Transformative learning: shaping a sustainable, equitable, and intelligent "tomorrow"

Gabriela MARCHIS,
Danubius International University, Galați, Romania
ROR ID: https://ror.org/00qt2x502
gabrielamarchis@univ-danubius.ro

Abstract

This paper reflects on pressing questions facing contemporary education and society: *Are academic disciplines equipped to promote a more equitable, intelligent, and sustainable future?* Its aim is to explore how emerging educational standards, including the new ARACIS guidelines, alongside technological advances, can shape more intelligent, inclusive, and socially responsible learning paradigms. The study argues for *a holistic educational framework* that links technical rigor with a humanistic perspective, challenging conventional disciplinary boundaries. Situated at the intersection of education, technology, and sustainability, the research builds on interdisciplinary literature, including recent studies in the Smart Cities and Regional Development (SCRD) Journal, highlighting the societal impact of digital transformation. The analysis takes into account global trends in artificial intelligence, immersive media and other emerging technologies, highlighting the need for curricula that dynamically respond to societal challenges. A conceptual and analytical approach was employed, synthesizing evidence from literature review, policy analysis, and critical reflection on case studies of interdisciplinary initiatives. This methodology enables identification of the limitations of current educational paradigms and the potential of integrative models that combine analytical, creative, and empathetic capacities. The findings indicate that *transformative learning* emerges at the convergence of academic tradition and technological advancement. Integrating technical expertise with creativity and ethical awareness enhances human potential and institutional adaptability, equipping learners to address complex societal challenges. The study emphasizes that education must be both intellectually rigorous and socially aware in order to "program" a smarter, more equitable, and sustainable future. The implications extend to faculty, policymakers, and researchers designing curricula and institutional strategies aligned with sustainability and inclusive innovation. The paper's key contribution consists in proposing a holistic, interdisciplinary framework for learning for an intelligent "tomorrow," and its originality lies in offering a visionary roadmap for learning in the 21st century, offering a unique and original perspective to the ongoing scholarly discourse.

Keywords: smart education; interdisciplinary learning; immersive technology, human-centred design; AI and pedagogy.

1. Introduction

Education plays a pivotal role in cultivating the intellectual, ethical, and creative capacities necessary to sustain smart societies. Contemporary education faces an unprecedented convergence of challenges and opportunities. The rapid advancement of artificial intelligence, immersive technologies, and digital transformation has fundamentally altered the landscape of knowledge creation, dissemination, and application. Simultaneously, pressing global challenges of the 21st century such as: climate change, social inequality, democratic fragility, and sustainable development, demand educational approaches that transcend traditional disciplinary boundaries and prepare learners to navigate through this complexity with competence and conscience.

This reality forces a critical re-evaluation of our educational systems.

The central question this paper addresses is: Are our current academic disciplines and pedagogical models sufficient enough to equip learners with the capabilities needed to "program" a more intelligent, equitable, and sustainable future? The metaphor of "programming" carries profound implications for contemporary education. Just as software developers write code to shape digital experiences, faculty and policymakers craft curricula, pedagogies, and institutional frameworks that fundamentally determine the trajectory of future societies. This programming of tomorrow requires not merely technical proficiency, but a holistic understanding that integrates intellectual rigor, creative innovation, ethical awareness, and social responsibility. By integrating technical rigor with a deep-seated humanistic and ethical perspective, education can evolve from a system of knowledge transmission to one of societal transformation.

