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NATIONAL
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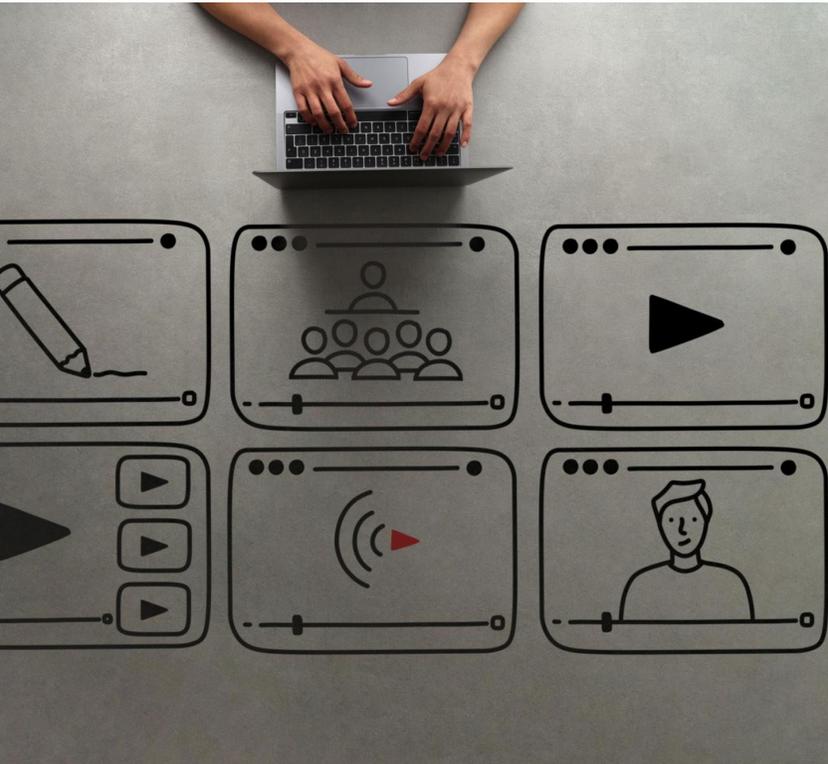
Technological Tools & Frameworks in K-12 Mathematics Education: **Spain**

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Guidance and Frameworks Shaping AI, Data Science, and CT in Spain



National Education Framework

Decentralized across Autonomous Communities but a compulsory national minimum curriculum is established.

Mathematics curriculum is largely uniform nationwide.

The **LOMLOE (2020) law**, established in 2022, aligns education with EU and UNESCO 2030 goals promoting: **competency-based learning and digital skills**.

CT and use of DT

Explicit **in mathematics** and technology **curricula**.

- **Computational Thinking Integration** within Mathematics K-12.

The **INTEF** (National Institute of Educational Technologies and Teacher Training) provides the "Digital Competence Framework for Educators," aligned with the European **DigCompEdu framework**.

- **Evolving Data Science Curriculum:** from statistics to "**Sense of Data**" with visualization and real-world modeling using digital tools.
- **Ethical AI Usage Guidance:** Ministry of Education published a guide (2024), which promotes an "**AI-augmented**" rather than "AI-led" with focus on **ethics and transparency** in algorithms.

Mitigation Strategies and Challenges in Spain



RECURSOS EDUCATIVOS

Proyectos	Total	Publicados en 2024
Procomún	48 200	14 443
Banco Multimedia	94 179	15 596
Observatorio de Tecnología Educativa	127	13
La aventura de aprender (Guías)	59	6
La aventura de aprender (Experiencias)	849	130
Experiencias Educativas Inspiradoras	155	27
Proyecto EDIA	306	30
Banco de rúbricas de CEDEC	2 107	267
Infografías de CEDEC	165	8
Itinerarios Didácticos	257	-
Situaciones de aprendizaje	171	6
INTEF, cámara y acción	1 115	-
Mates GG	1 336	266
Code INTEF	402	81
Aula del Futuro	497	140
AseguraTIC	509	17
Kits eTwinning	125	24

<https://intef.es>

Mitigation strategies

PROA+ Program Support: Funding and resources for socioeconomically vulnerable schools to adopt AI and CT equitably.

