Guidelines for a Public Policy on the Digital Transformation of Education in Romania

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Abstract: Objectives: This paper examines the need for a coherent national public policy for the digital transformation of Romanian education, with artificial intelligence (AI) integrated as a cross-cutting component. **Prior Work**: The analysis draws on European and international frameworks (Digital Decade 2030, Digital Education Action Plan, AI Act, UNESCO and OECD guidance) and on established models of technology integration (SAMR, TPACK). **Approach**: A documentary analysis of European and national strategies was combined with a critical review of the literature and a case study of Estonia's systemic approach. **Results**: Romania has formally aligned with the European framework through national documents, yet lacks a dedicated strategy for the digital transformation of education; Estonia's institutional coordination, data interoperability and responsible AI integration offer transferable lessons. **Implications**: The findings support policymakers, education administrators and researchers in designing a formal, funded and monitored strategy, with clear objectives, indicators and responsibilities. **Value**: The paper proposes seven strategic dimensions — digital ecosystem, accessibility, connectivity, curriculum and assessment, innovation, ethics and security, sustainability — and argues for measures to ensure digital equity.

Keywords: AI governance; teacher training; interoperability; equity of access; European agenda

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1. Introduction: A Dilemma

The first dilemma in addressing public policies on the digital transformation of education is as follows: is it preferable to have a single national strategy for the digital transformation of education, in which artificial intelligence is a cross-cutting component, clearly visible and with its own measures, or two completely separate strategies, one concerning digital transformation and the other concerning artificial intelligence?

The first option ensures coherence across the entire digital education ecosystem (infrastructure, resources, data, skills, governance, inclusion), with artificial intelligence acting as an accelerator rather than an 'isolated project' (European Commission, 2021b). Indeed, the European Digital Education Plan is structured around the digital ecosystem and skills, explicitly including the use of AI (European Commission, 2026a). Digital transformation encompasses the infrastructure and systemic capacity that enable the use of artificial intelligence: connectivity, educational resources, digital pedagogy, governance and institutional capacity, cybersecurity, and partnerships. The second option – that of two separate strategies – would, in many cases, risk duplicating objectives and measures, creating parallel indicators and structures, or establishing solutions before schools have the conditions for equitable use. Artificial intelligence cannot be relegated to a separate chapter, but must be addressed across the board in the context of digital transformation in education. The OECD recommends a policy framework to support trustworthy generative AI, with requirements regarding privacy, safety, bias, transparency, age appropriateness, alignment with educational objectives and equitable access (OECD, 2026a). A second strategy would only make sense if it were a cross-sectoral document, rather than one strictly focused on education: for example, a national AI strategy covering education, public administration, health, labour, research, infrastructure and the economy.

A national strategy for the digital transformation of education, with a 3–4-year timeframe, sets out the vision, objectives, lines of action and subsequent measures, linking AI to all objectives and, underpinning these, to the lines of action and measures. UNESCO recommends that AI regulation be integrated into a broader national AI strategy, with cross-sectoral coordination, data protection and specific ethical rules. In education, this means that the sectoral strategy must be compatible with the national AI strategy and with horizontal regulations, without duplicating them (UNESCO, 2023).

Within a strategy for the digital transformation of education, artificial intelligence can be included as an area of intervention, operating simultaneously on three levels:

- AI for education: personalised learning, formative feedback, accessibility, support for teachers, responsible data analysis and early intervention.
- Education about AI: AI literacy, critical thinking, understanding the limitations of models, ethics, data, bias, intellectual property and disinformation.
- AI governance in education: safety, protection of pupils' data, transparency, independent evaluation, responsible procurement, human oversight and monitoring of the effects on equity.

UNESCO emphasises the development of AI skills, teacher training, pedagogical validation and monitoring of impacts, including on inclusion and equity (UNESCO, 2023).

The benefits of AI for learning depend on clear pedagogical principles and its use to support, rather than replace, cognitive effort, pupil autonomy and the teacher–pupil relationship (OECD, 2026a).