This study investigates the role of emerging standards in fostering transformative learning paradigms, particularly through the lens of:

- academic discourse surrounding sustainable regional development and education. [1]. Within the perspective of previously published articles in SCRD Journal between 2019 and 2025 [2, 3, 4, 5, 6, 7, 8, 9], smart cities and education are understood as interconnected ecosystems where digital transformation intersects with social equity and sustainability. Education is thus positioned as a pivotal mechanism for preparing citizens to navigate these complex challenges.
- ARACIS Guidelines – The Romanian Agency for Quality Assurance in Higher Education introduce new quality assurance standards that emphasize interdisciplinarity, digital literacy, and sustainability [10]. These developments align Romanian higher education with broader international trends and reinforce the shift toward more flexible and future-oriented learning models [11, 12].
- global policy frameworks that illustrate a converging international agenda where local, regional, and global standards reinforce one another, advancing education as a driver of sustainable, inclusive, and adaptive societies [12]. Key examples include: UNESCO's Education for Sustainable Development which calls for curricula deeply integrating sustainability values and competencies [13, 14]; the European Commission's Digital Education Action Plan 2021–2027 (2020) that promotes digital literacy, inclusivity, and innovation; the OECD's Learning *Compass 2030* which highlights creativity, empathy, and adaptability as essential competencies for future learners [15].

The central thesis advanced by this research is that transformative education emerges at the convergence of academic tradition and technological innovation, where technical expertise meets creativity, analytical thinking interfaces with empathy, and disciplinary depth engages with interdisciplinary breadth. This holistic framework challenges conventional boundaries and proposes pathways toward learning ecosystems that are simultaneously rigorous, relevant, and responsive to complex societal needs.

The core-contribution of this research is a visionary roadmap that redefines the purpose and practice of education for an *intelligent tomorrow*, proposing a conceptually integrative educational framework that produces graduates who are technically competent, creatively adaptive, and ethically responsible.

2. Literature review

2.1 Smart education and digital transformation

The concept of "smart education" has evolved in parallel with smart city initiatives, reflecting broader societal shifts toward technology-enabled innovation and data-driven decision-making. Research published in the SCRD Journal [2, 3, 4, 5, 6, 7, 8, 9] demonstrates that smart city development is fundamentally intertwined with educational transformation, as cities require digitally literate, innovative, and adaptable citizens to realize their potential.

Smart education encompasses several interconnected dimensions:

- personalized learning experiences enabled by adaptive technologies;
- collaborative learning environments facilitated by digital platforms;
- data-informed pedagogical decisions;
- integration of emerging technologies such as artificial intelligence, virtual reality, and learning analytics [16, 17].

However, critical perspectives warn against techno-determinism, emphasizing that technology alone cannot guarantee educational quality, equity, or relevance without appropriate pedagogical frameworks and institutional support.

Digital transformation in education extends beyond technology adoption to encompass fundamental shifts in organizational culture, pedagogical approaches, and learning outcomes. Recent studies [18, 6, 19, 20, 9] highlight the importance of digital literacy not merely as technical competence but as critical capacity to navigate, evaluate, and create in digital environments.

This broader conceptualization aligns with calls for education that prepares learners not just to use technology, but to shape it ethically and purposefully [6, 14].

2.2 Interdisciplinary learning and educational innovation

Traditional disciplinary boundaries, while providing depth and methodological rigor, increasingly prove insufficient for addressing complex, multifaceted challenges characteristic of contemporary society [7]. Climate change, public health crises, urban sustainability, and social inequality demand integrative approaches that draw on diverse knowledge domains and methodological traditions [1].

Literature on interdisciplinary education [12, 4] identifies both opportunities and challenges. Successful interdisciplinary initiatives require institutional support, faculty development, appropriate assessment mechanisms, and cultural shifts that value integration alongside specialization. Research demonstrates that interdisciplinary learning can enhance critical thinking, problem-solving abilities, and capacity for innovation [21], but implementation remains challenging within traditionally structured academic institutions.

The concept of STEAM (Science, Technology, Engineering, Arts, and Mathematics) education exemplifies efforts to bridge technical and humanistic domains. By integrating

creative and aesthetic dimensions with analytical and technical competencies, STEAM approaches recognize that innovation requires not only computational thinking but also imagination, empathy, and contextual understanding [6].

