.45$, $p < .001$). The perception of threat remained unchanged, both with regard to decision-making autonomy ($p = .171$) and with regard to the opacity of algorithms ($p = .740$) (Figure 1).

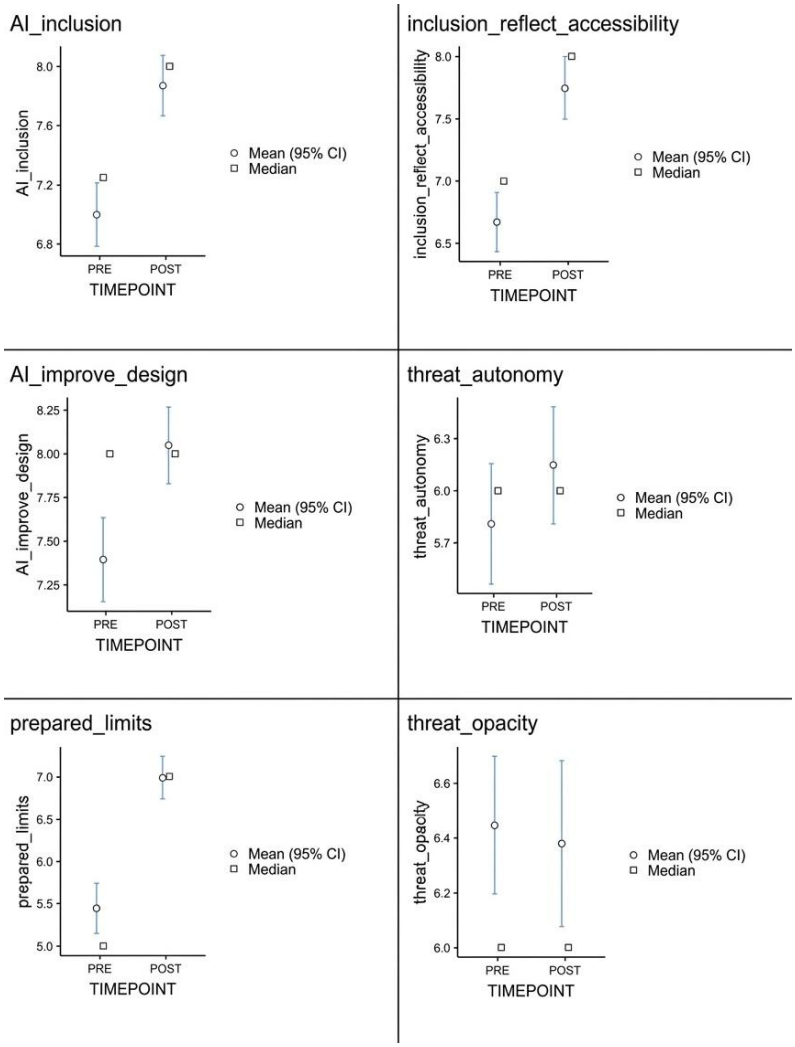


Fig. 1: Perception of AI as a support and as a threat, and readiness to identify the limitations of spatial planning in the two surveys

At the end of the workshop, those who fear that AI will reduce autonomy also tend to be more concerned about the opacity of algorithms ($\varrho = .56$, $p < .001$ in the post-test; $\varrho = .29$, $p = .001$ in the pre-test). These concerns do not appear to translate into reduced trust in AI as a tool for inclusion. This suggests that participants appreciate the tool's usefulness, whilst at the same time recognising its risks. Participants in the pre-test found AI to be most useful during the conceptualisation phase of the design process (68.5 per cent). By the end of the workshop, there was a significant increase in the proportion of those who considered it useful for ensuring accessibility (from 26.2% to 46.5%; $\chi^2(1) = 11.61$, $p < .001$) and personalization (from 20.0% to 35.7%; $\chi^2(1) = 7.91$, $p = .005$) (Figure 2).

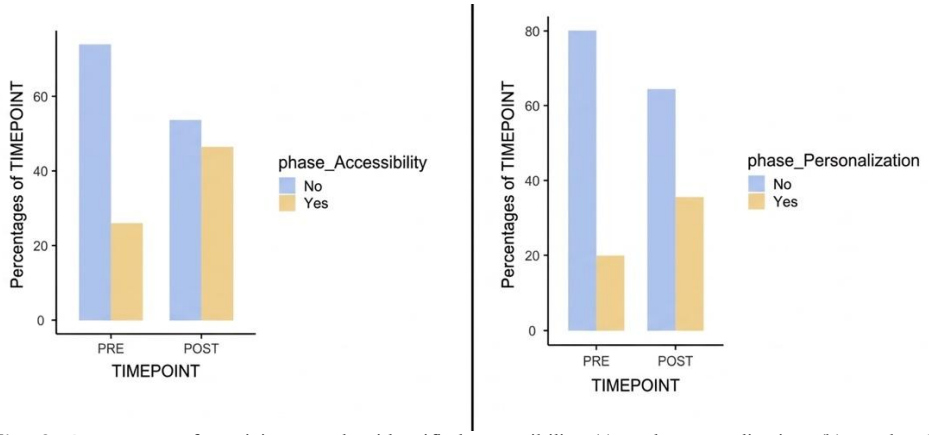


Fig. 2: Percentage of participants who identified accessibility (a) and personalisation (b) as the design phases in which AI is most useful, in the two surveys