INTEF: Official unit responsible for integrating ICT and training non-university teaching staff.

- tutored and open courses,
- teaching resources for the classroom
- projects such as the Classroom of the Future.
- library of resources created by teachers for teachers.

Challenges

Despite the push for digitalization, Spain faces several challenges:

- **The Rural-Urban Gap:** Small schools in rural areas often lack high-speed infrastructure.
- **Teacher Training:** Although the “Digital Competence” plan aims to certify all teachers by 2025/2026, many feel overwhelmed by the speed of AI development.
- **The "Digital Divide" 2.0:** It is not just about access to devices (most schools have tablets/laptops), but about the **quality of their use**.

Accessibility to Key Digital Tools in Spain

Programming is introduced progressively as a vehicle for mathematical abstraction, following a **No-Code → Low-Code → High-Code** pathway supported by public resources, researchers proposals and common classroom practice

GOAL	TOOL	CODE LEVEL	ACCESSIBILITY
Statistical Analysis	Google Sheets / Excel	Low-code	High (Free/Institutional)
Algebraic Visualization	GeoGebra	Low-code	Very High (Standard in Spain)
Algorithm Logic	Scratch	No-code	High (Web-based)
Advanced Modeling	Python / R	High-code	Medium (Requires training)

Tool Usage Across K-12 in Spain (some experiences)

STAGE	FOCUS	TOOLS USED
Primary (K-6)	Visual Logic	No-code: ScratchJr, Bee-Bot, LEGO Education, 3d printing
Lower Secondary (7-10)	Block Based CT	Low-Code: Scratch, App Inventor, MakeCode
Upper Secondary (11-12)	Data & Algorithms, Dynamic Mathematics	High-Code: Python, GeoGebra

GeoGebra a standard for Math teaching in Spain

 matesgg

MATEMÁTICAS CON GEOGEBRA



A space for Math teachers with a **selection of materials created with GeoGebra** through teaching guides created with the **eXeLearning authoring tool**. Specific applets for **Autism Spectrum Disorder**.

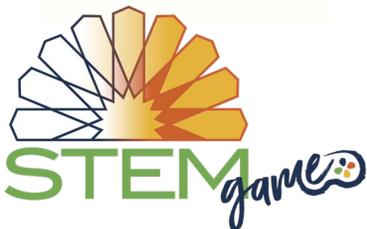
Teaching guides contain detailed information about the resource:

- curriculum information,
- suggestions for use,
- supplementary material,
- the source file for the guide (to edit, modify, and adapt), the resource itself in interactive mode.

Some innovative projects



IAxEM



EU funding

- **Open STEAM:** Teaching and Learning Mathematics through innovative and high -tech contexts
<https://www.opensteamgroup.unican.es/>
- **STEAM-CT:** Computational Thinking in STEAM contexts
<https://www.steam-ct.org/>
- **MATRIX:** Math Trails with an Inclusive Perspective on Students Experiences based on MathCityMap <https://matrix-project.eu/>

Regional Funding

- **IAxEM-CM** (Madrid): Augmented intelligence in mathematics education through modeling, automated reasoning, and artificial intelligence
<https://iaxem.es/>
- **STEMGAME** (Andalucia): Educational experiences based on the STEM approach and game-based learning have on students' STEM competence. <https://stemgame.ugr.es/>

Final remarks and Conclusion



- **Practice vs Policy:** 96% of Spanish students aged 10–15 use computers, but a very few at school ($\approx 33\%$). Systematic classroom use of AI, DS, and CT remains limited due to classroom management challenges and high-stakes exams.
- **Challenges and risks:**
 - Classroom management,
 - Teacher capacity (training gaps),
 - Inequity of access, and
 - Contradictions between policy promotion and technology bans (e.g., the growing trend toward forbidding cell phones in schools).
- **Conclusion:** Despite structural challenges, innovative projects show promising paths for integrating AI, DS, and CT into mathematics education through problem-solving and project-based assessment.

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