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The Innovative Teaching Mindset in an Era of Digital Evolution: A Longitudinal Study of Teacher Perceptions and the Rise of AI

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Abstract

This paper presents a longitudinal empirical study conducted between 2022 and 2025, examining the evolution of innovative teaching mindset among a cohort of 494 secondary school teachers. Against the backdrop of rapid digital transformation in education, this research tracks teachers' core pedagogical values, their perceptions of the characteristics of an innovative educator, and their professional development aspirations. The study's unique contribution lies in its four-year perspective, which culminates in capturing teachers' initial perceptions and attitudes towards Artificial Intelligence (AI) following its mainstream emergence. The quantitative data, collected via repeated cross-sectional surveys, reveals a stable and deeply ingrained commitment to student-centred learning principles, such as student empowerment and empathetic relationships, which consistently take precedence over teacher-centric or technology-centric priorities. The findings from 2025 indicate that while a minority of teachers express apprehension, the predominant attitude towards AI is one of "cautious openness," with a majority viewing it as an "opportunity." This paper argues that a pre-existing, robust innovative mindset-characterized by values like creativity, reflection, and problem-finding-is a significant predictor of this nuanced and reflective stance towards new technology. The study concludes that teachers are not embracing AI for its novelty, but are cautiously evaluating its potential as a tool to more effectively implement the student-centred pedagogy they already hold as a core professional value. These findings have significant implications for designing effective Professional Development (PD), suggesting that fostering a resilient and reflective pedagogical mindset is a more sustainable strategy for navigating technological change than focusing on technical skills alone.

Keywords: *Innovative Mindset, Edtech, AI Teaching, Innovative Education, Education Survey*

1. Introduction

The 21st-century educational environment is characterized by continuous change and uncertainty, largely driven by technological advancements and shifting societal expectations. Teachers are increasingly asked not only to adopt new tools but also to redefine their roles as facilitators, guides, and co-learners.
This requires cultivating an innovative mindset that transcends the acquisition of discrete technical skills and instead emphasizes adaptability, resilience, and a deep commitment to student growth.
Such a mindset aligns with Dweck's theory of growth mindset [1], where challenges are reframed as opportunities for improvement. Within educational contexts, this belief extends beyond student potential and applies to teachers' professional growth, allowing them to embrace technological and pedagogical disruptions with reflective openness.

1.1 The Innovative Mindset

A robust innovative mindset incorporating growth-oriented pedagogical beliefs is essential for effective educational innovation, as George Couros mentions in his book about the Innovator's mindset [3]. An innovative mindset is dynamic rather than fixed. It involves creativity, empathy, problem-finding, risk-taking, and a commitment to reflection. This mindset promotes student-centred learning and guides the appropriate and impactful integration of technologies like Artificial Intelligence [6,7,8]. Recent findings indicate that teachers predominantly adopt a cautious yet open approach toward AI integration, aligning with frameworks like DigCompEdu [5] and guidelines provided by UNESCO [6,7]. Such findings emphasize the importance of creativity, reflection, problem-solving, and critical pedagogical practices. It's important to distinguish this from a mere "technology mindset". While

comfort with technology is part of innovation, the underlying pedagogy is what determines how technology is used. Studies [4] show that teachers' core beliefs—particularly whether they adopt student-centred or teacher-centred approaches—largely shape their use of digital tools. A teacher with a fixed mindset might use technology to reinforce traditional lecture methods, while one with a growth-oriented, student-centred mindset uses it to foster collaboration, critical thinking, and student agency. Ultimately, it is the innovative mindset that drives meaningful and effective technology integration in education.

Innovation requires courage to experiment, resilience in facing setbacks, and curiosity in exploring new methods. These qualities are increasingly crucial in the digital age, where disruptive technologies like artificial intelligence can simultaneously inspire opportunities and raise ethical dilemmas.