Participants' ability to recognise the limitations of a location-based activity increased from 5.45 in the pre-test to 6.98 in the post-test ($t(250.6) = 7.84$, $p < .001$, $d = 0.97$) (Figure 1). The evaluation of the methodologies also changed between the two surveys (Table 3). Collaborative methodologies received a higher rating in the post-test ($M = 7.37$ vs 7.97; $t(255.6) = 2.59$, $p = .010$, $d = 0.32$), and cooperative learning was deemed the most suitable methodology for both community-based projects ($M = 8.07$) and inclusive projects ($M = 8.14$). As summarised in Table 3, the mean score for peer tutoring, considered suitable for a community-based project, increased significantly ($M = 6.45$ vs 7.64; $t(246.6) = 4.50$, $p < .001$, $d = 0.57$). For outdoor education, the increase is small ($d = 0.25$; $p = .045$), whilst gamification shows no significant changes ($d = 0.20$; $p = .114$).

Immersive methodologies show a smaller increase ($M = 6.32$ vs 6.81; $t(255.9) = 2.07$, $p = .040$, $d = 0.26$). In the post-test, those who attribute a greater role to AI in supporting inclusion tend to place greater value on collaborative methodologies ($\varrho = .31$, $p < .001$); in the pre-test, this link was weaker and not significant ($\varrho = .13$, $p = .136$). A weaker link is also observed with regard to immersive methodologies ($\varrho = .23$, $p = .010$ in the post-test; $\varrho = .15$, $p = .092$ in the pre-test).

Variable	Pre-test M (SD)	Post-test M (SD)	Welch's t (df)	p	d
Collaborative methodologies index	7.37 (1.94)	7.97 (1.79)	2.59 (255.6)	.010	0.32
Immersive methodologies index	6.32 (1.89)	6.81 (1.93)	2.07 (255.9)	.040	0.26
Peer tutoring (territory)	6.45 (2.21)	7.64 (1.98)	4.50 (246.6)	< .001	0.57
Outdoor education (territory)	7.23 (2.33)	7.78 (2.00)	2.01 (246.1)	.045	0.25
Gamification (territory)	6.46 (2.06)	6.88 (2.21)	1.59 (252.1)	.114	0.20

Table 3. Evaluation of methodologies across the assessments

The importance attributed to debriefing following an educational activity is very high and remains consistent between the pre- and post-intervention assessments ($M = 9.02$ vs 9.00; $t(257.0) = -0.15$, $p = .880$). This suggests that an emphasis on

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reflection was already present among the course participants at the beginning of the program.

Qualitative analysis categorized 71.8% of the text segments (387 out of 539) into three classes: inclusive activities and the local context; AI as a support for critical use; and the risks associated with delegating tasks to AI (Figure 3). The first and largest class (47.0%) which is distinct from the other two—consists primarily of responses to the question regarding inclusive activities (χ^2 = 375.1). The most frequently recurring terms include "local context", "enhance/valorize," "accessible," "inclusive," and "engage," with no differences observed between the pre- and post-intervention assessments. The remaining two classes are closely related, both addressing the interplay between AI, creativity, and autonomy, albeit from different perspectives. Class 3 (27.9%), which is significantly associated with the pre-test (χ^2 = 10.68, p = .001), frames AI as a potential risk. This is evidenced by terms such as "entrust," "limit," "creativity," "autonomy," "decision-making," "trust," and "laziness"all of which reflect a fear of delegating one's own thinking to a machine. Class 2 (25.1%), which is primarily linked to the question concerning concerns or fears (χ^2 = 95.6), describes the conditions necessary for the conscious and informed use of AI. For the course participants, AI appears to be a tool to be used critically, with the understanding that responses require further refinement and that the final selection rests with the instructor. Its association with the post-test does not reach the threshold of statistical significance (χ^2 = 3.63, p = .057).

