

Digital tools and inclusion

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Abstract: This article focuses on the importance of technology - AI, ICT etc.- in inclusive education, mainly for students with special educational needs, who get to show their skills and to ease their learning. Technology in education includes the use of ICT tools, computational thinking and coding, paired with a hands-on approach and modern teaching methods based on students' real needs; it encourages interaction between mind, body and environment, using digital tools. Students practice active, integrated learning, like in robotics or coding, merging AI, ICT, and physical assistance. Digitally educated teachers, within scientifically well-structured learning spaces and communicating tools, can be successful in helping students acquire digital skills that will last a lifetime -through school, work, social community. Computational thinking and ICT use are now considered essential skills for consciously and critically navigating the modern world, which is increasingly influenced by digital technologies, automation, and artificial intelligence. Tomorrow's education must be conceived as an environment rich in opportunities where each individual can fully manifest their potential, cultivating not only cognitive skills but also emotional, physical, and interpersonal ones.

Keywords: technology; disability; skills.

1. Introduction

“Since the beginning of the new millennium, the concept of digital competence has received increasing attention from the European Union. With Recommendation 2006/962/EC of the European Parliament and Council, digital competence became part of the framework of key competences for lifelong learning, shaping the set of basic knowledge that compulsory education must promote: no longer, and not only, knowing how to read, write, and calculate, but also knowing how to use Information and Communication Technologies (ICT) critically and for a variety of purposes”. (RANIERI, 2022).

In recent years, the growing spread of digital devices, including in schools, has significantly changed the educational sector, creating new opportunities to foster the inclusion of students with Special Educational Needs (SEN). Digital inclusion represents the acquisition of skills that ensures every individual, regardless of age, ability, origin, or economic situation, the possibility to access, use, and understand digital technologies to contribute constructively to the digital world.



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Technology can be considered truly innovative and effective only when it is available and accessible to all. Inclusion implies providing a voice, opportunities, and resources to those in a disadvantaged position, and digital inclusion represents the new frontier of personal rights. The student will one day become a worker and a citizen: it is within this perspective that their life project must be built.

Over the past twenty years, the integration of digital technologies in education has led to a significant revision of teaching models, resulting in the emergence of practices focused on inclusion and the personalization of training pathways. The strategic use of digital tools has been identified as a potential lever to overcome barriers to learning and participation, in line with the principles of inclusive teaching and pedagogy.

The effectiveness of technology in facilitating school inclusion should not be taken for granted: it's influenced by a series of interrelated factors—instructional design, teachers' digital competence, the availability of adequate resources, and the school system's ability to flexibly adapt to individual educational needs and the PTOF (Three-Year Educational Offer Plan). Furthermore, not everyone agrees with adopting digital technologies, especially in school contexts characterized by socio-economic-cultural disadvantage.

“The human-computer interaction is today reinterpreted as a human-computer integration, in which human beings and soft computing are in a symbiotic continuum, and only an HC-Integration (HIInt) approach can express the current relationship between human agents and the machines/software that cooperate at multiple levels, including social levels.” (Santoianni, 2023).

Considering these observations, the present study intends to critically examine the role of digital tools in supporting the school inclusion of students with Special Educational Needs (SEN), focusing on assistive technologies, accessible digital resources, and the methodological strategies that support their effective integration in the classroom, which are also applicable in everyday situations outside the school context. Through a review of academic literature and the analysis of some significant experiences, the article aims to reflect on the opportunities for growth through the use of digital tools by both teachers and students.

2. The Inclusive Learning Environment

The concept of pedagogy applied to the design of learning spaces emphasizes the dynamic relationship between the individual and the educational environment, given that physical, environmental, and digital spaces have a significant impact on the formative process. A learning environment that is defined as inclusive represents a pedagogical and organizational creation aimed at guaranteeing all students, SEN (Special Educational Needs) or not, equal opportunities in terms of access, participation, and success in their school journey.

“The environmental elements directly or indirectly connected to the possibilities of learning play a substantial role in the formative function they are able to exercise.” (Ciasullo, 2024)

This environment isn't limited to integrating disadvantaged or disabled students, but requires a comprehensive transformation of the entire educational context, adopting a system-level approach and shared responsibility in the educational process. The creation of an inclusive context is facilitated by promoting collaboration, empathy, and the valorization of diversity. In this context, the teacher's role is funda-

mental in building an emotionally safe and welcoming environment, where every student can feel recognized and respected. Teaching implies influencing a person's path, and neuroplasticity has the capacity to change the ways in which one learns. Support teachers play a fundamental role in providing a basis for the systematic approach to the individualization of learning (Ciasullo, 2024).