In conclusion, the solution to the aforementioned dilemma lies in adopting the first option: the development of a single strategy for the digital transformation of education that includes a cross-cutting component on artificial intelligence. In this case, the structure of the policy documents would be as follows:

- National AI Strategy: national capabilities, research, infrastructure, regulation, innovation, the labour market, ethics and societal-level skills.
- Strategy for the digital transformation of education: sector-specific application in education, with a substantial pillar on AI.
- Action Plan for AI in Education: the practical tool, reviewed annually, for rapidly changing measures.

This approach provides sufficient stability for public policy, whilst also offering flexibility for a field in which technologies, risks and educational practices are evolving much faster than the normal cycle of a strategy.

2. The Programme Framework for the Digital Transformation of Education

One of the most interesting conceptions of the future of information societies comes from Manuel Castells (2010). In this approach, the future primary form of social organisation is described as a 'network society', defining the network as a set of interconnected nodes (individuals, organisations, data centres, etc.) that process and transmit information electronically. In this type of society, power is no longer based on traditional hierarchies, but operates through *'switchers'* (critical nodes that direct the flow of information) and artificial intelligence, these two elements controlling information flows and, by extension, social and economic outcomes. The individual is left to define their virtual identity between two forces: the 'Net' (the global information network) and the 'Self' (personal identity).

Castells' approach is not the only one to raise questions without definitive answers. Numerous debates are taking place in the public sphere concerning digital ghettos, cloud technologies, blockchain, big data, as well as the gig economy (a type of labour market based on short-term, temporary projects, usually carried out via digital platforms, rather than a traditional, permanent job with a single employer), in which digital workers operate in environments without a fixed location, characterised by 'virtual reality' and a sense of timelessness. These disparities tend to exacerbate present and future challenges, which can only be overcome through innovative approaches to education.

2.1. Key European and International Policy Documents

The European policy framework for the digital transformation of education is structured across several complementary levels: horizontal strategies, education-specific frameworks, regulations on artificial intelligence and funding instruments. At the most general level, *the Digital Decade 2030 Policy Programme* sets out common objectives and targets for Europe's digital transformation by 2030, monitored through an annual cycle of cooperation between Member States, the Commission, the Parliament and the Council (European Union, 2022).

The Commission's communication *'Digital Compass 2030'* sets out two major targets: at least 80 per cent of the Union's adult population with basic digital skills and 20 million ICT specialists, with a gender-balanced distribution, and highlights Europe's structural shortcomings: insufficient digital training, a lack of digital tools

in basic education, and the under-representation of women in the digital sector (European Commission, 2021a).

The European Education Area (European Commission, 2020) is the EU's strategic framework for a common learning area, which builds on *the European Framework for Citizens' Digital Competences* (DigComp: digital literacy, communication, content creation, online safety, problem-solving). Its key component, the Digital Education Action Plan 2021–2027 (European Commission, 2021b), sets out 14 actions for high-quality, inclusive and accessible digital learning across all national education systems in the EU.

The European framework for teachers' digital competences, DigCompEdu, provides a reference tool for teacher training, often used in conjunction with the TPACK model (Redecker, 2017). Erasmus+, for its part, incorporates a pillar dedicated to inclusion and digital transformation in education, training, youth and sport (European Union, 2021).

The European Commission's Communication on *the Spring Package of the European Semester 2026* emphasises, in line with the Compass for Competitiveness, the need for investment in human capital and for aligning education, training and skills with labour market requirements, as essential factors for the European Union's competitiveness, innovation and strategic autonomy (European Commission, 2026b). Within the same framework, the country-specific recommendations addressed to Romania in 2026 highlight the significant shortage of basic digital skills and recommend strengthening basic skills, reducing early school leaving and utilising skills data in education policies, with a focus on rural areas and disadvantaged groups (Council of the European Union, 2026).

Another policy framework is provided by the regulation of artificial intelligence. *The AI Act* classifies AI systems into four risk categories (unacceptable, high, limited and minimal) and imposes, for sensitive sectors such as education, rigorous requirements regarding transparency and human oversight (European Union, 2024).