2.3 Quality assurance and educational standards

Educational quality assurance frameworks, such as the ARACIS standards in Romania [10], play crucial roles in shaping institutional practices and priorities. Recent revisions to such frameworks increasingly emphasize outcomes beyond traditional metrics of academic achievement, incorporating dimensions such as social impact, sustainability, digital competencies, and employability.

However, tensions persist between standardization and innovation. Quality assurance mechanisms can promote consistency and accountability, but may also constrain experimentation and flexibility necessary for responding to rapidly evolving educational needs. Effective frameworks balance core standards with adaptability, recognizing diversity of institutional missions and contextual specificities [19, 9].

2.4 Human-centred design and pedagogical innovation

Human-centred design principles, originating in design thinking methodologies, increasingly inform educational innovation. This approach emphasizes understanding learner needs, contexts, and aspirations; [22] iterative development and testing of pedagogical interventions; and continuous improvement based on feedback and evidence [3, 16, 15].

Applied to education, human-centred design challenges instructor-centric or content-centric models, instead positioning learners as active participants in shaping their educational experiences. This shift aligns with constructivist and participatory pedagogical traditions while leveraging contemporary design methodologies and technologies.

2.5 AI, Immersive technologies, and pedagogical transformation

Artificial intelligence and immersive technologies present both transformative opportunities and significant challenges for education [16]. AI applications range from intelligent tutoring systems and automated assessment to learning analytics and content generation [5]. Immersive technologies, including virtual and augmented reality, enable experiential learning in simulated environments, potentially democratizing access to experiences previously limited by cost, geography, or safety considerations [3, 4, 20].

Critical perspectives emphasize the importance of ethical considerations, including algorithmic bias, data privacy, accessibility, and the potential for technology to exacerbate rather than reduce educational inequalities. Effective integration of these technologies requires not only technical infrastructure but also pedagogical frameworks that leverage their affordances while mitigating risks [23, 6, 24].

3. Methodology

This research uses a conceptual and analytical approach, aiming to synthesize existing knowledge and build an innovative theoretical framework. To facilitate a rigorous examination of educational structures, technology integration and the impact of evolving regulations, three types of sources were investigated:

- a systematic review of the literature on smart education and regional development [1], covering the following topics: smart education and digital transformation in higher education; interdisciplinary learning and curriculum innovation; quality assurance frameworks and educational standards; emerging technologies (AI, immersive media) in pedagogy; sustainability and social responsibility in education;
- a policy analysis of ARACIS guidelines [10] and recent revisions and related policy frameworks [15, 20] (European Higher Education Area (EHEA) standards; UNESCO frameworks for quality education and sustainability [13, 14]), to elucidate institutional priorities and evolving regulatory frameworks. This critical analysis of educational policy frameworks was undertaken to understand the implications of policy changes for curriculum architecture, pedagogical design and strategic institutional planning of educational priorities, identifying both enabling factors and constraints for innovation.

4. The intelligence of change: programming tomorrow

The proposed holistic framework for smart, equitable and sustainable learning is based on five fundamental principles. (Fig.1).

The path to a smarter, more equitable, and sustainable future is paved by an educational paradigm that is itself *intelligent*, *inclusive*, and *integrative*. The relentless pace of technological change and the complexity of global challenges demand nothing less than a fundamental rethinking of how we structure learning.

The proposed holistic framework offers a roadmap. By deliberately creating learning environments where technical rigor, humanistic perspective, and a structured pedagogical process converge, we can equip learners with a more complete and powerful set of capabilities.

Technical rigor, combined with proficiency in the use of contemporary tools such as artificial intelligence, data analytics, immersive media, and computational thinking, facilitates understanding the "*how*" of solving complex problems. In contrast, a humanistic and ethical perspective addresses the "*why*" and "*for whom*" by incorporating critical thinking to challenge underlying assumptions, creativity to imagine alternative futures, empathy to appreciate diverse stakeholder perspectives, and a robust ethical framework to guide the responsible use of technology.

