

Digital awareness in educational settings

Silvana Arcodia¹

¹ UNIMC; silvana.arcodia@unimc.it

Abstract: The growing use of digital technologies in schools calls for a rethinking of teaching and learning methods. Digital technologies are no longer merely supportive tools but complex environments capable of reshaping knowledge-construction processes, cognitive dynamics, social relationships, and instructional practices. This contribution examines the notion of technological awareness as a fundamental requirement for the effective, responsible, and sustainable use of technologies in educational contexts. Specifically, it explores digital skills, critical and media literacy, data-related ethics, social and interpersonal implications, and the risks associated with technological dependence. By integrating perspectives from multiple disciplines, the study highlights the importance of developing educational practices aimed at fostering conscious technology use, adopting personalized learning systems, promoting inclusion, and supporting critical thinking, while simultaneously encouraging responsible digital citizenship.

Keywords: Educational innovation; Technological environments; Digital literacy



Copyright: © 2026 by the authors.
Submitted for possible open access
publication under the terms and
conditions of the Creative Commons
Attribution (CC BY) license
(<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

The increasing digitalization of educational systems has significantly transformed teaching and learning methods, influencing instructional practices, the roles of educational actors, and learning environments, while reshaping the cognitive, communicative, and work-related processes of younger generations. The expanded integration of digital technologies within school settings requires critical awareness from teachers, learners, and policymakers, as these tools interact meaningfully with existing teaching practices and learning strategies (Messina & De Rossi, 2015). Technologies affect how knowledge is accessed, how social interactions unfold, and how thinking processes develop, thereby restructuring the educational experience as a whole.

Technological innovation is therefore not merely a collection of tools; it embodies values, interests, and political and economic choices made by groups of individuals. Moreover, it concretely influences people's lives, social interactions, workplaces, inequalities, modes of communication, and even the ways in which individuals reflect on their own thinking.

A revision of educational models and a pedagogical reflection capable of addressing the cultural, cognitive, and ethical transformations associated with technological use are thus necessary. Schools must move beyond the mere introduction of digital tools and instead cultivate individuals capable of using them critically, consciously, and responsibly. Teachers' digital awareness becomes an essential require-

ment for designing learning environments aligned with the educational challenges of the twenty-first century.

It is therefore crucial to reflect on the conditions that make technological integration genuinely meaningful and oriented toward human and social development.

2. The Concept of Technological Awareness in Education

Technological awareness can be described as the ability to critically understand how digital technologies function, to analyse their educational implications, and to guide their use toward relevant instructional goals. It represents a broad competence that integrates technical knowledge, pedagogical understanding, and value-based considerations, moving beyond a narrow view of technology as a mere tool. Technologies applied to teaching possess qualities of flexibility, adaptability, and organizational capacity that make them potentially valuable both for strengthening connections within learning communities and for supporting individuals' personal development (Ciasullo, 2024). However, these potentials can become genuine educational opportunities only when supported by a solid technological awareness that intentionally and reflectively guides instructional decisions, as digital technologies transform teaching and significantly influence practices, relationships, and cognitive processes.

It is therefore necessary to cultivate a critically informed perspective in order to implement effective teaching strategies capable of reshaping learning abilities and positively influencing classroom dynamics. This requires integrated technical, critical, and ethical competencies. Recent research shows that the targeted integration of technologies enhances students' capacity to develop cultural, critical, and metareflective skills. (Sharma & Chaudhary, 2020).

Technology is not limited to serving as a practical aid; it constitutes a genuine cognitive environment that alters modes of accessing information, reshapes learning styles (visual, multimodal, and interactive), and stimulates active and participatory experiences, thereby supporting inclusion, personalization, and equity.

3. Data Ethics and Educational Responsibility

The extensive use of digital technologies in educational contexts raises significant ethical issues, particularly concerning the management of personal data, the protection of privacy, and the security of information. Critical literacy and data ethics therefore become essential components of technological awareness, requiring teachers and institutions to implement clear and responsible practices that take into account social implications, risks, and potential dependencies associated with technology use. Teachers must guide students in developing critical digital literacy, conceived as a set of competencies that enable the enhancement of learning and the promotion of inclusive teaching practices. In this sense, "their influence extends far beyond the mere execution of tasks with greater efficiency, as these technologies become an almost invisible yet omnipresent presence that merges with our everyday reality." (Sebastiani, 2024, p. 46).