1.2 The Trajectory of Digital Education: from Integration to Transformation

Digital technology in education has progressed from supporting efficiency to fundamentally reshaping the learning process. Early integration focused on digitizing resources and improving access through tools like computers, calculators, and Learning Management Systems (LMS), all of which largely reinforced traditional teaching models. The emergence of Web 2.0 technologies—such as social media and collaborative platforms—ushered in more interactive, student-centred learning, blurring boundaries between formal and informal education. Today, the rise of Artificial Intelligence (AI) marks a paradigm shift. Unlike earlier tools that assisted teachers, AI introduces a non-human agent capable of generating customized content, offering real-time feedback, adapting learning paths, and automating assessments. Moreover, the advent of Agentic AI is bringing Artificial Intelligence to the next level, where non-human multi-agents can collaborate effectively to orchestrate complex tasks, presenting new opportunities and potential impacts for educational environments [10]. Combined with VR and AR, AI is transforming classrooms into immersive, data-driven, and highly personalized environments. This evolution towards more interactive and conversational forms of AI-driven learning aligns with recent theoretical advancements that describe conversational hyperconvergence as a key dimension of AI's transformative potential [9]. This shift presents educators with challenges that go beyond technical adaptation. While past tools required new skills or workflow changes, AI challenges the essence of teaching itself—raising questions about the teacher's role, professional identity, and ethical responsibility in a more automated landscape. Teachers' responses to this shift are shaped not only by the technology but by its broader implications for their practice and authority.

2. Methodology and Cohort Profile

This research adopts a longitudinal survey-based methodology spanning four years (2022–2025). Surveys were deployed during professional development workshops, ensuring anonymity while fostering honest reflection.

The sample included 494 secondary school teachers from diverse disciplines, including humanities, languages, STEM (Science, Technology, Engineering, and Mathematics), special needs education and varying levels of experience. This methodological design provided a robust base for tracing evolving perceptions, particularly as AI entered mainstream discourse by 2025.

2.1 Survey Design

The survey, conducted over four years, was designed to measure educators' innovative teaching mindsets. While a core set of questions was used for longitudinal analysis, new questions were added in 2025 to gauge perceptions of artificial intelligence (AI).

The recurring variables measured included: pedagogical priorities - what educators considered central to the learning process -, perceptions of innovation - the importance of specific traits for an innovative teacher -, aspirational goals - the teaching skills educators wanted to improve - and self-reflection - how educators viewed their own classrooms from a student's perspective -.

In 2025, the survey was expanded with new questions to specifically assess the perceived role and attitude of educators toward AI. All survey items were professionally translated from Italian to English to ensure consistency for this international study.

2.2 Sample Characteristics

Teachers with 1–2 years of experience accounted for 10% of respondents, 3–5 years for 15%, 6–10 years for 30%, 11–15 years for 20%, and over 16 years for 25%. As shown in figure 1, this distribution ensures that the findings are not skewed by a single experience group, incorporating the views of both early-career teachers, who may be more digitally native, and veteran educators, whose perspectives are shaped by decades of pedagogical practice and previous waves of reform.

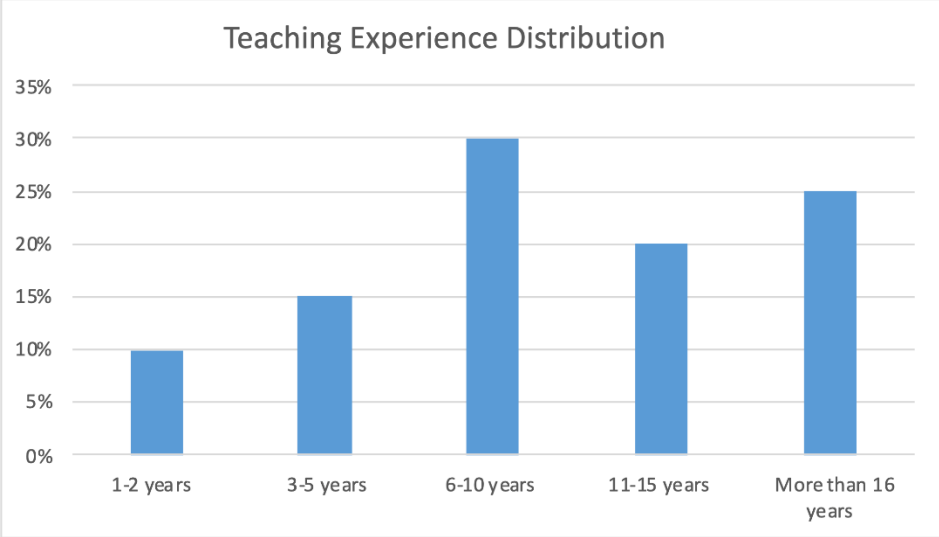

Fig. 1: Teaching Experience Distribution

3. Findings and Analysis

3.1 Student-Centered Priorities

Across all four years, respondents consistently placed students at the centre of the educational process. Items such as 'student empowerment,' 'empathetic relationships,' and 'learning aligned with passions' were rated significantly higher than teacher-centric values or frontal instruction.
Traditional practices consistently received lower scores, highlighting a progressive detachment from teacher-dominated approaches. Even when technology was mentioned, it was viewed as a supportive tool rather than the core of teaching practice.
Data in Table 1 represents mean scores on a 25-point Likert scale (5=Strongly Disagree, 25=Strongly Agree).