Human-centered design provides a systematic methodology for addressing ill-defined problems, while project-based learning provides an authentic environment in which technical and humanistic skills are integrated and applied to real-world challenges.

Emerging educational standards, exemplified by ARACIS guideliness, serve as frameworks that promote and validate this form of complex, competency-based learning.

This conceptual framework asserts that the deepest learning – transformative learning – occurs at the intersection of these elements, where learners not only use technological tools but also engage in critical and creative applications within a structured, ethically anchored process focused on solving meaningful human problems. This approach does not discard academic tradition but evolves it, ensuring that education remains the primary engine for human development and societal progress.

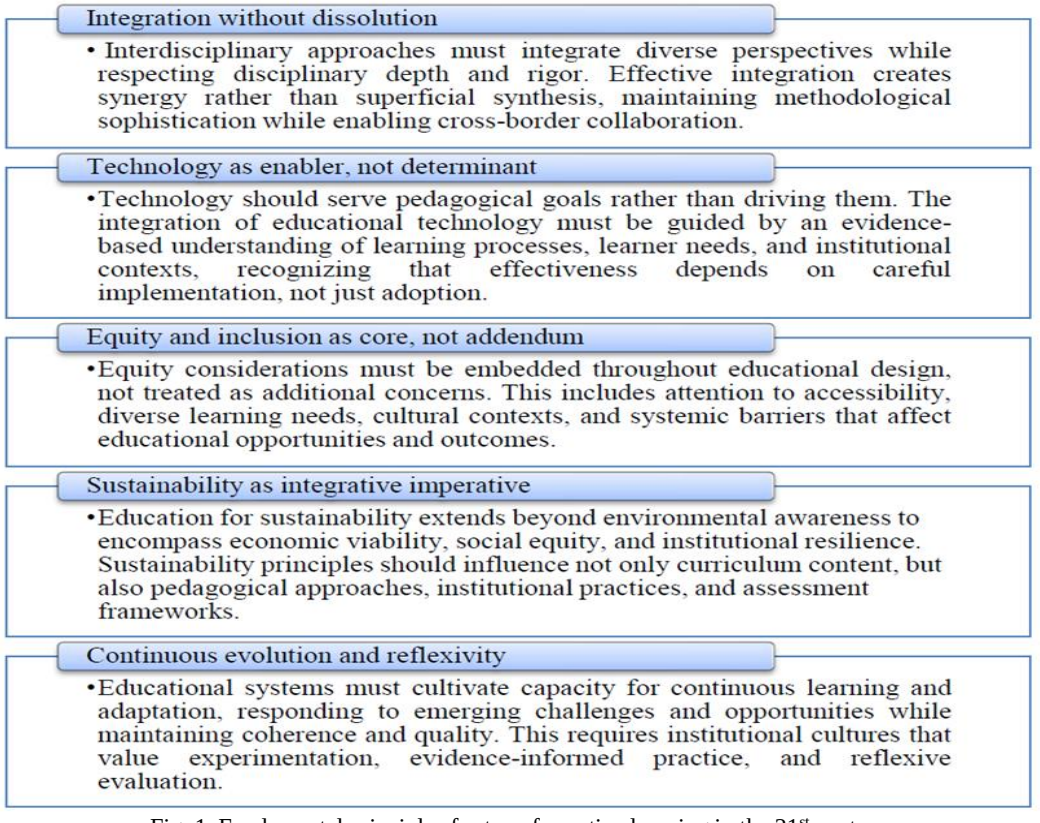

Fig. 1. Fundamental principles for transformative learning in the 21st century

To "**programme**" a better future, we must first reprogram our institutions of learning to be as dynamic, interconnected, and purposeful as the world they aim to serve. Therefore, the roadmap for educational transformation involves four interconnected routes.

