

**Redesigning Curriculum
and Assessment for
CT and AI in K-12
mathematics**

**INSIGHTS FROM
THE ITALIAN
CONTEXT**

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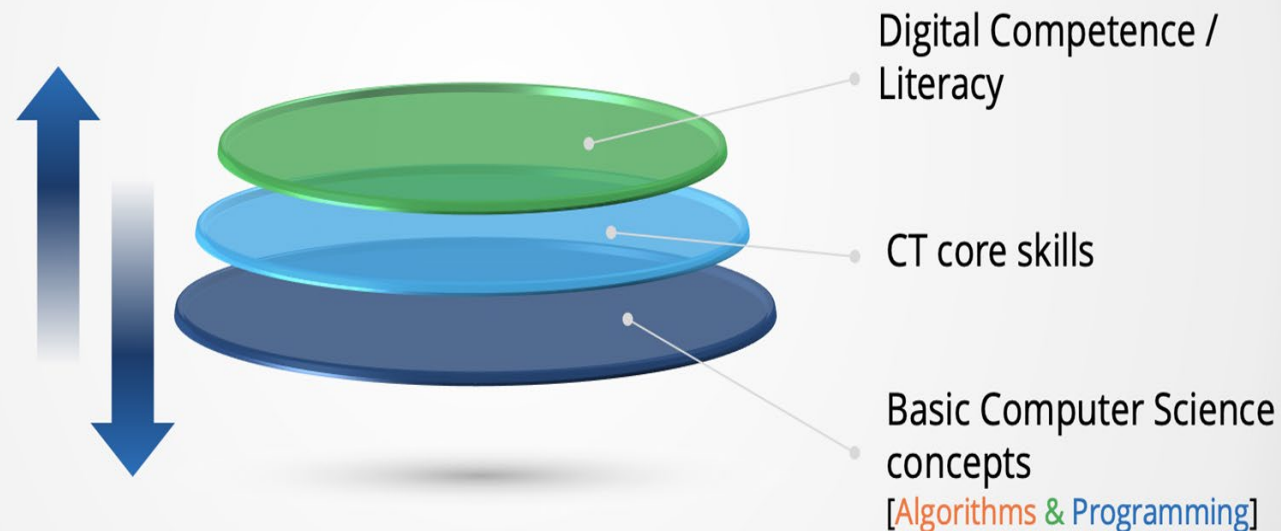
European Overview: Curriculum Integration of Computational Thinking (CT)

Policy positioning of CT in compulsory education

Across 22 Member States, CT is implemented through three main models: (i) as a *separate subject*, (ii) embedded within existing subjects such as *Maths or Technology*, or (iii) as a *cross-curricular theme*.

- **Primary** level (Grades 1-5): often **hybrid models** (cross-curricular + subject integration)
- **Lower secondary** (grades 6-8): predominantly as a **separate subject**


Core conceptual focus





Italy 2025: Curriculum framing of CT and Artificial Intelligence

- National Curriculum Guidelines (2025) distinguish between *digital competence* and CT/CS competences related to **algorithmic processes** and automated information treatment, signalling conceptual awareness of CT as structured reasoning.
- However, **AI integration** is still predominantly articulated as an **extension of digital competence** rather than as a reconfiguration of disciplinary structures within Mathematics. **Schools have the autonomy to introduce modules or activities that address topics related to AI** and digital literacy.
- In 2024, the Ministry launched a **two-year pilot introducing AI-based virtual assistants in 15 classes** (grades 8-12) across four regions to personalise learning in STEM and languages; INVALSI monitors outcomes before any potential nationwide rollout.
- In 2025, INVALSI launched a **national assessment of digital competences aligned with EU DigComp 2.2 framework (Grade 10)**. While this strengthens competency-based evaluation, CT and AI-related reasoning are not yet structurally integrated into national mathematics assessment.