Educational Value	2022	2023	2024	2025
Empowerment of the student	23.5	20.5	22.0	22.0
Empathetic relationship teacher/student	22.5	23.0	21.5	22.0
Learning path focusing on student passions	21.5	22.0	24.0	20.0
The student	20.1	20.5	21.0	22.5
Teacher's & student's tech skills	13.5	15.0	13.0	14.5
The teacher	16.5	14.0	12.0	14.5
Frontal lesson	12.0	11.0	12.0	15.5

Table 1: Longitudinal Trends in Core Educational Values (2022-2025)

3.2 Innovator Traits and Aspirations

As shown in figure 2, when asked what makes an innovative educator, teachers consistently rated creativity, resilience, reflection, and problem-finding as highly important. Over time, aspirations shifted further toward developing creativity and networking with colleagues.

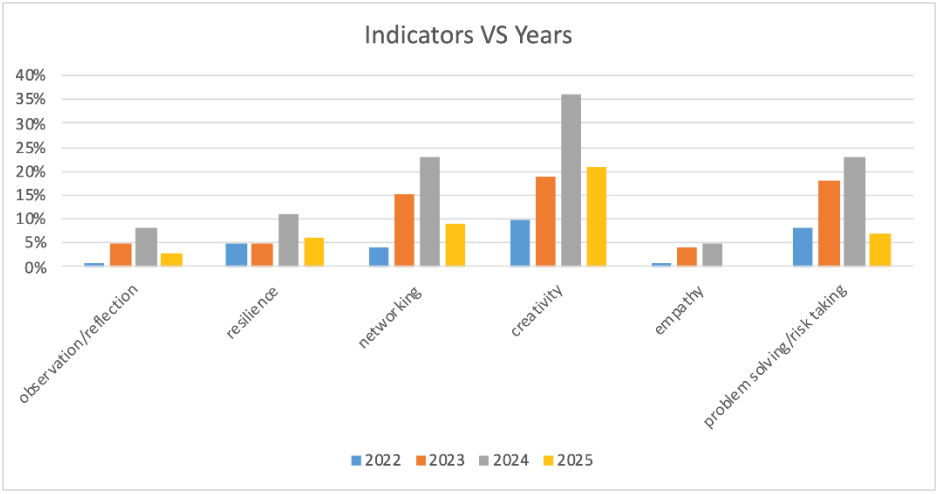

Fig. 2: Aspirational Characteristics Selected by Educators (2022–2025)

Further insight is revealed through the cumulative aspirational data, where teachers identified the single characteristic, they most wished to improve in their own practice. Out of 494 responses collected over multiple years, creativity emerged as the clear priority, selected by 35% of teachers. This was followed by problem solving/risk taking (23%) and networking (20%), indicating a strong desire among educators to enhance innovation-oriented and collaborative capacities. More inward-facing traits—such as resilience (11%), observation/reflection (7%), and empathy (4%)—were less frequently chosen. These results, shown in figure 3, suggest a collective drive toward developing active, future-focused competencies like creativity and risk-taking, rather than solely emotional or reflective skills. The pattern points to a teaching workforce increasingly motivated to adapt, invent, and lead within a rapidly evolving educational landscape. This persistent desire to enhance creativity reveals a perceived gap between the teachers' ideal of an innovative educator and their current daily practice, highlighting a key area for professional development