Fig. 2. The roadmap for educational transformation

I. pedagogical transformation

- From content delivery to learning facilitation

Traditional lecture-based pedagogies are increasingly giving way to facilitative approaches that position faculty as designers of learning experiences rather than content providers. This shift recognizes that knowledge is not simply transmitted but actively constructed through engagement, application, and reflection.

- Personalization and differentiation

Emerging technologies enable increasingly sophisticated personalization of learning experiences, adapting to the individual needs, preferences, and paces of learners. However, personalization must balance adapting to individual needs with building community, recognizing that learning is fundamentally social and collaborative.

- Active and experiential learning

Immersive technologies, simulation environments, and project-based approaches create opportunities for experiential learning that links theory to practice. Such approaches are particularly valuable for developing complex skills that resist traditional instructional methods, including systems thinking, creative problem solving, and ethical reasoning.

II. curricular transformation

- Disciplinary depth and interdisciplinary breadth

Effective curricula balance specialization with integration, enabling learners to develop disciplinary expertise while cultivating the ability to work across boundaries. This may involve core disciplinary foundations complemented by interdisciplinary modules, projects, or capstone experiences.

- Competency-based frameworks

The shift from purely content-based to competency-based curricula emphasizes what students can do with knowledge, rather than just what they know. Key

competencies include critical thinking, creative problem solving, digital literacy, collaboration, ethical reasoning, and adaptive learning.

- Real-world relevance and application

Curricula increasingly incorporate authentic issues, community engagement, and partnerships with sectors of practice. This enhances both relevance and student motivation, while providing valuable opportunities to apply knowledge in the complex and ambiguous contexts of professional practice.

III. institutional transformation

- Organizational culture and leadership

Educational transformation requires institutional cultures that support experimentation, value teaching excellence alongside research productivity, and encourage collaboration across units and disciplines. Leadership plays a crucial role in articulating vision, allocating resources, and creating conditions for innovation.

- Infrastructure and support systems

Physical and digital infrastructure, professional development opportunities, support for instructional design, and technological resources are essential foundations for pedagogical and curricular innovation. Institutions must strategically invest in these enabling systems.

- Quality assurance and continuous improvement

Quality assurance frameworks should balance accountability with flexibility, incorporating multiple measures of educational quality including learner outcomes, stakeholder satisfaction, and social impact. Continuous improvement processes should be evidence-informed and participatory.

IV. societal transformation

- Preparing change agents

Education should explicitly cultivate capacities for positive social change, including systemic thinking, ethical leadership, sustainability skills, and civic engagement. Learners should be prepared not only to adapt to existing systems, but also to critically evaluate and transform them [23].

- Partnership and co-creation

The boundaries between educational institutions and broader society should become more permeable, enabling partnership in defining problems, creating knowledge, and implementing solutions. This includes engagement with government, industry, civil society, and communities.

- Global citizenship and local rootedness

Education should prepare learners for participation in increasingly interconnected global systems while maintaining awareness and connection to local contexts, cultures, and communities. This balance recognizes that the challenges of sustainability and equity are simultaneously global and locally specific.

5 The role of emerging technologies

5.1 Artificial intelligence in education

AI applications offer significant potential for enhancing personalization, efficiency, and accessibility in education. Intelligent tutoring systems can provide individualized support, learning analytics can inform pedagogical decisions, and automated assessment can reduce instructor workload for certain task types [18, 24, 25].

However, effective and ethical AI integration requires critical attention to several dimensions:

- algorithmic transparency and fairness: AI systems must be designed and validated to ensure fairness across diverse learner populations, with attention to potential biases in data and algorithms.
- human-AI collaboration: AI should augment rather than replace human judgment and relationship in educational contexts, recognizing the irreplaceable value of human mentorship, empathy, and contextual understanding.
- data privacy and ethics: Collection, storage, and use of learner data must respect privacy, obtain informed consent, and maintain security, with clear policies governing data governance.
- digital literacy and critical engagement: Learners should develop understanding of how AI systems function, their capabilities and limitations, and implications for society, enabling informed and critical engagement.