Teaching data ethics involves helping students develop a deep understanding of the risks and opportunities linked to the use of digital platforms, while promoting respect for individual and collective rights. It is essential for teachers to verify sources, evaluate content, and recognize biases and algorithms that may distort learners'

cognitive processes. In this context, ethical considerations cannot be treated as secondary; they must be structurally embedded within curricula and teaching methodologies. Pedagogical competence plays a crucial role in understanding how technology affects motivation, attention, and learning strategies, as well as in managing collaborative and cooperative dynamics within digital environments.

4. Digital Technologies and the Cognitive Processes of Learning

A substantial body of literature shows that digital technologies significantly influence the mental processes involved in learning. “Technologies began to find application in educational and school contexts in the 1950s in the United States and, in the following decade, in Italy. The earliest studies can be traced back to Skinner [...] who, within the behaviourist paradigm, developed a specific instructional technology known as ‘programmed instruction’, consisting of the articulation of curricula and school programmes into sequences of minimal units, each followed by positive reinforcement. Subsequently, educational technologies developed along two main lines: curriculum and instructional design theories (Bloom, Carroll, Gagné, etc.) and the technical-informatic approach, in which the computer is used as an instructional agent and as a support for learning.” (Guglieman, 2004, p. 38).

The use of digital technologies in education facilitates the assimilation of information by stimulating specific mental mechanisms essential for learning, such as perception, processing, and concentration. Integrating technological tools into the school environment enriches sensory experiences and helps manage cognitive load, thereby increasing students’ engagement and attentional capacity (Mayer, 2009; Baddeley, 2012). The structured presentation of content on a screen, for example, can support a more effective mental organization of information, making comprehension and memorization easier.

Within this framework, technologies can foster the development of advanced cognitive skills, such as problem-solving, through critical approaches to knowledge and divergent thinking. Technology-enhanced instructional practices may promote more effective information processing; for example, the sequential presentation of content on a screen can enhance linearity and activate fundamental learning processes, particularly input processes such as sensation, perception, and attention. This approach is grounded in the belief that digital technologies encourage students to expand their creative perspectives and operational competencies, thereby preparing them more effectively for success in academic and social contexts.

When used consciously, technologies can support key cognitive processes:

- Sensation and perception: through multimodal stimuli that activate different sensory channels;
- Attention: through scaffolding, content segmentation, and microlearning;
- Memory: through spaced repetition, digital concept maps, and simulations;
- Critical thinking: through source analysis, data comparison, and reliability checks;
- Creativity: through content creation, multimedia editing, and augmented-reality environments.

5. Personalization of Learning, Equity, and Inclusion

When discussing inclusion, we refer to a broad conception that concerns the school community's capacity to develop instructional and organizational practices that value the individual differences of each student, including those experiencing difficulties. Inclusion represents the exercise of a fundamental right and constitutes an essential dimension of human dignity (UN Convention, 2006; UN, 2006; WHO, 2007). The growing need within school contexts to create personalized learning environments aligns with a substantial body of research highlighting the capacity of digital technologies to accommodate diverse learning styles and paces. Technologies make it possible to design personalized educational programmes that value individual differences and promote greater equity and inclusion.

Within this perspective, personalized education becomes a key element in making learning genuinely accessible to all, contributing to the reduction of educational disparities and ensuring equal opportunities for access to knowledge. The responsible use of technologies thus emerges as a crucial factor in creating inclusive and participatory educational environments. Technology represents a significant educational resource, offering flexibility and personalization, providing tools for reflection and metacognition, and serving as an effective support for learning communities. Moreover, it enables the creation of highly customizable digital environments through adaptive platforms, differentiated learning pathways, and compensatory tools for students with special educational needs, specific learning disorders, and sensory or motor disabilities. This approach fosters a greater democratization of learning, helping to reduce inequalities and enhance equity.

The benefits of educational technologies extend beyond these aspects. They enable increasingly personalized forms of instruction that adapt to different learning styles, thereby promoting broader access to education and strengthening equal opportunities and inclusion.

In this context, teachers' awareness plays a crucial role in an increasingly digitalized society, as it allows them to offer students meaningful opportunities to acquire digital literacy skills—including computer literacy, media literacy, and digital citizenship—along with the ability to critically analyse and responsibly use digital resources, while also navigating issues related to sustainability.

Within this framework, genuine differentiation is possible only when teachers understand the characteristics, specificities, potential, abilities, and personal experiences of each individual learner. Additionally, it is essential for teachers to determine whether the educational offer aligns with students' motivations, curiosities, levels of attention, and personal interests. Finally, understanding students' learning styles is fundamental—that is, recognizing the ways in which they prefer to work in order to achieve optimal results. This includes whether they perform better independently or in small groups (whether they respond more effectively to oral or written instructions, whether visual supports are essential to sustain their attention, and whether they benefit from substantial movement or prefer a more sedentary learning environment etc). (Buccini, 2024).