“No longer are only the methods, the ways in which the teaching-learning processes are carried out, the tools, and the technologies essential for the purpose of structuring a significant training process, but also the constant exercise that a given setting can play in the organic composition of the implicit/explicit relationship of learning processes.” (Ciasullo, 2024)

An inclusive environment requires adaptable teaching approaches that consider the variety of cognitive styles, different initial abilities, and students' modes of expression. The use of digital technologies makes it possible to diversify training paths and materials, offering alternative ways for content access and creation. Often, the use of technologies can compensate for psychophysiological functions that would not receive adequate reinforcement (Ciasullo, 2024).

The inclusive environment becomes a dynamic and interactive space where digital technologies are tools, not definitive solutions. The effectiveness of such tools depends on how they are integrated into educational practice and the professional culture of teachers. It is not sufficient to introduce digital tools to promote inclusion: it is imperative that these tools are functional to a person-centered pedagogy and aimed at eliminating barriers to learning.

“Placing the student and their individual needs at the center; promoting active and collaborative learning; using new technologies creatively and innovatively; creating a learning environment that is flexible and adaptable to different needs.” (Ciasullo, 2024)

In the field of inclusive education, technology serves as a tool that can transform the learning context, making it accessible, adaptable, and participatory for every student, with particular attention to students with Special Educational Needs (SEN). Creating an inclusive learning environment, supported by digital technology, requires a change in mindset: from the traditional educational method to more participatory and personalized forms of teaching, in which the student is the center of the educational process. From this perspective, digital tools are not neutral but act as mediators in teaching, influencing how space, time, and educational interactions are organized. Technology has the potential to overcome sensory, cognitive, and physical barriers. In addition to cognitive aspects, it can facilitate social inclusion processes through appropriate platforms, participatory virtual spaces, collaborative educational games, and tools that respect various communicative styles, also with the aid of Augmentative and Alternative Communication (AAC).

“Materials, therefore, are also an essential part of the learning environment and are characterized as elements of mediation between the subject and the spaces designated for their formation. We could thus state that the classroom, as a place designated for education, exerts an implicit and explicit pressure on the learning subject, but the mediation that can be achieved is structured thanks to the significant use of materials that serve as a path of relationship between the subject and the environment.” (Ciasullo, 2024).

An inclusive digital context is also achieved through specific teaching techniques, where the careful use of technology allows for the personalization of educational

paths with the support of digital platforms. However, the use of technologies alone does not guarantee inclusivity. Teacher training on the inclusive use of technology often tends to be uneven or insufficient. In fact, it is necessary to specify that technology is effective if applied by prepared teachers: it is essential that they become skilled users of digital tools, studying their possible functions, in order to effectively adapt them to the educational context and the needs of students. This digital competence required of teachers is necessary to support inclusion in schools, to be able to knowingly analyze the available scientific evidence, and to offer critical, common-sense considerations on the problems that still exist in the educational system.

The integration of digital tools requires a systematic and organized approach, involving the curriculum, school organization, and collaborative work among teachers from different areas. Technology can truly become a valid factor for change to create inclusive learning contexts that promote educational equity and the participation of all. However, its effectiveness is conditioned by the quality of the pedagogical design, the competence of the actors involved, and the availability of adequate resources. Thus, a truly inclusive school environment is not only technologically equipped but is pedagogically based on principles of justice, respect, and the valuing of diversity, taking into account the time and abilities of each individual. Every situation must be open to everyone to foster connections between the school and the community; it is fundamental to initiate new practices that allow for the exploration of new research issues.

It remains an undeniable fact that no technological element can ever replace the human brain—and this should be constantly reminded to students—as it modifies, adapts, and can undergo every kind of change. Valid inclusion must be elastic and stimulate adaptation skills. Education is also based on the concepts of comfort and discomfort (*agio e disagio*), elements that facilitate or hinder learning and which are also observable in interaction with the students' daily reality, which is constantly evolving. The more an individual is open to change, the greater their ability will be to positively face those inevitable external and internal modifications to their situation that will influence their personal choices and growth. We know that through the acquisition of competences, an individual improves self-esteem and their relationship with the social and working environment, and digital competences become an essential asset that accompanies the person not only during their studies but also in the workplace and in daily life. One only needs to think of now 'normal' necessities such as home banking, SPID (the Italian public digital identity system), online medical bookings, or buying tickets for the cinema or concerts.