5.2 Immersive technologies and experiential learning

Virtual reality, augmented reality, and mixed reality technologies create possibilities for experiential learning previously constrained by practical, safety, or financial limitations.

Applications include:

- simulation-based learning: Complex procedures, dangerous scenarios, or rare situations can be practiced in safe and controlled virtual environments.
- virtual field experiences: Learners can explore geographical locations, historical periods, or microscopic/astronomical scales that are difficult to access physically.
- perspective-taking and empathy: Immersive experiences can foster understanding of diverse perspectives and lived experiences, supporting the development of empathy and cultural competence.

Effective implementation requires pedagogical frameworks that integrate immersive experiences with reflection, discussion, and connection to theoretical concepts [20]. Technology alone is insufficient. Learning design determines educational value.

6. Actionable insights for policy, practice, and research

Educational policy frameworks, including quality assurance standards, accreditation criteria, and funding mechanisms, significantly shape institutional practices and priorities. Several policy implications emerge from this analysis:

- flexible accreditation frameworks – Quality assurance systems should provide clear standards while enabling flexibility for innovation and institutional diversity.

Outcome-focused criteria that allow multiple pathways to demonstrated quality support experimentation while maintaining accountability.

- investment in educational infrastructure – Public investment in physical and digital infrastructure, faculty development, and educational technology is essential for equitable access to quality education. Funding mechanisms should recognize the resource requirements of pedagogical innovation and interdisciplinary programming.
- recognition of diverse forms of scholarship – Academic career structures and evaluation criteria should value diverse forms of scholarship, including pedagogical innovation, community-engaged research, and interdisciplinary collaboration, alongside traditional disciplinary research. This broader recognition supports institutional transformation.
- national and transnational collaboration – Educational transformation benefits from sharing of evidence, resources, and innovations across institutions and borders. Policy frameworks should facilitate collaboration while respecting institutional autonomy and contextual specificity.

Transformative approaches introduce several practical implications for educational institutions:

- strategic vision and leadership commitment – Transformation requires clear articulation of institutional vision, sustained leadership commitment, and alignment of resources and incentives with transformation goals. Change cannot be imposed but must be cultivated through participatory processes.
- faculty development and support – Professional development opportunities, instructional design support, communities of practice, and recognition systems are essential for enabling faculty to adopt new pedagogical approaches and technologies effectively.
- learner-centred design processes – Learners should be engaged as partners in educational design, not just recipients. Feedback mechanisms, co-design processes, and continuous improvement cycles ensure that innovations address the real learner's needs and contexts.
- cross-functional collaboration – Educational transformation requires collaboration across traditional organizational boundaries including academic affairs, information technology, student services, research administration, and community engagement. Integrated approaches replace siloed operations.

This analysis identifies several priorities for future research:

- longitudinal outcome studies – Rigorous evaluation of long-term outcomes of innovative educational approaches is needed, examining not only immediate learning gains but also career trajectories, civic engagement, adaptive capacity, and well-being.
- equity and access research – Research should examine how educational innovations affect different learner populations, identifying approaches that mitigate rather than exacerbate inequalities. This requires careful consideration of intersectional factors and the systemic barriers that shape learners' opportunities.

- implementation science – Understanding conditions that enable successful implementation and scaling of educational innovations requires a systematic investigation of organizational, cultural, and resource factors. Implementation science provide robust methodologies for examining these factors and for assessing how innovations perform in authentic, real-world educational contexts.
- ethical and social implications – As technology becomes ever more embedded in educational ecosystems, it is essential to investigate its ethical dimensions, potential unintended consequences, and broader societal impacts. Key areas of concern include data privacy, surveillance practices, algorithmic bias, and the ways technological mediation influences human development, social dynamics, and interpersonal relationships.

