STIAEM

Slow Tech Innovation

AI, Ethics and New Teaching Methods

Key Competencies and Pedagogical Framework of the STIAEM Learning Ecosystem

Co-funded by the European Union

2025-1-IT02-KA220-SCH-000365213

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them... Project reference code: 2025-1-IT02-KA220-SCH-000365213

Università di Foggia
Studi Umanistici, Lettere, Beni Culturali, Scienze della Formazione

İSTANBUL - ESENLER
İLÇE MİLLÎ EĞİTİM MÜDÜRLÜĞÜ

1474

STIAEM

Slow Tech Innovation AI, Ethics and New Teaching Methods

Co-funded by the European Union

2025-1-IT02-KA220-SCH-000365213

eduOpen

CC BY-NC-SA 4.0 International

This license requires that reusers give credit to the creator. It allows reusers to distribute, remix, adapt, and build upon the material in any medium or format, for noncommercial purposes only. If others modify or adapt the material, they must license the modified material under identical terms.

Università di Foggia
Studi Umanistici, Lettere, Beni Culturali, Scienze della Formazione

OER 1.1.2: Key Competencies and Pedagogical Framework of the STIAEM Learning Ecosystem
Reference Module: Module 1 – Introduction to STIAEM and Pedagogical Framework
Related Video-Pill: Video 1.1 – Presentation of the STIAEM project
Authoring partner: University of Foggia – Italy
Topic / Thematic Focus: STIAEM learning ecosystem, key competencies and pedagogical framework

Introduction and Learning Objectives

The text integrates the critical matrix of Slow Tech (Patrignani & Whitehouse, 2014) with the principles of Universal Design for Learning (CAST, 2024) and with the operational ARTE model (Agency, Reflection, Transformation, Ethics), outlining a systemic vision of the teaching ecosystem and establishing a direct correspondence with the main European and international reference frameworks (Miao & Cukurova, 2024; Redecker, 2017). The pathway is organically calibrated on the European framework for the digital competences of educators (DigCompEdu; Redecker, 2017), with a specific connection to:

- Area 1: Professional Engagement (1.1, 1.2, 1.3, 1.4);
- Area 2: Digital Resources (2.1, 2.2, 2.3);
- Area 3: Teaching and Learning Practices (3.1, 3.2, 3.3, 3.4);
- Area 4: Assessment of Learning (4.1, 4.2, 4.3);

Area 5: Enhancing Learners' Potential (5.1, 5.2, 5.3).

The document also incorporates the dimensions of algorithmic literacy outlined by DigComp 3.0 (Cosgrove & Cachia, 2025), through the AI-Explicit and AI-Implicit descriptors, as well as the five pillars of the UNESCO AI Competency Framework for Teachers (Miao & Cukurova, 2024).

The Erasmus+ programme and its priorities for transnational cooperation constitute the institutional frame of reference for the STIAEM project (European Commission, 2025).

The Beijing Consensus on Artificial Intelligence and Education identifies the ethical and pedagogical integration of AI as a global priority for education systems (UNESCO, 2019).

The 2023 Global Education Monitoring Report analyses the role of technology in school systems and the conditions for its effective use (UNESCO, 2023).

By the end of this module, teachers will be able to:

Articulate the theoretical matrix of the STIAEM ecosystem, understanding how the Slow Tech paradigm and the ARTE model reconfigure the teacher's role within a triangular pedagogical relation (teacher-AI-student; Miao & Cukurova, 2024; Patrignani & Whitehouse, 2014).

Select, adapt and critically evaluate artificial intelligence tools for teaching, linking them to the DigCompEdu competence areas (Redecker, 2017) and to the learning descriptors of DigComp 3.0 (Cosgrove & Cachia, 2025).

Design classroom pathways according to the principles of Universal Design for Learning (CAST, 2024), employing AI as accessible and inclusive cognitive scaffolding to break down barriers to learning and to enhance the individual variability of students.
Preserve ethical oversight, decision-making autonomy and professional responsibility (human-in-the-loop approach), averting the risk of passive cognitive disengagement and the standardisation of assessment processes (European Commission, 2022; Smits et al., 2026).