A further element that enriches the educational environment is Virtual Reality, which allows for overcoming the limits of the classic classroom. Traditional lessons, when supported by immersive and interactive environments, transform into fascinating experiences that engage the senses. Augmented Reality is used in various teaching processes; students can benefit from the immersive classroom and the Snoezelen room, environments from which different and enriching learning modalities can evolve.

In this context, the learning environment takes on a new form: it is no longer a place defined by walls and desks, but an articulated system where physical and digital elements integrate and blend to synergistically influence the educational process. The union of information and communication technologies is therefore essential to promote active, engaging, and meaningful learning. This experience transforms the

school into a space of discovery and innovation, capable of recognizing and valuing diverse forms of intelligence.

School inclusion is the result of a precise, programmatically realized pedagogical choice on the part of the teacher. Inclusion and digital tools are a fundamental pair for creating accessible learning environments where the student is at the center of active learning.

Artificial Intelligence (AI), along with other Information and Communication Technologies (ICT), has fundamental importance in promoting inclusion in schools, particularly regarding students with disabilities. These technologies not only offer greater possibilities for accessing educational materials but also allow students to reveal their abilities using customized tools that adapt to various learning and communication styles. The use of AI in the educational sector allows for the flexible modification of study paths based on individual needs, simplifying interaction with the educational context and supporting forms of active and conscious participation. Furthermore, artificial intelligence plays an important role in developing students' personal and professional autonomy because it facilitates the acquisition of skills valuable not only in school but also in the job market, thus providing greater opportunities for professional success.

In fact, artificial intelligence is not limited to providing automatic responses or performing repetitive tasks; it creates new opportunities for personalizing teaching and learning. Advanced algorithms are capable of examining the specific needs of each student, recommending personalized training paths, adjusting materials to their own pace of learning, and offering differentiated strategies based on cognitive, emotional, and behavioral abilities. In this way, education becomes increasingly open, available, and focused on the individual.

In recent years, technology has supported inclusive teaching and has served as a useful tool for learning various subjects. Technology and language teaching (Caon & Serragiotto, 2012) have made learning easier through the use of the internet in lessons, creating innovative and digital learning environments aimed at a constructive and bold approach to technologies.

Every individual takes on the role of director and main actor in their own learning journey, where metacognition fosters awareness of one's mental processes. The small environment of the classroom transforms into a large context where learning is diversified, adaptable, and accessible to all. Digital support guides towards environments of exploration where thought can express creativity and materialize. It is fundamental for teachers and students to use digital resources effectively in teaching (Ranieri, 2020).

In the complexity of contemporary pedagogy and with a focus on inclusion, integrated education offers resources and teaching proposals to promote a digitalized education. In this way, learning is conceived not merely as a transmission of information, but as an active process of knowledge construction through interaction, exploration, error, and discovery, to be internalized for the conscious use of the tools involved. To ensure that this process is truly effective, it is essential to provide students with appropriate stimuli, meaningful contexts, and resources that allow them to assimilate and transform the experiences they have had. It is in this context that the importance of adopting technological tools that support teaching, thereby helping to improve its effectiveness, is highlighted. Existence generates meanings; body and

mind will learn parallelly and similarly, especially when the classroom transforms into a laboratory that activates the individual's involvement in learning.

Technological and mathematical subjects are frequently seen by students as abstract, difficult, and, at times, poorly connected to their real-life experience. New technologies can generate new interests in students, increase the efficiency of their work, and change the way they interact with the surrounding environment. The introduction of Artificial Intelligence (AI) in the field of education offers real resources for the future of teaching, not only of scientific disciplines but also, for example, of linguistic ones: the more clearly one expresses oneself, i.e., the clearer the prompt, the more effective the AI's response will be.