6. The Teacher's Role and the Design of Informed Instructional Practices

The increasingly perceived need within schools to create personalized learning environments aligns with a broad body of research and regulatory frameworks (Law

53/2003) highlighting how the advent of digital technologies—now pervasive in educational processes—requires every teacher to develop a high level of pedagogical awareness in the use of digital tools. With the introduction of digital technologies, the teacher's role undergoes a profound transformation. Each teacher is expected to promote critical awareness in the use and instructional design of technologies, ensuring that their potential is directed toward enhancing students' cultural competencies by strengthening critical thinking and fostering ethical reflection.

This perspective underscores the close relationship between technology and teachers' level of awareness in selecting the most appropriate instructional practices (Sharma & Chaudhary, 2020). The literature shows that teachers' technological knowledge is strongly linked to the selection of effective and meaningful teaching methods (Haksale et al., 2024). Instructional practices that employ technology consciously allow for more targeted and meaningful education, avoiding approaches that are purely procedural or driven by technology itself. Instead, they promote the genuine integration of digital tools into learning processes. At the centre of this perspective stands the digitally aware teacher, since the adoption of technological tools holds little value if it is not accompanied by a thoughtful transformation of instructional practices.

Teachers' digital awareness comprises:

Technical awareness:

- Understanding the functioning, limitations, and potential of digital tools;
- Recognising the implications of platforms, algorithms, and online environments.

Pedagogical awareness:

- Selecting technologies according to educational objectives;
- Designing activities that meaningfully integrate digital media;
- Understanding the cognitive effects of different digital stimuli (text, audio, video, interactivity).

The role of school governance is fundamental, as its focus is on efficiency, effectiveness, and the quality of services aimed at students' success. For this reason, strengthening digital awareness requires teacher training to be supported by regular monitoring of outcomes through in-depth analysis of implemented actions. Tools such as reports, checklists, and other evaluation methods help verify the effectiveness of instructional practices, identify strengths and weaknesses, and progressively improve educational strategies. Only continuous, reflective, and collaborative professional development enables teachers to acquire genuine digital awareness, which translates into responsible and effective use of technologies in school settings.

Furthermore, the use of models such as TPACK and SAMR (Muslimin, Mukminatien & Ivone, 2023) provides valuable support for assessing and validating the integration of technology within instructional processes.

Designing effective educational interventions requires shared responsibility and coordinated commitment from families, school leaders, and health services, in order to ensure timely remedial actions and subsequent personalized pathways (Cottini, 2016; 2017; Buccini, 2024). It is therefore necessary for schools to promote continuous teacher training, active family involvement, and critical evaluation of the inclusive tools adopted. Schools are called upon to develop effective digital governance to ensure coherent planning of activities and to adequately respond to the needs of the school community.

7. Social Implications, Relationships, and Risks of Technological Dependence

In addition to the opportunities it offers, the use of digital technologies in education also presents critical issues that require careful reflection. Technologies influence relational and interpersonal dynamics, reshaping the ways individuals communicate and collaborate within educational communities. On the one hand, digital networks can support the creation of collaborative learning experiences; on the other, they may exacerbate situations of isolation, distraction, and dependence. These digital tools “are no longer confined to specific functions but act as genuine agents of control and orientation of our mental and relational habits. They enhance cognitive and operational capacities while simultaneously shaping and directing our behaviours indirectly. Their impact does not merely improve existing processes; it radically alters the boundaries between the organic and the inorganic, between the real and the virtual, and between fixed and dynamic identities” (Sebastiani, 2024, p. 46). In line with this perspective, it is worth noting that “numerous studies show a ‘non-significant difference’ in learning outcomes when technologies are used merely as vehicles for content delivery; other studies, however, which analyse their use as ‘cognitive tools’ for collaboration, construction, sharing of experience, and representation of knowledge, highlight an improvement in learning” (Marconato & Litturi, 2008, pp. 3–4). Preventing the risks associated with technological dependence therefore represents a significant educational challenge, requiring a moderate, critical, and conscious use of digital tools. In this context, the role of teachers is crucial in promoting students’ psychological well-being and guiding educational practices toward an appropriate and sustainable use of digital technologies.

8. Towards a Critical and Sustainable Digital Citizenship

Education for sustainable digital citizenship represents one of the central aims of contemporary schooling. It extends beyond the development of computer and media literacy skills to include the ability to critically analyse digital resources and to use technologies in an ethical, responsible, and informed manner, taking into account their social, environmental, and economic implications.