1. The Epistemological Challenge: Redefining Educator Competence in the Algorithmic Age

The pervasiveness of generative artificial intelligence systems in secondary schools marks an epistemological rupture with respect to the previous phases of educational digital transformation (European Commission, 2020; Miao & Cukurova, 2024). Where traditional computer devices operated mainly as transmissive tools or instruments of deterministic executive automation, models based on transformer architectures and deep learning act as probabilistic engines capable of processing texts, synthesising concepts and generating complex symbolic solutions (Cosgrove & Cachia, 2025). This transformation reconfigures the classic binary teaching relation between teacher and pupil, inaugurating a triadic dynamic mediated by the artificial agent (Miao & Cukurova, 2024). In such a scenario, a concrete risk emerges: that a misplaced trust in the supposed objectivity of the machine may generate widespread phenomena of cognitive disengagement (cognitive offloading), both among students, inclined to delegate the processes of formulating critical thought, and among teachers, exposed to a progressive bureaucratisation and standardisation of teaching and assessment formats (Crompton et al., 2026; Smits et al., 2026).
To govern this transition, the response of the school community cannot be limited to the acquisition of extemporaneous operational skills or to the decontextualised transposition of general-purpose language models, pre-trained on a large scale without a specific educational intentionality and often perceived through a naive anthropomorphisation of the machine's responses (European Commission, 2022; Miao & Cukurova, 2024). It is indispensable to redefine the very construct of teachers' professional competence, anchoring it to principles of professional responsibility, awareness of the structural limits of models (such as hallucinations, computational opacity and the reproduction of stereotypes stratified in training datasets) and safeguarding of the authentic educational relationship (Cosgrove & Cachia, 2025; Miao & Cukurova, 2024). Having recognised the profile of the teacher as a designer of learning, today's urgency requires a refined capacity to hybridise algorithmic devices within the concrete classroom ecology. As highlighted by recent investigations into teachers' perceptions of AI, the real challenge lies neither in fideistic adherence nor in a priori rejection, but in the construction of a hybrid educational relationship founded on complementarity and not on the replacement of the human factor (Vinci & Berardi, 2025). This implies a flexible and situated orchestration of the hybrid interaction (teacher-student-AI), where pedagogical judgement establishes moment by moment when technological integration amplifies conceptual discovery and inclusion according to the UDL guidelines, and when, instead, the pondered choice of reflective disconnection (AI-off) protects cognitive effort and the authentic educational relationship (Patrignani & Whitehouse, 2014; Smits et al., 2026; Vinci & Berardi, 2025).

2. The STIAEM Pedagogical Architecture: Socio-Constructivism, UDL, and the Slow Tech Matrix

The pedagogical architecture developed by the STIAEM consortium responds to this challenge by founding its proposal on the synergistic convergence of three theoretical-methodological pillars: the socio-constructivist matrix, the framework of Universal Design for Learning (CAST, 2024) and the Slow Tech paradigm (Patrignani & Whitehouse, 2014).

From the constructivist point of view, learning is understood as a social process of co-construction of meanings, in which the computational tool does not replace the learner's mind but operates as a limited heuristic scaffold (bounded scaffolding), situated within the zone of proximal development (Miao & Cukurova, 2024). The machine does not generate valid knowledge autonomously: it offers provisional symbolic configurations that require the dialogic mediation of the teacher and the critical deconstruction of the peer group (Smits et al., 2026).

This scaffolding acquires a markedly inclusive vocation through the systematic adoption of the principles of Universal Design for Learning (CAST, 2024). The heterogeneity of learners is not conceived as a managerial obstacle, but as a biological and cultural constant to be enhanced through multiple forms of engagement, representation and expression (CAST, 2024; Redecker, 2017). Artificial intelligence, if guided by an accessible pedagogical intentionality, becomes a powerful multimodal converter: it makes it possible to translate an academic text into concept diagrams to support visual cognitive styles, to calibrate lexical complexity without impoverishing the rigour of the content, and to structure graduated assignments for pupils with special educational needs or specific learning disorders, breaking down the barriers of access to knowledge (CAST, 2024; Cosgrove & Cachia, 2025).

Finally, the Slow Tech paradigm acts as the regulatory horizon of the entire ecosystem (Patrignani & Whitehouse, 2014). Rejecting the imperative of digital acceleration and of efficiency for its own sake, this approach promotes a deliberate and unhurried management of cognitive times, oriented towards human and ecological sustainability. Technology is thus subordinated to reflective depth, to awareness of the environmental impact of computational infrastructures and to a constant safeguard against socio-technical inequalities in access to and use of algorithmic tools (Cosgrove & Cachia, 2025; Patrignani & Whitehouse, 2014). The STIAEM ecosystem thus formalises a space of intellectual and ethical sustainability, in which operational slowness becomes synonymous with analytical depth and a reflective posture, enhancing that practical and situated knowledge of the teacher which arises from the constant interrogation of one's own teaching action (Perla & Vinci, 2021; Smits et al., 2026).