3. Robotics, Computational Thinking, and Virtual Reality

The previously mentioned robotics, for example, allows for the creation of a collaborative educational approach, where Artificial Intelligence and Information and Communication Technologies integrate, and tools and materials merge to create active, engaging, and revolutionary learning experiences. However, to create a successful educational system, it is not enough to simply bring technological tools into the classroom: the valorization of human capital cannot be stressed enough, meaning training qualified and conscious teachers who are able to guide students through stimulating and well-structured learning experiences. It is also crucial to plan clearly defined learning spaces that meet strict scientific and pedagogical standards and that encourage curiosity, creativity, and active involvement.

Educational robotics offers several benefits from a teaching perspective. Firstly, it allows students to acquire a deeper understanding of mathematical concepts as they use them in practical situations: for instance, calculations regarding angles, measurements, proportions, and algorithmic logic become essential elements in the design and functionality of a robot. Even in younger children, coding activities effectively reinforce spatial orientation and awareness, as well as basic topological and mathematical concepts. Additionally, programming offers the opportunity to discover the principles of computer science and electronics in a hands-on way, thus facilitating the development of computational thinking, which is now considered one of the essential skills for consciously and critically navigating the current world, increasingly characterized by digital technologies, automation, and Artificial Intelligence.

However, limiting computational thinking solely to knowing how to program would result in an excessively narrow view. It is, in fact, a mental attitude, a way of conceiving and addressing complex problems efficiently, creatively, and systematically. Starting from the foundations of computer science, one arrives at problem-solving (Wing, 2006).

Nevertheless, the advantages of robotics go beyond simple technical skills: it fosters creativity, improves problem-solving abilities, promotes teamwork, and supports autonomy in decision-making. Students must conceive, plan, build, and evaluate, following an iterative process that significantly mirrors the scientific method. Every mistake transforms into a learning opportunity, and every success represents the result of collective reflection and actionable execution. In this way, educational robotics presents itself as a link between theory and practice, between theoretical knowledge and real-world experience.

4. Conclusions

To ensure the effectiveness of introducing and integrating technology into teaching, especially for students with disabilities, neurodivergence, or Special Educational Needs (SEN), the design of well-defined learning environments is of fundamental importance. These environments must meet rigorous scientific and pedagogical criteria and must stimulate curiosity, creativity, and active participation.

In summary, the education of the future must be conceived as a laboratory rich in possibilities, where every individual can fully express their potential, developing not only intellectual but also emotional, physical, and relational skills—a place where the student feels safe and where error is seen as a constructive element in a path of improvement. Only in this way will it be possible to face the challenges of the present with awareness and build new horizons for the future.

The use of ICT (Information and Communication Technologies) in inclusive schools has generated, over the past twenty years, significant concrete evidence regarding the effectiveness of teaching and the engagement of students with SEN. During these years, various studies have highlighted how the use of accessible digital tools—such as support software, electronic concept maps, text-to-speech tools, and online learning environments—has led to an improvement in academic performance, an increase in learning motivation, and an enhancement of students' operational autonomy.

In particular, a favorable effect on active participation in educational activities has been noted, due to the possibility of adapting content and curricula in line with the principles of Universal Design for Learning (UDL). ICT also promotes social inclusion by facilitating peer interactions through collaborative digital spaces and Augmentative and Alternative Communication (AAC) tools, which are invaluable in cases of communicative or cognitive disabilities.

Some studies conducted in Europe (European Agency for Special Needs and Inclusive Education, 2019) also highlight an increase in the perception of self-efficacy among students with disabilities, who, through the use of ICT, manage to overcome the traditional limitations associated with paper-based materials, predefined time limits, or single methods of assessment. This helps to form a context where equity replaces equality, viewing diversity as an educational asset rather than an obstacle.

Despite the positive results, disparities in access to technologies still exist, caused by socio-economic, geographical, and cultural factors. Furthermore, heterogeneity remains in teacher training regarding the design and management of inclusive teaching paths through the use of digital tools. Without adequate teacher training, without tools, but above all, without a strong motivation linked to planning, it is not possible to achieve significant results and have positive impacts on teaching. The focus must be on developing socio-emotional skills by reducing phenomena of micro-exclusion; the focus must be on creating accessible learning environments where the student is at the center of active learning in which technology offers new opportunities for growth. In this way, there are more learning opportunities, school dropout rates are lowered, especially in at-risk areas, and everyone discovers they have diverse abilities and develops greater competencies. The use of ICT also offers online and offline actions that can be used in various real-life contexts, without forgetting to consolidate basic learning, use textbooks, and always leave room for the frontal lesson that precedes any action directed at digital tools.

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