The OECD Council Recommendation on Artificial Intelligence, adopted in 2019 and revised in 2023 and 2024, emphasises the importance of algorithmic transparency, developer accountability and the justification of automated decisions (OECD, 2024), whilst *the NATO Strategy on Artificial Intelligence*, adopted in 2021 and revised in July 2024, confirms the geopolitical scope of the agenda on the responsible development of AI (NATO, 2024).

The *OECD* report *'Economic Surveys: Romania 2026'* recommends strengthening teacher training, modernising the curriculum and investing in school infrastructure in disadvantaged areas, whilst also highlighting the digital skills gap that limits the adoption of advanced technologies (OECD, 2026b). Complementarily, *the OECD's 'Digital Education Outlook 2026'* report recommends reconfiguring assessment practices by shifting the focus from the exclusive assessment of the final product to the assessment of the learning process, reasoning and the way in which artificial intelligence-based technologies are used responsibly and critically in educational activities (OECD, 2026a).

The key principles promoted by European and international bodies relate, in summary, to digital equity and inclusion, digital literacy, the responsible use of AI and continuous professional development.

2.2. National Policy Documents

Romania's National Strategy for Artificial Intelligence 2024–2027 promotes the development of the skills required for the use and development of artificial intelligence-based technologies, assigning a central role to education in training specialists and stimulating research and innovation, establishing and increasing the number of AI programmes at undergraduate, master's and doctoral levels, creating funding streams and encouraging collaboration with the tech industry (Government of Romania, 2024a).

The National Strategy for Research, Innovation and Smart Specialisation 2022–2027 (SNCISI) promotes collaboration between universities, research institutes and the business sector to develop skills in fields such as artificial intelligence, data analysis and emerging digital technologies, thereby contributing to the preparation of the workforce for the knowledge-based economy (Ministry of Research, Innovation and Digitalisation, 2022).

The National Action Plan on the Digital Decade for Romania 2030 aims to develop digital skills, expand digital infrastructure in educational institutions and increase the use of digital technologies in the educational process, thereby helping to reduce the existing gaps between Romania and the European Union average (Government of Romania, 2024b).

The National Strategic Framework for Education and Training at All Levels, 2021–2030 (the 'Educated Romania' Project), subsequently transposed into law, includes

provisions on digital skills in the curriculum, infrastructure for laboratories and platforms, and digital reporting (Presidential Administration, 2021).

3. Research Methodology and Working Models

The motivation for this study stems from the gap between the transformative potential of digitalisation and artificial intelligence and the actual capacity of the Romanian education system to capitalise on these opportunities. This paper aims to help clarify the role of the digital transformation of education, to critically analyse existing policy initiatives, and to set out guidelines for an effective digital public policy in the field of education, adapted to the national context and aligned with European developments.

From a methodological perspective, the research is based on a documentary analysis of the main European and national policies and strategies in this area, as well as on a critical review of the specialist literature and relevant public policy documents. Particular attention is paid to documents from the European Union and the OECD, digital competence frameworks, initiatives concerning the regulation of artificial intelligence, and national strategic proposals. The analysis is complemented by an applied perspective, aimed at identifying public policy solutions tailored to the specific characteristics of the Romanian education system.

Two working models were used to identify benchmarks for digital educational processes, including AI-assisted teaching, learning and assessment.

The SAMR model (Puentedura, 2009) shows that digital technology:

- replaces an analogue tool without changing the task (for example, pupils write an essay in a word processor instead of on paper): *Substitution*;
- adds functionality, enhancing the task (for example, a digital essay that includes comments, automatic correction, hyperlinks, etc.): *Augmentation*;
- enables a significant redesign of the activity (for example, collaborative online writing, real-time feedback, revision based on data analysis): *Modification*;
- enables entirely new tasks that were previously impossible (e.g. international collaborative multimedia projects, interactive digital portfolios integrated with AI tools for analysis): *Redefinition*.