3. The ARTE Model: Operationalizing Teacher and Learner Progression

In order to translate the principles of Slow Tech (Patrignani & Whitehouse, 2014) and of universal inclusion (CAST, 2024) into observable teaching indicators, the STIAEM consortium has structured the ARTE pedagogical model, articulated in four interdependent dimensions: Agency, Reflection, Transformation and Ethics.

The first dimension, Agency, places at the centre the decision-making autonomy of the teacher and of the student (Natarajan et al., 2025). It establishes the inalienable principle of human oversight (Memarian & Doleck, 2024; Mosqueira-Rey et al., 2023), laying down that

no algorithm may substitute for pedagogical judgement, authentic assessment and the design of the educational pathway (Vinci et al., 2026). The student's agency is safeguarded by preventing AI from replacing personal elaboration: the learner maintains active control over their own study objectives, formulating questions, guiding the interaction and taking responsibility for the results obtained (Miao & Cukurova, 2024; Vinci & Berardi, 2025).

The second dimension, Reflection, promotes the posture of systematic doubt and metacognitive sedimentation (Cosgrove & Cachia, 2025; Redecker, 2017). Interaction with AI is structured so that the system's errors, incompletenesses or hallucinations are transformed into genuine pedagogical triggers for fact-checking and the critical analysis of sources (European Commission, 2022). This dimension values the introduction of reflective pauses and non-mediated sessions (AI-off), during which students reorganise their ideas, discuss in a circle and internalise concepts away from the distractions of the hyperconnected environment, feeding that process of becoming aware of one's own knowledge which is proper to the reflective posture (Patrignani & Whitehouse, 2014; Perla & Vinci, 2021).

The third dimension, Transformation, concerns the spatiotemporal organisation of the classroom and the nature of teaching assignments (Crompton et al., 2026). The model promotes the shift from transmissive frontal teaching to active methodologies and flipped learning (Redecker, 2017). AI can support the preparatory phases of home exploration or initial synthesis, freeing up classroom time for authentic tasks, field investigation activities, argumentative debates and the resolution of real problems anchored to the local context, where the standardised answers of the machine prove structurally insufficient (Miao & Cukurova, 2024).

The fourth dimension, Ethics, permeates the whole educational action with constant civic and professional vigilance (European Parliament, 2024; Miao & Cukurova, 2024). It comprises the identification and deconstruction of historical, cultural and gender bias rooted in algorithmic corpora, the scrupulous observance of the European data protection regulation (GDPR) and of the AI Act to protect the identity and rights of minors, as well as the development of an ecological responsibility aimed at minimising the computational footprint and the energy consumption of large-scale systems (Cosgrove & Cachia, 2025; European Commission, 2022).

4. Competence Mapping across European Benchmarks (DigCompEdu, DigComp 3.0 & UNESCO AI CFT)

The STIAEM pedagogical matrix connects with the main European and international institutional frameworks, guaranteeing the transferability and transparency of the competences acquired by teachers. The centre of gravity of this alignment is constituted by the European DigCompEdu framework (Redecker, 2017), whose six-area taxonomy is traversed in a transversal and synergistic way. Specifically, the dimension of professional engagement finds space in the model's capacity to feed organisational communication, collegial collaboration within transnational networks, a constant reflective posture and continuous training throughout the teacher's career. At the same time, the governance of digital resources is oriented towards the critical selection of reliable applications, the co-design and modification of open materials and the ethical administration of data in full respect of usage licences.

On the side of classroom teaching practices, the STIAEM architecture supports the planning of methodologically innovative interventions, the provision of personalised and timely tutoring, the promotion of collaborative contexts and the development of pupils' self-regulation of study. This approach is closely in dialogue with the diversification of formative assessment strategies, which values the critical interpretation of digital evidence and the use of authentic feedback oriented towards continuous improvement (Vinci & Berardi, 2025). The inclusive vocation of the pathway finds its fulfilment in enhancing the potential of learners, translating into unconditional accessibility of content for students with disabilities or specific learning disorders, the differentiation of cognitive rhythms and the active engagement of individual creativity (CAST, 2024; Redecker, 2017). Finally, the educational action aims at the development of the students' own digital competences, guiding them towards solid information literacy, civil communication, the original production of content, security awareness and the heuristic resolution of complex problems (Redecker, 2017).