Key Concepts of CT and AI in the 2025 Italian Curriculum

Primary School (Grades 1-5)

(Embedded in Mathematics, STEM, Digital Competence)

- **Data representation:** simple tables, graphs, pattern recognition
- **Algorithms & sequencing:** structured procedures and logical steps
- **Introductory coding:** visual programming experiences
- **Digital literacy:** guided search, online behaviour, misinformation awareness
- **AI awareness:** understanding automated systems; safe use of AI-based tools; basic data protection concepts

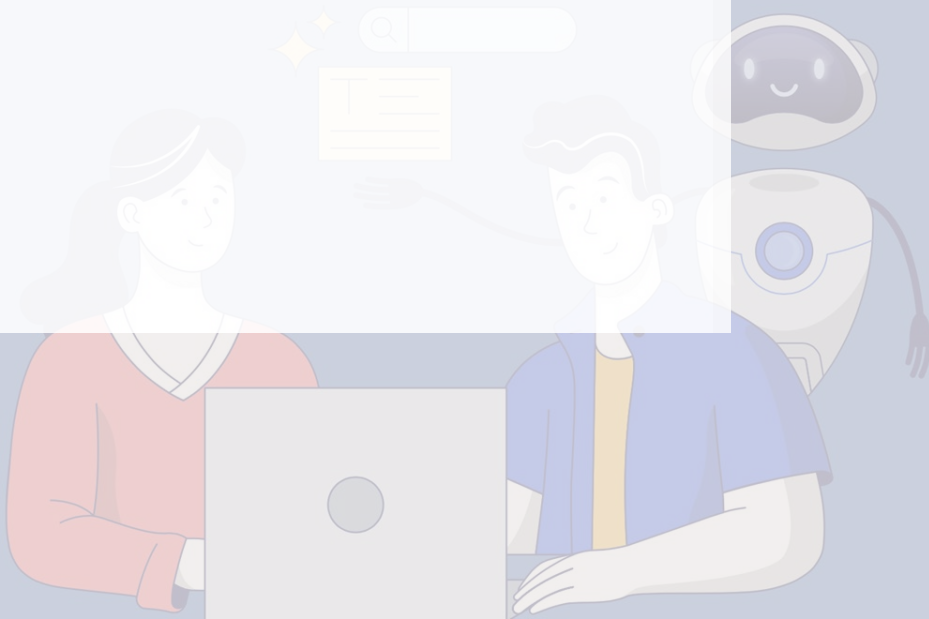
Lower Secondary School (Grades 6-8)

(Technology, integrated with Mathematics & STEM)