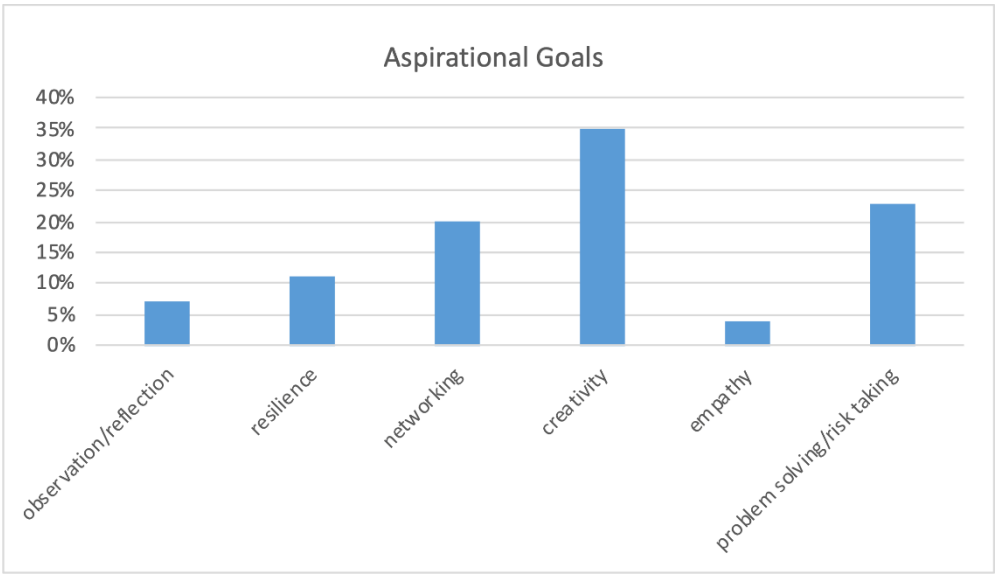

Fig. 3: Aspirational Goals: "What would you like to improve in your way of teaching?" (2025)

3.3 AI Perceptions in 2025

The 2025 survey included new questions to understand teachers' first reactions to the rise of generative AI in education which comes with concerns like errors, unreliable information, and security threats such as prompt injection [11, 15]. The results show a mix of hope, worry, and careful thought. When asked what AI means to them, most teachers answered positively. As shown in figure 4 and 5, more than 50% said it's" an opportunity." But many also expressed doubts or concerns—almost 30% don't know yet and 10% viewed it as "a threat". None dismissed AI as irrelevant, highlighting the perceived inevitability of its influence.

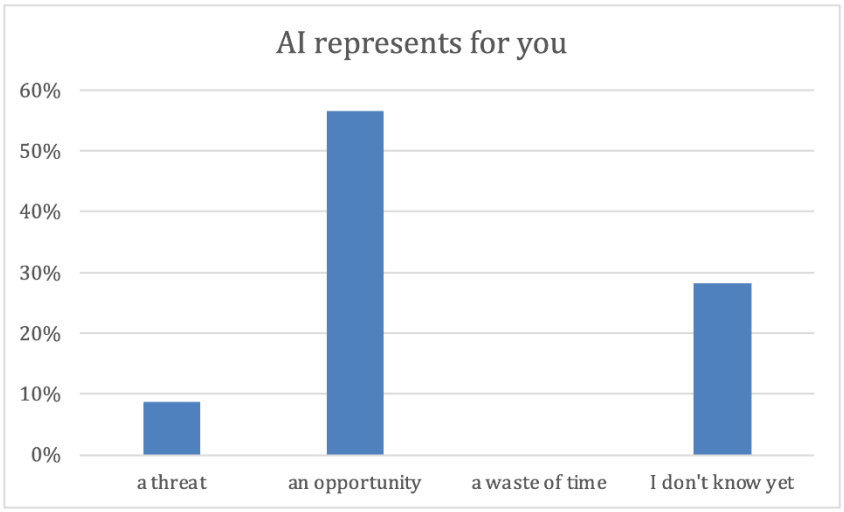

Fig.4: Teacher Perception of AI's Role in Education (2025)

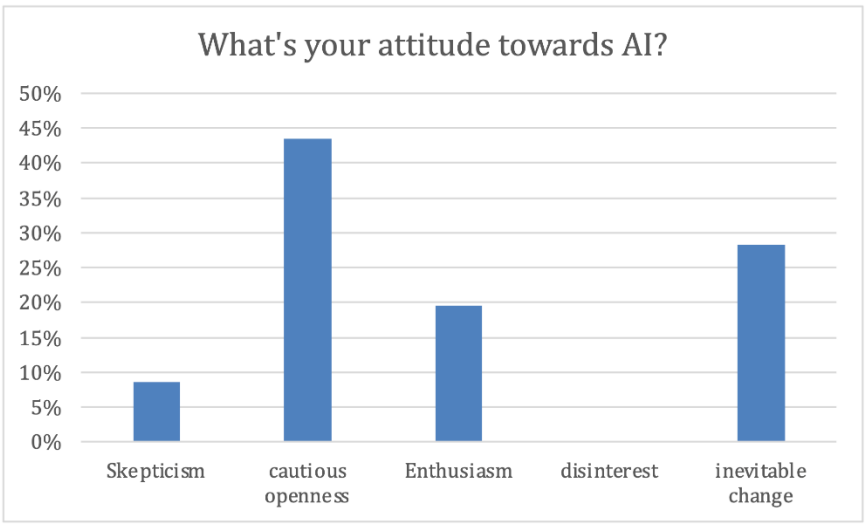

Fig. 5: Teacher Attitudes Towards AI Integration (2025)