Alongside this solid structure stands the recent DigComp 3.0 framework issued by the Joint Research Centre (Cosgrove & Cachia, 2025), which introduces a transversal reading of the impact of artificial intelligence by distinguishing between AI-Explicit descriptors, focused on the explicit understanding of algorithmic systems, training logics and hallucinations, and AI-Implicit descriptors, in which automatic computation intervenes as an integrated component in processes of research, processing and networked cooperation. The articulation of DigComp 3.0 across four progressive levels of proficiency (Basic, Intermediate, Advanced, Highly Advanced) also makes it possible to outline rigorously the teacher's growth trajectory, accompanying their evolution from guided operational use to an autonomous capacity for leadership and system innovation (Cosgrove & Cachia, 2025).

The overall framing finally converges on the guidelines of the UNESCO AI Competency Framework for Teachers (Miao & Cukurova, 2024), which structures educational action around five fundamental dimensions: the development of a Human-centred Mindset, the constant safeguarding of algorithmic ethics (Ethics of AI), mastery of computational foundations (AI Foundations and Applications), methodological integration (AI Pedagogy) and the conscious use of intelligent tools for continuous professional development (AI for Professional Development). This scientific and institutional convergence ensures that the teacher trained within the STIAEM ecosystem internalises an organic, solid standard of competences fully usable in the context of European educational cooperation (Miao & Cukurova, 2024; Redecker, 2017).

5. From Framework to Action: The Iterative Ecosystem for School Transition

The declination of the pedagogical model is not conceived as an abstract theoretical construction, but finds concrete application within the work plan of the STIAEM consortium through the iterative PDCA (Plan-Do-Check-Act). Once the preliminary empirical mapping (Plan) conducted in the five partner countries (Italy, Spain, Greece, Turkey and Lithuania) is completed, the phase of didactic operationalisation (Do) takes shape through the delivery of the certified MOOC on the EduOpen platform and the progressive publication of the 36 Open Educational Resources.

The participating teachers directly experience the coherence of the model within the digital learning environment, where the sequential barrier architecture (gating), the integration of formative micro-tests with a pass threshold of eighty per cent and the presence of immediate feedback translate into practice the logics of self-regulation of study and continuous monitoring (Redecker, 2017). The materials and competences acquired in the online pathway constitute the operational prerequisite for the start of the subsequent phase of pilot experimentation in secondary classes (Check). In this phase, teachers apply the teaching plans designed within their own subject, verifying the inclusive effectiveness of the UDL strategies (CAST, 2024) and the impact of the ARTE model on the levels of attention and creativity of the pupils (Smits et al., 2026). The systematic collection of field evidence, the analysis of the critical issues that emerged and the collegial validation during the transnational mobility will finally make it possible to consolidate stable recommendations and policy guidelines (Act; European Commission, 2020), intended for educational institutions and European decision-makers to accompany an authentically democratic, ethical and sustainable school digital transition (Crompton et al., 2026; Miao & Cukurova, 2024).

6. Conclusion

The formative architecture and the competence matrix outlined in the STIAEM ecosystem show how the challenge posed by artificial intelligence to secondary schools is not played out on the terrain of instrumental adaptation or technocratic catch-up, but on the capacity of the educating community to safeguard the pedagogical meaning and the ethical direction of teaching processes. The convergence between the unhurried posture of Slow Tech, the articulation of the ARTE model and the flexibility of Universal Design for Learning returns to the teacher a precise epistemological responsibility: that of orchestrating learning environments in which recourse to the algorithm does not degrade into uncritical automation or passive delegation, but sustains an authentically hybrid educational relationship, founded on the enhancement of the person and on the enhancement of differences.

The anchoring to international reference frameworks such as DigCompEdu, DigComp 3.0 and the UNESCO AI competency framework for teachers confers on this vision the necessary methodological solidity, transforming theoretical principles into documentable, rigorous and equitable classroom practices.