7. Conclusion: programming a sustainable, equitable, and intelligent "tomorrow"

The metaphor of "programming" with which this paper began extends beyond simple technological technological proficiency to encompass the need for an intentional, thoughtful, and value-driven design of educational systems that shape human potential and the future of society. Just as effective programming requires understanding of both technical capabilities and user needs, effective education requires the integration of disciplinary rigor with pedagogical innovation, technological possibilities with human values, and individual development with collective well-being.

This paper argued for a holistic framework that challenges conventional educational boundaries while maintaining intellectual rigor and social responsibility. The framework integrates five foundational principles (integration without dissolution; technology as enabler; equity as core commitment; sustainability as imperative; and continuous evolution) with four dimensions of transformation: pedagogical, curricular, institutional, and societal. Several key conclusions emerge.

First, transformative education is not fundamentally about technology, although technology plays important enabling roles. Rather, transformation is about purposes, processes, and relationships: Why do we educate?; How does learning occur?; and What kinds of individuals and societies are we cultivating?. Technology should serve these deeper purposes, and not determine them [25].

Second, disciplinary depth and interdisciplinary breadth are complementary rather than contradictory [21]. Real progress comes from an integration sophisticated enough to preserve the methodological depth of the individual disciplines, not from a superficial combination that sacrifices academic quality. Integration that lacks rigor results in superficiality; true synergy emerges only from a genuine and rigorous integration.

Third, equity and sustainability cannot be treated as additional concerns but must be embedded throughout educational design and practice. This requires ongoing attention to who has access to quality education, whose perspectives and experiences are centred in curricula, and how educational institutions contribute to or combat systemic inequalities.

Fourth, educational transformation is fundamentally a social and cultural process, not just a technical one. Sustainable change requires institutional cultures that value teaching excellence, support experimentation, recognize diverse forms of research, and engage stakeholders in participatory processes.

Fifth, the challenges facing contemporary society, such as: climate change, inequality, democratic fragility, technological disruptions, require an educational framework focused on transformative leadership. Students must therefore be prepared not only to adapt, but also to lead transformative change. Education should cultivate capacities for critical thinking, creative problem-solving, ethical reasoning, collaborative action, and resilient adaptation.

The ARACIS guidelines and similar quality assurance frameworks can play constructive roles in promoting transformation when they balance clear standards with flexibility for innovation, emphasize outcomes over processes, and recognize diverse pathways to quality. However, standards alone are insufficient; implementation requires vision, resources, and sustained commitment from educational leaders, policymakers, faculty, and learners themselves.

Looking forward, educational institutions face both unprecedented challenges and remarkable opportunities. The convergence of technological capabilities, societal needs, and evolving understanding of learning creates possibilities for more personalized, relevant, accessible, and effective educational experiences than ever before. Realizing this potential requires courage to challenge inherited assumptions, wisdom to preserve valuable traditions, and commitment to the values of equity, excellence, and social responsibility.

“Programming Tomorrow” begins with intentional choices, today. Choices about what we value, whom we serve, and what kind of future we want to create. Education is perhaps humanity’s most powerful tool for shaping that future. Used wisely, thoughtfully, and ethically, it can indeed contribute to a smarter, more equitable, and more sustainable world. The framework proposed here is not a blueprint but a compass, offering principles and perspectives to guide the continuous transformation of education toward human flourishing and planetary well-being. The journey toward transformed education is not a destination but a direction, not an arrival but a continuous evolution. As we “program Tomorrow” through today’s decisions, we must proceed with vision, rigor, and hope.

References

[1] E. P. Trindade, M. P. Hinnig and et al., "Sustainable development of smart cities: A systematic review of the literature," *Journal of Open Innovation: Technology, Market, and Complexity,* vol. 3, no. 3, pp. 1-14, 2017.

[2] B. Zankova, "Smart societies, gender and the 2030 spotlight - are we prepared?," *SCRD,* vol. 5, no. 3, p. 63–76, 2021.

