

PREFACE

Looking for Traces of the Future in the Present: Supporting Well-Being Growth for All

In a world shaped by rapid technological advances and changing economic landscapes, the challenge of preparing learners for the future has never been more pressing. This Special Issue brings together researchers and practitioners who explore the potential of Smart Learning Ecosystems and Smart Digital Services to address these challenges.

Such a mindset requires more than technological solutions; it demands a holistic approach that considers the broader social, cultural, and economic contexts, as well as the skills and capabilities of its workforce and the well-being of all involved actors. Moreover, this mindset requires a commitment to inclusivity and equitable development - i.e., ensuring that advancements in education and technology contribute to the well-being of all stakeholders. As such, identifying traces of the future within the present means recognizing the latent possibilities in today's ecosystems and regional contexts and using them as a foundation for long-term prosperity and sustainability. This vision emphasizes the importance of investing in education and training, promoting inclusive development, and designing systems that prioritize collective well-being.

The selected papers in this Special Issue address these transformative possibilities through diverse perspectives. They explore the role of gamified narratives and collaborative platforms in reshaping the teaching process, examine the challenges and opportunities of digital innovations in education, and offer insights into sustainable learning futures that integrate technology with well-being.

The article entitled "Sustainability in IT education: A game-based approach" by Benedicte H. Gangstø and Monica Divitini [1] investigates the potential of collaborative games as tools for enhancing IT students' knowledge and perceptions of sustainability. The study introduces SustainIT, a 3D collaborative game designed to teach students about sustainability by engaging them in decision-making for an IT company. The game promotes systems thinking, highlights the interconnection between IT and sustainability, and challenges existing perceptions. Emphasis was placed on designing game elements that enhance learning and engagement. The game was evaluated by a sustainability education expert and a group of target students, receiving positive feedback for its relevance and engagement. However, challenges were identified in seamlessly integrating sustainability concepts into gameplay. The study findings are aimed to inform the future development of educational games that address IT's role in sustainability.

The article entitled “Gamification for teacher professional development: the case for narrative approaches” by Francesca Pozzi and Donatella Persico [2] introduces a gamification strategy grounded in a narrative framework. Indeed, narrative-driven approaches appear to align better with teacher training needs, where collaboration and practice sharing need to be encouraged rather than hindered by competitive mechanics such as points, leaderboards, and badges. The proposed approach was tested through an exploratory study, and preliminary data were collected and reported in the paper. The findings are promising, with teachers responding positively to the approach’s perceived usefulness and effectiveness. Additionally, participants expressed a willingness to incorporate similar gamification strategies into their teaching practices, highlighting the potential of narrative gamification for fostering collaboration and professional growth.

The article entitled “Designing a collaborative learning platform based on learnersourcing and gamification” by Alexandru Smarandache and Elvira Popescu [3] introduces an innovative educational system called ShaLe, whose name comes from the two main activities it is based on: Share and Learn. Thus, ShaLe enables students to share supplementary educational resources alongside teacher-provided materials, and it incorporates a question-answer system to facilitate discussions and clarifications related to course content. The platform also encourages students to create new assignments and evaluate their peers’ solutions, promoting critical thinking and active engagement. Additionally, ShaLe features performance visualization tools and a gamification element, where students earn badges for their achievements. This approach not only enhances student collaboration and motivation but also reduces teachers’ workload by distributing some educational responsibilities. By integrating learnersourcing and gamification, ShaLe aims to transform students from passive participants into active contributors to the learning process.

The article "Teaching Urban Sensing Skills – Experiences from a Summer School" by Åse Håtveit et al. [4] is about the design and implementation of a five-day summer school aimed at teaching urban sensing skills to graduate students from diverse disciplines, including architecture, engineering, and environmental science. The summer school used an open-source urban sensing platform to teach sustainability topics, such as decarbonization and the social cost of climate change. Students participated in a series of project-based learning activities, including lectures, prototyping, urban data collection, analysis, and public presentations – with the goal of improving their technical proficiency, interdisciplinary collaboration, and scientific literacy. The activities also included real-world applications such as monitoring air pollution on bike lanes and assessing pollution exposure during commutes. The use of hands-on learning and iterative project development allowed participants to gain practical experience in urban sensing and its applications. Surveys, interviews, and observations were conducted to evaluate the summer school. The authors report that participants appreciated the hands-on engagement and interdisciplinary collaboration but noted challenges such as technical issues, limited preparation time, and misaligned

expectations for outcomes. Best practices were identified for teaching urban sensing skills – for example, providing structured support for hardware and data analysis while encouraging collaborative problem-solving. The authors recommend improving the program by adjusting expectations, refining technical tools, and allocating more time for project development to improve learning outcomes.