Within this perspective, teachers’ digital awareness assumes a strategic role, as it enables them to guide students in acquiring the competencies needed to navigate the knowledge society critically and to participate actively in the construction of a digital culture oriented toward sustainability. Educating for digital citizenship therefore means promoting responsible and inclusive behaviours, raising awareness of the risks associated with technology use, and enhancing its potential as a tool for conscious participation and sustainable development.

It is therefore essential to monitor issues such as privacy, security, data profiling, and the responsible use of digital platforms and environments, as well as to consider the impact that the web may have on relationships and on active participation in educational and social contexts. Such monitoring is crucial to reducing the risks of isolation, social and behavioural inequalities, overexposure, and dependence. According to major European frameworks such as DigComp and DigCompEdu (Fabri & Soriani, 2021), digital literacy encompasses computer literacy—namely, the ability to understand how devices function and to manage files, software, and

operating systems—and media literacy, understood as the capacity to evaluate the reliability of information, recognise manipulation and misinformation, and produce responsible digital content.

9. Conclusions

The analysis of the literature demonstrates that technological knowledge is essential for addressing the challenges posed by digitalization in the educational sphere. When used thoughtfully and analytically, digital technologies can serve as effective tools for personalizing learning, promoting inclusion, and supporting the development of students' cognitive, social, and ethical competencies.

Fostering a culture of technological awareness requires sustained investment in teacher training and the development of instructional practices capable of understanding and managing the technical and cultural processes that shape today's educational experience. Such an approach promotes a conscious, inclusive, and meaningful use of technologies within education.

Digital awareness is not merely an accessory set of skills but a structural component of the teacher's professional identity. It facilitates the design of innovative, equitable, and sustainable learning environments and supports the development of students capable of navigating the complexities of the digital world responsibly and competently. In this regard, digital awareness represents an essential prerequisite for contemporary schooling, which demands the cultivation of critical, ethical, and interdisciplinary competencies.

The overarching aim, therefore, is the conscious, inclusive, and meaningful use of digital technologies—an approach that considers classroom dynamics while integrating ethical, critical, and interdisciplinary skills.

References

- Baddeley, A. D. (2012). Working memory: Theories, models, and controversies. *Annual Review of Psychology*, 63, 1–29. <https://doi.org/10.1146/annurev-psych-120710-100422>
- Buccini, F. (2024). *Personalizzazione didattica e inclusione. Come procedere? SIPEs – Studi sulla formazione*, 1, 1–15. <https://doi.org/10.7346/sipes-01-2024-06>
- Ciasullo, A. (2024). *Il futuro dell'apprendimento*. Milano: Mondadori.
- Ciasullo, M. V. (2024). *Tecnologie educative e comunità di apprendimento*. Milano: FrancoAngeli.
- Cottini, L. (2016). *L'autodeterminazione nelle persone con disabilità: percorsi educativi per svilupparla*. Trento: Erickson.
- Cottini, L. (2017). *Didattica speciale e inclusione scolastica*. Roma: Carocci.
- Fabbri, M., & Soriani, A. (2021). Le sfide della scuola in una società complessa: educare alla cittadinanza digitale per la costruzione di una cultura della democrazia. *Pedagogia Oggi*, 19(2), 1–18. <https://doi.org/10.7346/PO-022021-07>

- Guglielman, E. (2004). Le tecnologie digitali per la didattica tra innovazione e nuove competenze. *Life Design - Research and Education*, 2(2), 38-46.
- Haksale, R., Minay, S., & Mehwhiah, A. (2024). Teacher technological awareness and instructional practices in digital learning environments. *International Journal of Educational Technology*, 11(2), 45-60.
- Marconato, G., & Litturi, P. (2008). *Apprendimento significativo con le tecnologie*. Trento: Erickson.
- Mayer, R. E. (2009). *Multimedia learning* (2nd ed.). Cambridge: Cambridge University Press.
- Messina, L., & De Rossi, M. (2015). *Tecnologie, didattica e formazione degli insegnanti*. Roma: Carocci.
- Muslimin, A. I., Mukminatien, N., & Ivone, F. M. (2023). TPACK-SAMR digital literacy competence, technostress, and teaching performance: Correlational study among EFL lecturers. *Contemporary Educational Technology*, 15(1), 1-15. <https://doi.org/10.30935/cedtech/12921>
- Sebastiani, R. (2024). Implicazioni etiche ed educative dell'uso delle nuove tecnologie: un'analisi critica e prospettive di ricerca. *Annali di Studi Pedagogici ed Educativi*, 1, 1-20. <https://doi.org/10.7346/aspei-012024-04>
- Sharma, H., & Chaudhary, A. (2020). Technology integration in education: Teachers' awareness and ethical considerations. *Journal of Educational Research and Practice*, 10(1), 1-12.