[3] I. Selkani, "Smart museums: enjoying culture virtually Case of Virtual Museum of the National Museums Foundation. Rabat - Morocco," *SCRD,* vol. 5, no. 3, p. 41–51, 2021.

[4] J. Kausch-Zongo and B. Schenk, "General technological competency and usage in public administration education: An evaluation study considering on-the-job trainings and home studies," *SCRD*, vol. 6, no. 1, pp. 55-65, 2022.

[5] M. A. Dima, "The impact of digital transformation: From traditional education to smart education," *SCRD*, vol. 1, no. 1, 2024.

[6] M. Krumova, "Development of STEM skills and competencies through object-based STEM learning," *SCRD*, vol. 9, no. 4, pp. 53-63, 2025.

[7] O. Sula, "Bridging the digital divide for Generation X and Boomers in the Western Balkan region through smart cities," *SCRD*, vol. 9, no. 3, pp. 19-27, 2025.

[8] R. Zdjelar and R. Kelemen, "The smart cities are implemented. Are citizens also 'smart'?," *SCRD*, vol. 3, no. 1, pp. 47-62, 2019.

[9] Turcan, L. Gujuman and T. Colesnicov, "Digital Transformation in Education: ASEM Case Study and the Integration of Modern Technologies in the Learning Process," *SCRD*, vol. 9, no. 3, p. 67–80, 2025.

[10] [Online]. Available: https://www.aracis.ro/en/methodology-guides-2025/ .

[11] [Online]. Available: https://education.ec.europa.eu/focus-topics/digital-education/plan .

[12] [Online]. Available: https://www.oecd.org/en/about/projects/future-of-education-and-skills-2030.html .

[13] UNESCO, Education for Sustainable Development Goals: Learning Objectives, Paris: UNESCO, 2017.

[14] UNESCO, Education for Sustainable Development: A Roadmap, UNESCO, 2020.

[15] OECD, OECD Learning Compass 2030, Paris: OECD, 2019.

[16] OECD, OECD Digital Education Outlook 2021: Pushing the Frontiers with Artificial Intelligence, Blockchain and Robots, Paris: OECD, 2021.

[17] X. Wang, "Enhancing Interdisciplinary Learning and Innovative Practice in Students through Mixed Reality: A Deep Learning Approach," *Int. J. Interact. Mob. Technol*, vol. 19, no. 10, p. 71–85, 2025.

[18] A. Dehbi, A. Bakhouyi and et al., "Education and smart technologies: towards a new pedagogical paradigm," *International Journal of Evaluation and Research in Education (IJERE)*, vol. 14, p. 297, 2025.

[19] M. Peters, C. Aubert and et al., "Skills alignment for lifelong learners in higher education: smart catalogues for reskilling and upskilling pathways," *Ubiquity*, vol. 3, no. 1, pp. 71-82, 2023.

[20] R. H. Huang, D. J. Liu and et al., Global Understanding of Smart Education in the Context of Digital Transformation, Beijing: Global Smart Education Network and Smart Learning Institute eof Beijing Normal University, 2024.

[21] M. Borrego and L. K. Newswander, "Definitions of interdisciplinary research: Toward graduate-level interdisciplinary learning outcomes," *Review of Higher Education*, vol. 34, no. 1, pp. 61-84, 2010.

[22] D. Laurillard, Teaching as a Design Science: Building Pedagogical Patterns for Learning and Technology, Routledge, 2012.

[23] C. Redecker, European Framework for the Digital Competence of Educators: DigCompEdu, Luxembourg: Publications Office of the European Union, 2017.

[24] O. Zawacki-Richter, V. I. Marín and et al., "Systematic review of research on artificial intelligence applications in higher education – where are the educators?," *International Journal of Educational Technology in Higher Education*, vol. 16, no. 39, 2019.

[25] W. Holmes, M. Bialik and C. Fadel, Artificial Intelligence in Education: Promises and Implications for Teaching and Learning, Center for Curriculum Redesign, 2019.