In recent years, SAMR has often been critically discussed as a 'hierarchical' model, which risks being used prescriptively without a contextual analysis of pedagogical needs, but it remains useful as a simple framework for reflecting on the role of technology in specific activities (Zamri & Mohamad, 2025). The model is used as a tool for assessing the level of ICT integration in teaching.

The TPACK model (Mishra & Koehler, 2006) extends Lee S. Shulman's concept of 'pedagogical content knowledge' (Shulman, 1987), adding the technological dimension and emphasising the intersection between:

- *Content Knowledge*: subject-specific knowledge (mathematics, history, science, etc.);
- *Pedagogical Knowledge*: knowledge of teaching methods, the organisation of learning and assessment;
- *Technological Knowledge*: knowledge of digital tools, platforms and applications, including those based on AI.

The model then describes three areas of intersection: *Pedagogical Content Knowledge,* the integration of content with teaching methods; *Technological Content Knowledge,* the way in which technology reshapes the representation of content (simulations, visualisations, interactive resources); *Technological Pedagogical Knowledge,* the way in which technology supports or transforms pedagogical strategies (online collaborative learning, automated assessment, AI-driven feedback).

TPACK achieves the coherent integration of these three domains, that is, it builds the teacher's capacity to design learning situations in which technology is not an 'add-on', but an integral part of the pedagogical and curricular design. TPACK is frequently linked to the European digital competence frameworks (DigCompEdu), being used as a framework for analysing and developing teachers' professional competences in relation to technology.

An example of the combined use of these two models can be found in recent studies analysing the integration of digital platforms or AI tools into teaching, using SAMR to assess the level of transformation of activities and TPACK to describe the types of knowledge required for teachers to use these tools effectively.

The present analysis is based on European and international policy documents on digital education and artificial intelligence, as well as on network society theory and established models for integrating technology into teaching.

4. Key Aspects of Digital- and AI-Assisted Learning

The integration of digitalisation and artificial intelligence into education has become a central topic on the international education policy agenda, and the most recent European and OECD policy documents and reports provide a useful framework for public policy decisions in Romania (OECD, 2026a; UNESCO, 2023).

The key aspects of digital transformation in education can be approached from several perspectives:

- the ability to personalise learning pathways through real-time adaptation to the learner's profile;
- AI-generated feedback can match or exceed the quality of human feedback, provided it is integrated into a deliberate pedagogical design;
- apparent performance improves through the use of AI, whilst deep understanding erodes (the concept of the 'mirage of false mastery');
- the risks of algorithmic bias and opacity, highlighted by both UNESCO and European regulations, must be eliminated (Boateng & Boateng, 2025);
- the lack of clear institutional policies and practices.

According to the most comprehensive global survey conducted by the Digital Education Council in 2026 (45,398 respondents from 35 countries), 88 per cent of students have used or are using AI, and 66 per cent say they are concerned about the effects on critical thinking; only 29 per cent believe their teachers are prepared to guide them, whilst 76 per cent have never taken part in AI literacy training (Digital Education Council, 2026), figures which confirm a gap between the de facto use of AI and the institutional capacity to integrate it pedagogically (OECD, 2026a).

In terms of regulatory frameworks, the AI Act (Annex III) classifies AI systems used for access to education, the assessment of learning outcomes and the monitoring of pupils' behaviour as high-risk, imposing requirements for transparency and human oversight (European Union, 2024). Article 4, applicable from 2 February 2025, establishes the first obligation regarding AI literacy.

Complementarily, the UNESCO Guide on Generative AI in Education (UNESCO, 2023) recommends an age limit of 13 years for independent conversations with AI platforms (a threshold that remains the current international benchmark, as it has not yet been revised) and GDPR-style regulations for the protection of minors' data. The UNESCO AI Competency Frameworks for teachers and pupils, published in their

final form in September 2024, structure AI literacy across four dimensions: a human-centred mindset, AI ethics, techniques and applications, and systems design (UNESCO, 2024a, 2024b). The UNESCO anthology *'AI and the Future of Education'* summarises these key points: the technical performance of AI is not sufficient without human judgement to guide its pedagogical use (UNESCO, 2025).