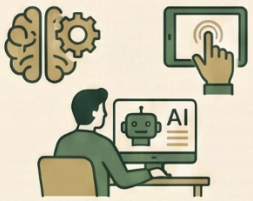
The appropriation of this paradigm nevertheless requires of the teacher a continuous exercise of self-observation and inquiry into their own classroom practice, capable of deconstructing habits and tacit beliefs in the midst of teaching action. On the level of professional autonomy and agency, it becomes a priority to ask which design and assessment junctures must remain the exclusive preserve of human decision, so that interaction with the artificial agent does not atrophy the epistemic curiosity and the capacity for autonomous judgement of the pupils. At the same time, in the horizon of universal accessibility outlined by UDL, it is necessary to critically examine how the multimodal modulation of disciplinary content mediated by AI can remove obstacles to learning without falling into a reductive cognitive simplification for students with special educational needs or specific learning disorders. Finally, the reflection interrogates the teacher's capacity to institute deliberate spaces of suspension of algorithmic computation (AI-off), restoring didactic legitimacy to the long times of personal elaboration, to reflective silence and to dialogic comparison within the peer group.

Visual Scaffolding

Matrice STIAEM: Navigare l'IA nella Scuola Secondaria

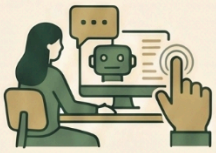
Illustrare la correlazione tra le dimensioni pedagogiche STIAEM (Modello ARTE/Slow Tech) e i quadri di riferimento internazionali per guidare i docenti nell'integrazione critica dell'IA.

Agency



Human-in-the-Loop

Il docente mantiene la supervisione etica e il giudizio pedagogico finale sull'output algoritmico.

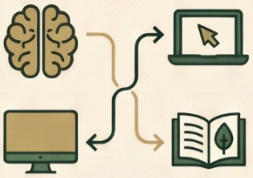


Reflection



Reflection e Momenti AI-off

Trasformare gli errori dell'IA in inneschi critici e alternare sessioni digitali a pause riflessive.



Transformation



Transformation e Compiti Autentici

Usare il Flipped Learning per dedicare il tempo d'aula ad attività non automatizzabili.



Ethics



Minimizzare i dati degli allievi, identificare bias e monitorare l'impatto ambientale computazionale.

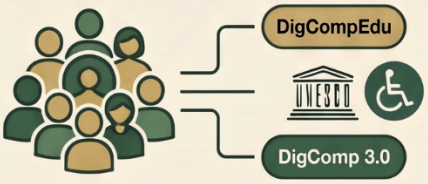
Ethics

Ethics: Privacy e Sostenibilità



Minimizzare i dati degli allievi, identificare bias e monitorare l'impatto ambientale computazionale.

UDL Integration & Standard



Integrazione UDL, Accessibilità e Standard Internazionali

Configurare prompt per generare mappe visive e testi semplificati per studenti con BES.

Allineamento sistematico per garantire competenze docenti organiche, etiche e pienamente spendibili in Europa.

Sintesi della correlazione framework internazionali

Dimensione STIAEM	Framework di Riferimento	Indicatore Operativo
Agency	**DigComp 3.0** (Advanced)	IA come supporto provvisorio; valutazione finale al docente
Ethics	**UNESCO AI CFT** (Deepen/Create)	Applicazione GDPR, non-discriminazione e sostenibilità verde
UDL Integration	**DigCompEdu** (Area 5.1/5.2)	Creazione di formati multimodali accessibili per disabilità o DSA