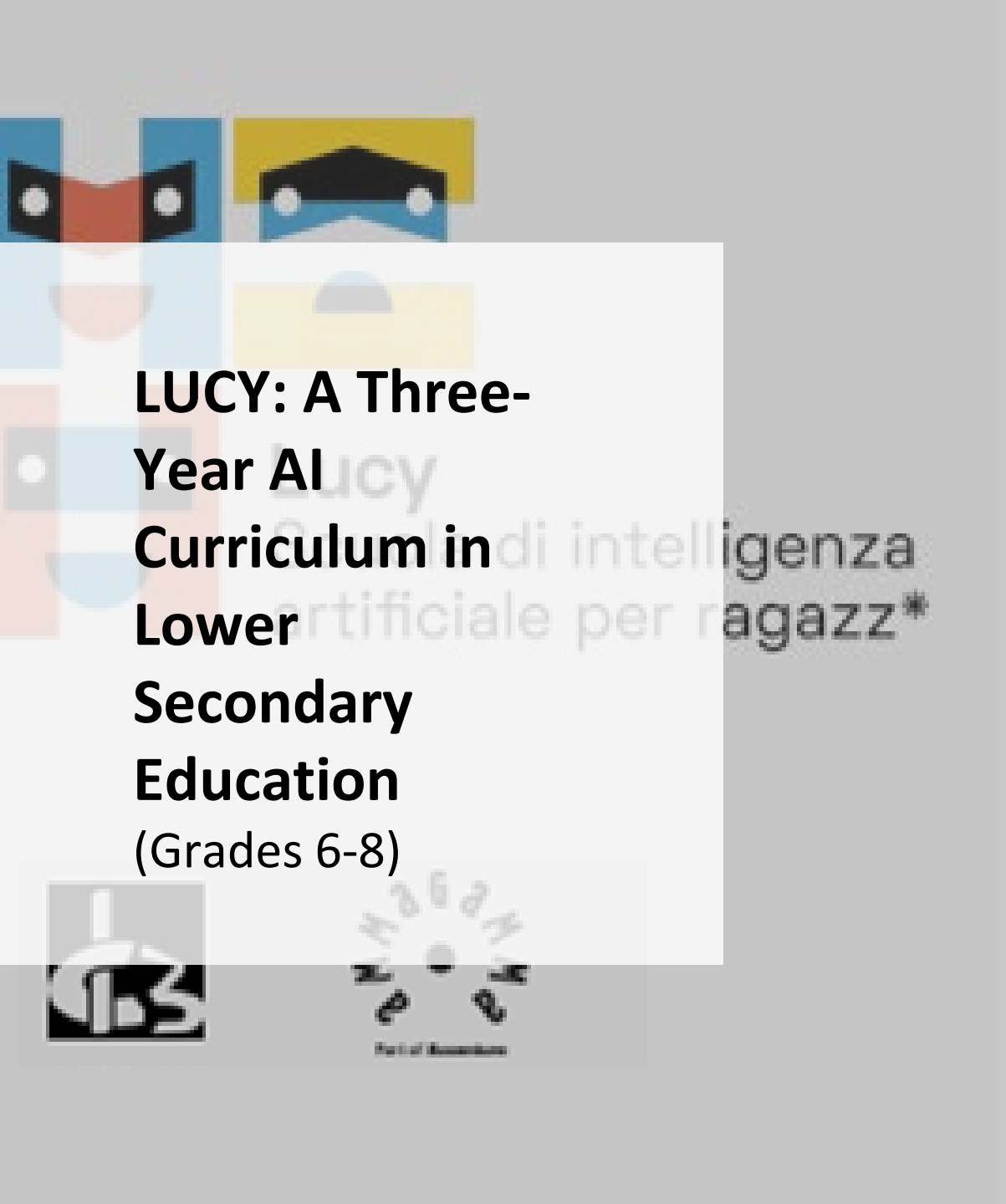
- **Algorithmic thinking:** formalisation of procedures; problem decomposition
- **Data analysis & evaluation:** critical assessment of digital information
- **Computational problem solving:** application of logical-scientific reasoning
- **Digital citizenship & cybersecurity:** privacy, platform responsibility, online risks
- **Foundations of AI:** automated data processing; distinction between digital and computational competences; ethical and societal implications of AI.

Guidelines for the introduction of Artificial Intelligence in schools

AI in School Policy – Italy



- In 2025, Italy has adopted **National Guidelines for the introduction of AI in schools**, positioning AI within a coordinated policy framework. It provides a structured system for ethical, technical, and regulatory compliance.
- The framework is grounded in an **anthropocentric vision**, safeguarding the centrality of the human person and the educational relationship.
- Under the European AI Act framework, **AI systems used to assess learning outcomes are classified as high-risk applications**, requiring human oversight and enhanced transparency, safeguards, and protection of fundamental rights.
- **Direct responsibility is on individual schools**, requested to adopt EU HUDERIA approach and be compliant with GDPR and EU AI Act. This decentralised model may stimulate local innovation but risks exacerbating inequalities between well-resourced and more fragile schools (OECD, 2025).



LUCY: A Three- Year AI Curriculum in Lower Secondary Education (Grades 6-8)

- **How AI is introduced**

AI is introduced in Grade 6 through linguistic, historical, and cultural exploration; deepened in Grade 7 through programming, logic, and the mathematical foundations of Machine Learning; and consolidated in Grade 8 through a capstone AI project. The progression clarifies increasing conceptual depth.

- **What is assessed**

Assessment is artefact-based: narratives, algorithms, datasets, and prototypes. The final Project Work functions both as learning activity and summative assessment, making students' reasoning and modelling processes visible.

- **Connection to mathematics and CT**

Modules explicitly address logic, proportionality, regression, and data modelling. Computational thinking is assessed through algorithm design, dataset construction, and interpretation of model performance.