All these key points converge on the principle of effective human oversight (human-in-the-loop), according to which AI must support, not replace, the professional judgement of teachers, and its role is synergistic, not substitutive (OECD, 2026a). For Romania, this principle requires priority investment in teacher training for AI literacy, in line with the provisions of the AI Act, and demands that the future strategy for the digitalisation of education treat AI not merely as a technical resource, but as an area of governance, with ethical frameworks and evaluation centred on the learning process, not just the final product.

5. Case Study: Estonia

Systemic public policy responses are taking shape in some European countries. Estonia provides a relevant example: the 'AI Leap' (TI-Hüpe) programme, initiated by the President of the Republic and implemented by the Ministry of Education and Research in partnership with the private sector (including OpenAI and Anthropic), has ensured, from 1 September 2025, free access to AI tools and dedicated training for 20,000 pupils in Years 10 and 11 and their teachers, with a planned expansion to vocational education in the 2026/2027 academic year, which would bring the total to approximately 58,000 pupils and 5,000 teachers by 2027 (Estonian Ministry of Education and Research, 2025; TI-Hüpe, 2026). The Estonian example is instructive precisely because of its contrast with the situation in Romania: the integration of AI is treated as a national policy endorsed at the highest level of government, with funding, a timetable and designated institutional bodies, rather than as a collection of ad hoc initiatives. The digitalisation of education in Estonia is addressed, at multiple levels, through a series of national public policies:

- Estonia 2035 — the national umbrella strategy, which includes digital pedagogy, the development of digital educational resources, the analysis of learning data and the personalisation of the learning process (Government of the Republic of Estonia, 2021).

- The Digital Society Development Plan 2035, the new national framework for digital transformation, with a focus on artificial intelligence, digital skills, data, connectivity and cyber security.
- The Education Strategy 2021–2035, which includes the development of digital skills, digital pedagogy and the use of technology to personalise learning.
- The Strategy for Research, Development, Innovation and Entrepreneurship 2021–2035 supports research, innovation and technological development, including the development and use of digital solutions.
- The National Roadmap for the European Digital Decade translates the European 2030 targets on skills, infrastructure and digital transformation into national priorities and measures.
- Operational programmes focused on the development of educational resources, personalised learning pathways and the use of learning analytics, and AI Leap / TI-Hüpe, launched in 2025 to integrate artificial intelligence into education.

By bringing together the digital and AI elements relating to education from the aforementioned strategies and plans, the following lines of action and pillars of implementation emerge:

- Developing the digital skills of pupils and teachers.
- Continuing professional development for teachers and the pedagogical integration of technology.
- Digital infrastructure and integrated school management.
- Development of digital content and open educational resources.
- Integrating research and innovation into the transformation of education.
- Public-private partnerships and experimentation.
- The responsible use of artificial intelligence in education.

The most transferable element of the Estonian model is not the technology, but the institutional focus. All digital education services are operated by a single state agency resulting from a deliberate consolidation. Educational data is centralised in a single state register, EHIS, which contains information on pupils, teaching staff, academic records, institutions and operating licences, whilst data exchange with other national

registers takes place via the X-tee common interoperability layer, used by over 3,000 public services (e-Estonia, 2026). Interoperability stems from the architecture, not from protocols negotiated retrospectively between separate systems.

Estonia has several monitoring tools: Digipeegel is a tool for self-assessing a school's digital maturity, developed by the University of Tallinn on a five-level scale, used by 432 schools in a 2019 study (HITSA, 2019); HaridusSilm publishes educational statistics on a single portal, which has been operational since 2013 (Haridussilm, 2026), whilst the OSKA system, administered by Kutsekoda, produces skills forecasts across 24 economic sectors, with a ten-year outlook (Kutsekoda, 2026).