Gemini Notebook

Technical Metadata Sheet

Metadata Field	Specification / Parameter Value
Identifier	OER 1.1.2
Title	Key Competencies and Pedagogical Framework of the STIAEM Learning Ecosystem
Creator	University of Foggia - Italy
Description	The resource sets out the theoretical matrix of the STIAEM learning ecosystem, combining the Slow Tech paradigm, the ARTE model (Agency, Reflection, Transformation, Ethics) and the principles of Universal Design for Learning. It connects these frameworks to the DigCompEdu competence areas and to the AI-Explicit and AI-Implicit descriptors of DigComp 3.0, turning them into criteria for selecting and adapting AI tools. The pedagogical focus is on preserving teacher agency and ethical supervision while AI works as accessible cognitive scaffolding.
Keywords	learning ecosystem; pedagogical framework; Slow Tech; ARTE model; Universal Design for Learning; DigCompEdu; DigComp 3.0; teacher agency
Language	EN (English)
Affiliation	University of Foggia - Italy
Contributor	STIAEM Transnational Scientific Board (peer review, Rhodes validation protocol)
Media Format	Text; Infographics
Genre	Training Manual; Educational Guide
URL	
Citation	CAST. (2024). Universal Design for Learning Guidelines version 3.0. CAST. https://udlguidelines.cast.org/ Cosgrove, J., & Cachia, R. (2025). DigComp 3.0: European Digital Competence Framework - Fifth edition (Report No. EUR 40491, JRC144121). Publications Office of the European Union. https://doi.org/10.2760/0001149 Crompton, H., Burke, D., Bozkurt, A., & Miao, F. (2026). A framework for generative AI policy and guidelines in K-12 education. Journal of Research on Technology in Education, Article in press. https://doi.org/10.1080/15391523.2026.2661641 European Commission. (2020). Digital Education Action Plan 2021-2027: Resetting education and training for the digital age. Publications Office of the European Union. European Commission. (2022). Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for educators. Publications Office of the European Union. https://doi.org/10.2766/153756 European Parliament. (2024). Regulation (EU) 2024/1689 laying down harmonised rules on artificial intelligence (Artificial Intelligence Act). Official Journal of the European Union. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32024R1689 Memarian, B., & Doleck, T. (2024). Human-in-the-loop in artificial intelligence in education: A review and entity-relationship (ER) analysis. Computers in Human Behavior: Artificial Humans, 2(1), Article 100053. https://doi.org/10.1016/j.chbah.2024.100053 Miao, F., & Cukurova, M. (2024). AI competency framework for teachers. UNESCO Publishing. https://doi.org/10.54675/ZJTE2084 Mosqueira-Rey, E., Hernández-Pereira, E., Alonso-Ríos, D., Pérez-Sánchez, R. C., & Moret-Bonillo, V. (2023). Human-in-the-loop machine learning: A state of the art. Artificial Intelligence Review, 56(4), 3005–3054. https://doi.org/10.1007/s10462-022-10246-w Natarajan, S., Mathur, S., Sidheekh, S., Stammer, W., & Kersting, K. (2025). Human-in-the-loop or AI-in-the-loop? Automate or collaborate? Proceedings of

	the AAAI Conference on Artificial Intelligence, 39(28), 28594–28600. https://doi.org/10.1609/aaai.v39i27.35083 Patrignani, N., & Whitehouse, D. (2014). Slow tech: A quest for good, clean and fair ICT. Journal of Information, Communication and Ethics in Society, 12(2), 78–92. https://doi.org/10.1108/JICES-11-2013-0051 Perla, L., & Vinci, V. (2021). La formazione dell'insegnante attraverso la ricerca: Un modello interpretativo a partire dalla didattica dell'implicito. Annali online della Didattica e della Formazione Docente, 13(21), 38–67. https://doi.org/10.15160/2038-1034/2325 Redecker, C. (2017). European Framework for the Digital Competence of Educators: DigCompEdu (Y. Punie, Ed.). Publications Office of the European Union. https://doi.org/10.2760/159770 Smits, A., Valtonen, T., & Piispa-Hakala, S. (2026). Protecting teacher agency in times of strong technology push: Grounding decisions in Biesta's educational purposes. Computers and Education Open, 10, Article 100383. https://doi.org/10.1016/j.caeo.2026.100383 Vinci, V., Agrati, L. S., Berardi, P., & Beri, A. (2026). Artificial intelligence as a catalyst for transformative assessment: Designing teacher literacy at the crossroads of ethics, pedagogy, and human relationships. Frontiers in Education, 11, Article 1760626. https://doi.org/10.3389/feduc.2026.1760626 Vinci, V., & Berardi, P. (2025). Between enthusiasm and resistance: Perceptions of AI in teacher education. Giornale Italiano di Educazione alla Salute, Sport e Didattica Inclusiva, 9(2), Article 1430. https://doi.org/10.32043/gsd.v9i2.1430
Educational Level	Secondary School
Associated Module / MOOC Video Lesson	Module 1 - Project Introduction and Pedagogical Model / Video 1.1 - Presentation of the STIAEM project
Learning Objectives	Articulate the theoretical matrix of the STIAEM ecosystem, understanding how the Slow Tech paradigm and the ARTE model reconfigure the teacher's role within a triangular pedagogical relation. Select, adapt and critically evaluate artificial intelligence tools for teaching, linking them to the DigCompEdu competence areas (Redecker, 2017) and to the DigComp 3.0 learning descriptors. Design classroom pathways according to the principles of Universal Design for Learning (CAST, 2024), employing AI as accessible and inclusive cognitive scaffolding. Preserve ethical oversight, decision-making autonomy and professional responsibility (human-in-the-loop approach), averting passive cognitive disengagement and standardisation.
Rights	Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0)
Date Available	02/09/2026
Date Modified	