AI4T: From Professional Learning to Classroom Resources (Grades 1-8)

- **Curricular outputs for classroom use**
A multilingual MOOC, an Open Textbook, and classroom-ready teaching scenarios covering AI fundamentals, machine learning concepts, ethical implications, and subject-specific applications (including mathematics). These resources are designed for direct integration into existing curricula.
- **Student-facing learning design**
The scenarios guide students to analyse AI systems, interpret algorithmic decisions, and reflect on data use and bias, embedding AI literacy within disciplinary learning rather than treating it as a standalone topic.
- **Assessment approach**
Reflective assessment focused on conceptual understanding, critical interpretation of AI outputs, and reasoning about data and algorithms

<https://www.ai4t.eu>

InspAIr: Assessing Critical AI Understanding through Futures Literacy (Grades 8-12)

- **How AI is introduced**
InspAIr unfolds through three labs: introduction to key concepts (AI, innovation, sustainability), speculative worldbuilding, and a final hackathon. AI and robotics are framed as socio-technical systems embedded in value structures. Students explore how different societal logics (hierarchical, individualistic, egalitarian) shape the use and impact of AI.
- **AI as assessment mediator, not content only**
Students interact with custom-designed GPT avatars that act as critical lenses (freedom/control, identity, environment, emancipation/oppression). Unlike typical AI tools, these GPTs do not provide answers but pose structured questions that surface hidden assumptions, power dynamics, and unintended consequences.
- **What is assessed**
Students' learning becomes visible through micro-narratives, GPT-mediated critical revisions, speculative artefacts, and final debate. The focus shifts from "Can students use AI?" to "Can students critically interrogate AI's societal implications?".

GROUP - E03943 - Commission Expert Group for the development of guidelines on high-quality informatics

Policy Area: Education

Towards High-Quality Informatics Education in Europe

Lead DG: DG EAC

Type: Informal, Temporary

Scope: Limited

Mission: The expert group is a direct follow-up of the Council Recommendation on improving the provision of digital skills and competences (November 2023).

Task: Assist the Commission in relation to the implementation of existing Union legislation, programmes and policies

Assist the Commission in the preparation of legislative proposals and policy initiatives

Other

Publication on the register of expert groups: 05 April 2024

Last updated: 22 May 2025

Contact: EAC-INFORMATICS-EDUCATION-EXPERT-GROUP@ec.europa.eu

- **European-level guidance currently under development** pointing toward stronger curricular coherence, inclusive design, enhanced teacher preparation, and assessment models capable of making CT and AI learning visible and meaningful.
- **What the literature highlights**
Recent studies identify four systemic priorities: equity and inclusion, teacher capacity, coherent K–12 curriculum progression, and more appropriate assessment strategies.
- **Assessment as a critical frontier**
Traditional models struggle to capture computational practices, creative artefact development, and critical engagement with AI systems.
- **CT and AI as a continuum**
Emerging scholarship frames AI as a natural extension of core informatics concepts—data, algorithms, systems, and societal impact—requiring a spiral progression from foundational CT to critical and ethical AI engagement.

Microcredentials & Assessment

01.  learningdigital



Ed Tech

*Education & Training Innovation
Design E-Learning Solutions*

02.  World Alliance for
Microcredentials



Foundation

*Global Advisory Board
Policy Activities*

03.  micoo⁺
Microcredentials made simple



Digital Platform

*App Ecosystem
Quality Assurance*

From AI Assessment to Competence Validation Ecosystems

- **From testing knowledge to validating competence**
Emerging frameworks on microcredentials emphasise assessment as the validation of demonstrated competence in authentic contexts rather than episodic testing of declarative knowledge
- **Continuous and modular validation**
Skills are dynamic; assessment systems must become continuous, modular, and stackable, enabling progressive documentation of learning rather than single high-stakes events
- **Evidence-rich assessment**
Validation increasingly relies on performance tasks, simulations, portfolios, and digitally traceable artefacts—formats that align closely with DS/CT/AI learning in mathematics. Microcredential logics invite a shift toward transparent, learner-owned, and digitally portable evidence of computational and AI-related competence.

Thank you

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