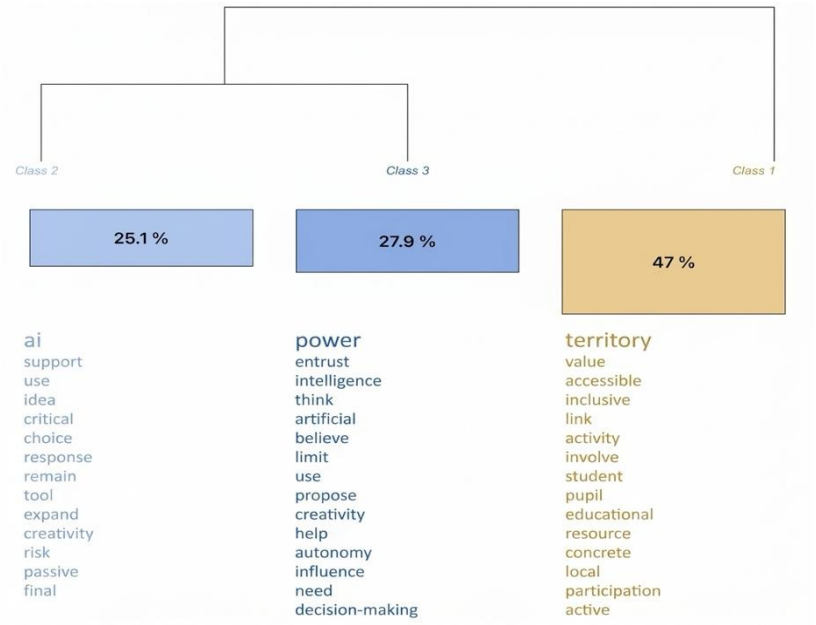


Fig. 3: Descending hierarchical classification (Reinert method) of open-ended responses (pre-test and post-test corpus; 387 segments classified out of 539).

The analysis of specificities confirms this shift. In the pre-test, responses are characterized by personal argumentation (e.g., why, to think, in my opinion, thought). In the post-test, terms related to educational practice (e.g., concrete, pupil, child, class, real, inclusive) and terms defining the role of the tool (e.g., tool, support, role) become prominent. The most characteristic word in the post-test is as

(specificity = 5.50), frequently used to assign a role to AI. Specifically, AI is primarily viewed as a tool and a form of support explicitly contrasted with the notion of it acting as a replacement (as support, not as a substitute). The conceptualization of AI as an interlocutor (a critical partner, collaborator, or consultant) appears in only a few responses.

4. Discussion

The results highlight, in particular, a shift in three aspects of perceived professional reflexivity. Regarding RQ1, by the end of the program, participants attributed a greater role to AI as a support for inclusive design specifically as a tool for reflecting on accessibility and critically analyzing one's own design work. Alongside the ideation phase which remains the most frequently cited application AI is increasingly associated with accessibility and personalization. The perception of a potential risk to autonomy remains stable: participants acknowledge the tool's utility while continuing to emphasize the importance of a critical approach. Regarding RQ2, the most significant finding concerns the ability to recognize the limitations of one's own design a fundamental trait in reflective practice (Machost & Stains, 2023). This shift is accompanied by a greater appreciation for peer tutoring and collaborative methodologies, aligning with a concept of inclusion rooted in participation and peer cooperation (CAST, 2024). Furthermore, in the post-test, those who view AI as a support for inclusion also recognize the importance of these collaborative methods. The consistently high value placed on debriefing suggests a predisposition toward reflection that was already present at the start of the workshop.

Regarding RQ3, the way participants articulate their relationship with the tool has evolved. The fear of delegating one's own thinking to AI has diminished; textual analysis reveals a transition from a discourse centered on risk prevalent in the pre-test to one focused on critical use, as evidenced in the post-test. The prevailing perspective is that AI serves as a support tool rather than a replacement for the educator. This study has certain limitations, primarily stemming from the anonymity of the questionnaire, which necessitated treating the data as independent samples and prevented the tracking of individual participants. The quality of the designs produced was not directly evaluated.

5. Conclusions

The research findings suggest that initial teacher education programs can serve as a strategic lever for critically guiding the digital transition of educational systems. Such training appears to help move beyond a purely instrumental view of Artificial Intelligence, fostering a more conscious, critical, and pedagogically intentional use of algorithmic technologies among future teachers (Fornasari, 2023). Furthermore, it is essential to support these training processes with pedagogical models that are reflective, laboratory-based, and grounded in educational theory. By the end of the program, the terminology used by participants increasingly characterizes AI as a support tool one that leaves the responsibility for decision-making in the hands of the teacher. In this sense, AI can facilitate professional reflection (Raviolo, 2025), enabling teachers to identify barriers to accessibility and to redesign learning environments in alignment with the principles of Universal Design for Learning (UDL). These insights highlight the value of Artificial Intelligence, not only for its

capacity to automate content creation but also for its potential to support professional reflexivity and foster more inclusive and accessible teaching practices. Future research could further examine these findings through paired assessments and a direct analysis of the instructional designs developed by participants.

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