6. Developing a Public Policy on the Digital Transformation of Education

Establishing a clear long-term vision and measurable objectives is essential to align all stakeholders around a holistic, beneficiary-centred approach. Without effective coordination and leadership, initiatives risk becoming fragmented and costly, and the involvement of teachers is a prerequisite for an inclusive transformation. Connectivity and infrastructure remain fundamental prerequisites for equitable access to educational resources, with alternative offline or mobile solutions where connectivity is poor. Costs must follow sustainable funding models, taking into account the total life-cycle cost of technologies and a contingency fund for cyber-security incidents. Skills and organisational culture complete the picture: systemic efforts are needed to train teachers, pupils and the community, through a national digital skills framework.

The vision of such a strategy would be to build an AI-centred digital educational ecosystem, in which pupils and teachers acquire the skills needed for an inclusive digital society. Two priorities stem from this vision:

(I) establishing the digital transformation ecosystem and

(II) the integration of AI into educational processes,

alongside six framework elements:

- **the digital ecosystem** and **digital governance** (a coherent architecture of interoperable platforms and services, avoiding fragmentation);
- **accessibility and connectivity** (reliable network infrastructure, aligned with the 5G coverage target for 2030 and with a focus on disadvantaged areas);

- **appropriate initial and continuing training for teaching staff**;
- **adapted curricula and assessments** (integration of digital skills and AI literacy);
- **innovation and partnerships** (partnerships between schools, universities and the private sector, including centres of excellence in AI);
- **ethics and cyber security** (protection of pupils' data, compliance with the AI Act).

The implementation of these elements must be based on clear principles: a focus on the beneficiary, equity and sustainability (continuity of funding, so that investments from the National Recovery and Resilience Plan (PNRR) and the Smart Growth, Digitalisation and Financial Instruments Programme (POCIDIF) become permanent institutional capacity).

To ensure these do not remain mere declarations, explicit mechanisms are required: accountable institutions, a phased timetable, measurable indicators linked to funding sources (state budget, POCIDIF) and regular monitoring. Such a policy must explicitly identify the main risks: chronic underfunding, institutional fragmentation, resistance to change and the urban-rural divide, and must provide for mitigation measures, learning from past failures.

7. Conclusions and Recommendations

At European and international level, there is a coherent set of strategies and recommendations aimed at developing digital and AI skills, as well as the responsible use of emerging technologies. Within this framework, Romania faces a series of structural and functional gaps that limit the pace and efficiency of the digital transformation of education. Existing strategic initiatives, whilst formally aligned with European trends, fail to generate sustainable systemic change, highlighting the need for a more coherent, well-founded and implementation-oriented approach.

The analysis presented leads to a key conclusion: Romania has a comprehensive and coherent European policy framework, to which it has formally aligned itself through national documents (SNCISI, the National Strategy on AI, the National Action Plan on the Digital Decade, and the PNRR component), but it does not yet have a dedicated national strategy on the digital transformation of education. Recent European data confirm this gap (Council of the European Union, 2026).

A public policy on the digital transformation of education requires legal force, clear institutional accountability, a phased timetable, measurable indicators and corrective mechanisms – essential conditions to ensure that investments already made through European funds do not prove unsustainable.

Romania's role in the digital transformation of education is currently one of catching up, not of anticipating trends. The fact that the country consistently ranks below the EU average on most relevant indicators calls for a pragmatic, implementation-oriented approach that makes the most of existing European funding instruments (the Education and Employment Programme — PEO, POCIDIF, Erasmus+) within a unified institutional framework, rather than through parallel initiatives.

The prospects for digital education are now inseparable from the development of generative AI, with its real potential for personalising learning, but also with its well-documented risks. The integration of AI requires a regulatory framework aligned with the AI Act and UNESCO guidelines, and a shift in the pedagogical paradigm, from assessing the product to assessing the process. Future research should explore, in the Romanian context, the impact of AI on learning outcomes under conditions of limited resources, as well as the institutional mechanisms for monitoring a future national strategy – a strategy which Romania has a duty to develop, adopt and implement with a rigour that previous projects have failed to achieve.

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