References

CAST. (2024). Universal Design for Learning Guidelines version 3.0. CAST. https://udlguidelines.cast.org/

Cosgrove, J., & Cachia, R. (2025). DigComp 3.0: European Digital Competence Framework - Fifth edition (Report No. EUR 40491, JRC144121). Publications Office of the European Union. https://doi.org/10.2760/0001149

Crompton, H., Burke, D., Bozkurt, A., & Miao, F. (2026). A framework for generative AI policy and guidelines in K-12 education. Journal of Research on Technology in Education, Article in press. https://doi.org/10.1080/15391523.2026.2661641

European Commission. (2020). Digital Education Action Plan 2021-2027: Resetting education and training for the digital age. Publications Office of the European Union.

European Commission. (2022). Ethical guidelines on the use of artificial intelligence (AI) and data in teaching and learning for educators. Publications Office of the European Union. https://doi.org/10.2766/153756

European Commission. (2025). Erasmus+ Programme Guide 2025 – Part A. Publications Office of the European Union. https://erasmus-plus.ec.europa.eu/programme-guide/part-a

European Parliament. (2024). Regulation (EU) 2024/1689 laying down harmonised rules on artificial intelligence (Artificial Intelligence Act). Official Journal of the European Union. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32024R1689
Memarian, B., & Doleck, T. (2024). Human-in-the-loop in artificial intelligence in education: A review and entity-relationship (ER) analysis. Computers in Human Behavior: Artificial Humans, 2(1), Article 100053. https://doi.org/10.1016/j.chbah.2024.100053
Miao, F., & Cukurova, M. (2024). AI competency framework for teachers. UNESCO Publishing. https://doi.org/10.54675/ZJTE2084
Mosqueira-Rey, E., Hernández-Pereira, E., Alonso-Ríos, D., Pérez-Sánchez, R. C., & Moret-Bonillo, V. (2023). Human-in-the-loop machine learning: A state of the art. Artificial Intelligence Review, 56(4), 3005–3054. https://doi.org/10.1007/s10462-022-10246-w
Natarajan, S., Mathur, S., Sidheekh, S., Stammer, W., & Kersting, K. (2025). Human-in-the-loop or AI-in-the-loop? Automate or collaborate? Proceedings of the AAAI Conference on Artificial Intelligence, 39(28), 28594–28600. https://doi.org/10.1609/aaai.v39i27.35083
Patrignani, N., & Whitehouse, D. (2014). Slow tech: A quest for good, clean and fair ICT. Journal of Information, Communication and Ethics in Society, 12(2), 78–92. https://doi.org/10.1108/JICES-11-2013-0051
Perla, L., & Vinci, V. (2021). La formazione dell'insegnante attraverso la ricerca: Un modello interpretativo a partire dalla didattica dell'implicito. Annali online della Didattica e della Formazione Docente, 13(21), 38–67. https://doi.org/10.15160/2038-1034/2325
Redecker, C. (2017). European Framework for the Digital Competence of Educators: DigCompEdu (Y. Punie, Ed.). Publications Office of the European Union. https://doi.org/10.2760/159770
Smits, A., Valtonen, T., & Piispa-Hakala, S. (2026). Protecting teacher agency in times of strong technology push: Grounding decisions in Biesta's educational purposes. Computers and Education Open, 10, Article 100383. https://doi.org/10.1016/j.caeo.2026.100383
Vinci, V., Agrati, L. S., Berardi, P., & Beri, A. (2026). Artificial intelligence as a catalyst for transformative assessment: Designing teacher literacy at the crossroads of ethics, pedagogy, and human relationships. Frontiers in Education, 11, Article 1760626. https://doi.org/10.3389/feduc.2026.1760626
Vinci, V., & Berardi, P. (2025). Between enthusiasm and resistance: Perceptions of AI in teacher education. Giornale Italiano di Educazione alla Salute, Sport e Didattica Inclusiva, 9(2), Article 1430. https://doi.org/10.32043/gsd.v9i2.1430
UNESCO. (2019). Beijing Consensus on Artificial Intelligence and Education. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000368303
UNESCO. (2023). Global Education Monitoring Report 2023: Technology in education – A tool on whose terms? UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000385723