The article titled "Phyigital Education through Storytelling and Learning by Doing: The Binario 9 $\frac{3}{4}$ Project" by Fabio Sartori, Claudia Maga, Barbara Tosi, and Alessandro Varallo [5] explores an innovative approach to competency-based education (CBE) through the integration of phyigital education and digital storytelling. The project, called Binario 9 $\frac{3}{4}$, uses virtual communities of practice (VCoP) to support secondary school students with learning disabilities, including those with language barriers or specific learning disabilities such as dyslexia. The project uses the learning-by-doing methodology, using the Scratch programming platform to implement playful digital storytelling. Each lesson is structured as an engaging three-part story: an interactive game that introduces implicit mathematical problems, a theoretical part with explanations, and a post-game that requires applying acquired knowledge. This framework facilitates students' progression from passive participants (bystanders) to active contributors to the learning process, improving their computational thinking and problem-solving skills. The project was carried out in two phases between 2019 and 2023 and involved schools in Italy and Switzerland, adapting materials for online use during the pandemic. The results show significant improvements in students' mathematical skills and engagement, with adapted storytelling fostering inclusion and educational success. The study highlights the scalability of virtual education and its potential to bridge educational gaps while improving the delivery of CBE. Future research aims to expand the project's scope and explore its impact on teacher practice.

The article by Angélique Ferrandoni, Inès Di Loreto, and Yann Verchier entitled "Maintain the Schooling of School Refusers: Conceptualization of a School Reception Protocol using Digital Technology" [6] explores innovative approaches to addressing the problem of school refusal (SR) among students. SR, often associated with anxiety or depressive disorders, can lead to long-term absenteeism and dropout. The study presents a hybrid digital reception protocol designed to integrate digital technology into educational practices in French schools. This protocol combines face-to-face and distance learning sessions to support the schooling of SR students, focusing on their psychological and educational needs. Based on qualitative data from interviews with educators, students, and families, the study identifies barriers to the continuity of education for SR students, including limited teacher training, inconsistent interventions, and the digital divide. The proposed protocol emphasizes adapted schedules, centralization of learning materials, and a mentoring system to maintain communication and ensure inclusion. Initial results from the pilot applications suggest the potential of digital solutions to mitigate the impact of SR, although they highlight the need for systemic adaptations and pedagogical flexibility. The findings highlight

the need for proactive identification and innovative teaching strategies to maintain the educational engagement of SR students.

The article entitled “An integrated evaluation framework – smartness, well-being, e-maturity – for participatory evaluation of learning ecosystems: first application to two Italian high schools” by Carlo Giovannella [7] introduces a participatory evaluation framework focused on 3 directions: focus on people, base the evaluation on an integrable set of multidimensional constructs (i.e., smartness and e-maturity), and provide reference values. It highlights the limitations of top-down, standardized evaluations and proposes a bottom-up, people-centered approach involving all stakeholders—students, teachers, and parents. The framework integrates multidimensional constructs to assess the quality of learning ecosystems and their alignment with digital maturity and individual well-being. The approach was applied in two Italian secondary schools, enabling synchronic and diachronic comparisons of educational contexts. The study underscores the importance of participatory methods for creating actionable improvement plans and supporting evidence-based decisions.

The article by Carlo Giovannella, Licia Cianfriglia, and Antonello Giannelli [8] “AIs @ School: the perception of the actors of the learning processes” explores the awareness and use of AI technologies in Italian schools, analyzing perceptions among principals, teachers, students, and parents. While the overall level of awareness is low across all groups, parents and students show higher interest in AI integration than educators. AI usage is mainly limited to generative tasks like creating exercises/tests or solving problems, with little emphasis on higher-order skills like critical thinking. Concerns include privacy issues and the potential for skills and competencies attenuation, while AI's capability to identify connections between various aspects and topics, as well as optimize solutions and resources, are seen as attractive. The study calls for systemic training programs to empower educators as critical guides for integrating AI into learning processes.

The article “Echo: A crowd-sourced Romanian speech dataset” by Remus-Dan Ungureanu¹ and Mihai Dascalu [9] presents Echo, a crowd-sourced Romanian speech dataset designed to improve automatic speech recognition (ASR) models. Featuring over 350 hours of diverse recordings, the dataset addresses the scarcity of Romanian-language resources and supports various applications, including education. The authors improved accuracy by fine-tuning OpenAI's Whisper model on this dataset, making Echo a valuable tool for transcription tasks and smart learning applications. The dataset's demographic focus on young speakers aligns well with educational use cases, and its openness encourages further collaboration and innovation for Romanian language processing.

In conclusion, this Special Issue highlights the transformative potential of Smart Learning Ecosystems and Smart Digital Services in addressing the challenges of modern education by integrating technological innovation with inclusive, human-centered approaches. The selected studies emphasize the importance of critical

thinking, fostering collaboration, and sustainability through gamified learning, narrative-driven strategies, and participatory evaluation frameworks. Additionally, they underscore the need for adaptive systems prioritizing well-being, interdisciplinary collaboration, and equitable development. Together, these contributions provide valuable insights into designing future-ready educational ecosystems that leverage technology and ensure collective well-being and long-term sustainability

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