4. Discussion

This four-year study shows a clear and lasting shift toward Student-Centred Learning (SCL) among these teachers. They consistently value student empowerment, empathy, and personalized learning, reflecting core SCL ideas like student agency and learning based on individual interests. However, there is a gap between their beliefs and daily practice. Many teachers admit their classrooms don't always meet their own high standards, likely due to challenges like strict curricula, testing pressure,

large classes, and limited resources. This creates a tension: teachers want student-focused teaching but work within systems still tied to older, teacher-centred methods. In this setting, new technologies like AI could either make things harder or help break through these barriers.

Rather than approaching digital technologies and artificial intelligence as threats to traditional education, it is more constructive to view them as catalysts for pedagogical innovation. As Gallese, Morriggi and Rivoltella argue [13], the digital should not be feared but understood through the lens of neuroscience and educational theory. They emphasize the importance of developing a "neuro-pedagogical" mindset that leverages the affordances of technology to support attention, empathy, and embodied cognition in the learning process. In this view, digital tools become opportunities to expand—not diminish—human presence in the educational relationship.

4.1 Innovative Mindset as a Predictor of AI Readiness

The presence of an innovative mindset—defined by creativity, reflection, resilience, and risk-taking—appears to predict a more balanced, cautious, and thoughtful engagement with AI.

Rather than being driven by the technology itself, teachers assess AI through the lens of how it supports or undermines their pedagogical mission. Their "cautious openness" reflects a thoughtful balance—they see AI as a chance to improve student-centred teaching but worry that bad use of AI could harm the human side of education. Their attitude is less about the tech itself and more about how well it supports their teaching mission. This shifts the conversation about AI in education. The question isn't how to get teachers to use AI, but how to develop AI tools that support the teaching values they already hold. Building a student-focused, innovative mindset is key to preparing teachers to use AI effectively.

4.2 Recommendation for Future Professional Development

This study offers clear recommendations for designing Professional Development (PD) that truly prepares teachers for digital changes, echoing Couros (2016) [3] on fostering an innovator's mindset. The key message is that PD should focus on pedagogy first—not technology. First, training should start with the teaching challenges AI can help solve, like personalization, creativity, and stronger student-teacher connections. Framing AI as a tool to reach these goals taps into teachers' real motivations. Second, PD must provide safe spaces for teachers to discuss the ethical and professional questions AI [11] raises—such as bias, privacy, and academic honesty. These concerns are real and should be addressed openly, following UNESCO's guidance [6,7]. Workshops should encourage critical thinking and help teachers decide when and how to use AI responsibly. Such workshops could be structured around established competency frameworks, such as UNESCO's AI Competency Framework for Teachers [14], to ensure that educators systematically develop the necessary skills and ethical understanding for effective AI integration. Third, PD should follow holistic frameworks like the European Commission's DigCompEdu [5], which focus less on technical skills and more on areas like professional engagement, teaching, assessment, and empowering learners. This approach keeps technology tied to good teaching. Ultimately, PD should aim to build a durable, innovative mindset—one that helps teachers adapt thoughtfully to AI and future technologies, maintaining both confidence and strong pedagogy. This aligns with Gallese, Moriggi and Rivoltella's (2024) perspective [13], which emphasizes that adopting a reflective and ethically grounded approach to digital technologies provides educators with an opportunity to reconfigure their role as critical guides in a digitally saturated environment

5. Conclusion

This four-year study tracked how a group of secondary school teachers developed an innovative, student-centred mindset during a time of rapid digital change. The findings show a strong, lasting focus on empowering students, building empathetic relationships, and personalizing learning—while traditional methods and technology are seen as tools, not the focus. The study's key insight is about teachers' early reactions to Artificial Intelligence. Rather than simply accepting or rejecting AI, most teachers show "cautious openness." This thoughtful attitude reflects their professional values of reflection, critical thinking, and problem-solving—traits they see as essential to innovation. The main argument is that teachers' readiness for AI depends on their existing mindset. They don't approach AI

with blind optimism but evaluate it based on how well it supports their student-centred goals. This shifts the challenge from convincing teachers to use technology to aligning AI with their teaching values. The way forward is clear: schools and policymakers should focus on nurturing teachers' innovative and reflective mindsets, supporting their role as thoughtful guides in the evolving digital landscape.

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