Learning Environments and New Technologies: Pedagogical Perspectives for the development of Inclusive Educational Scenarios

di *Francesca Latino, Francesco Tafuri*[*]

Abstract

The ongoing technological revolution in the present era brings forth new demands within the realm of education, necessitating the creation of innovative pedagogical and educational encounters. Learning through technologies serves as a framework to facilitate teaching, enabling the introduction of new experiences and social practices aimed at generating new knowledge and competencies. Within this framework, the realm of physical education demonstrates substantial interconnectedness with the application of technological tools that can serve as assets for its advancement. Hence, the objective of this manuscript is to provide insights and novel viewpoints regarding the influence of emerging information and communication technologies on the processes of teaching and learning. Indeed, these new technologies enable the diversification of teaching approaches, allowing all students to engage in knowledge acquisition through practical involvement and personal experimentation, thereby expanding the realms of perceptual-motor activities. By leveraging these new technologies, educators can create inclusive learning environments that cater to the diverse needs of all students, regardless of their abilities or backgrounds. However, it's essential to ensure that technology integration is done thoughtfully and with consideration for accessibility, equity, and inclusivity. Ongoing professional development and support for educators are also crucial to maximize the potential of these technologies in promoting inclusive didactics.

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Introduction

In recent years, technological evolution has led to the unstoppable development of teaching-learning models based on the use of digital technologies. The **digital dimension is now a widespread reality** in every sector and the world of schools must, therefore, be ready to respond positively to the challenges that new technologies can launch (Fabiano, 2020). Developing teaching processes in the age of digital natives means, in fact, the development of innovative teaching strategies in order to facilitate teachers in integrating technological tools within existing teaching methodologies. This objective has gained the utmost importance considering the demands for technological knowledge emerging from a labor market that is deeply committed to the digitalization process (Grządziel, 2021).

The significant disparity between emerging skills required in the labor market and the education provided in the mainstream school framework serves as a compelling catalyst leading to a fundamental reform of teaching practices (De Simone, 2023). Despite this, the introduction of digital technology in educational contexts remains a controversial topic that continues to provoke debates and disagreements. Digital competence, also known as digital literacy in educational settings, refers to the competence in using information and communication technologies (ICT) with familiarity and critical mindset (Lo Presti, & Zizza, 2024). This topic is of significant importance within the current pedagogical debate. While it is indeed correct to say that technology provides a motivation to transform the traditional approach to teaching, making it interactive and collaborative. On the other hand, it is clear that this digitalization requires deep efforts in an attempt to implement, within the school reality, technological equipment that facilitates the development of an educational curriculum tailored to meet the aforementioned requirements and the creation of well-organized educational programs (Navidad, Padial-Ruz, & Cepero González, 2021). Undoubtedly, the effectiveness of technology in enhancing learning lies in its facilitation of efficient pedagogical approaches, particularly in cases where it allows for the extension of time spent on educational activities and practice, promotes collaborative efforts, or addresses particular obstacles in the learning process (George, Rohr, & Byrne, (2016).

The integration of new technologies in educational contexts should be perceived as an opportunity to facilitate the process of knowledge acquisition. Information and communication technologies (ICT) provide means for collaboration, sharing, and task execution, enabling teachers to offer integrated education**.** Digital teaching is offered as an active teaching strategy, able to promote the active involvement of students and assess their skills in a more authentic context, fusing theoretical knowledge and practical skills, a scenario rarely found in traditional academic environments (van Hilvoorde, & Koekoek, 2018).

From a strictly curricular point of view, the integration of digital tools into teaching practice has initiated a process of change in the epistemological structure of the different disciplines that inevitably leads to conditioning the development of the educational process (Thomas, Hong, & Oates, 2017; Monacis, & Colella, 2019). This happens because the use of technologies determines a significant mediating effect between discipline and student, supporting a substantial change in the ways learners learn, in order to create what Colella (2016) defines as "*a re-setting of knowledge*". Any technology, in fact, modifies the social place to which it has been introduced. In the school environment, whether it is intended as a physical space or as a place of learning, when it welcomes new technologies, it undergoes a series of multiple changes that affect all the actors involved. In a school that has opted not to be excluded from the rapid and dynamic technological rise that characterizes our cultural context, there is a need for an education that is available to the "new" (Chiappini, & Manca, 2006). It becomes necessary, therefore, to think of a re-organization of spaces, times and contents that satisfies the need to make educational processes less theoretical and that integrates and completes, rather than trying to supplant, the conventional pedagogical approach. (Banville, & Polifko, 2009). In the field of education, ICT has a raison d'être in relation to its ability to offer new opportunities to implement and monitor the effectiveness of the teaching process. Therefore, they respond decisively to the need to personalize teaching processes, making it possible to create an integrated, rich, flexible and articulated training offer, in line with the indications of the European Commission's Memorandum on Continuing Education and Training (2005).

In addition, information, and communication technologies (ICT) enable the development and testing of new teaching resources, with the aim of promoting the fusion of conventional methodological approaches with innovative strategies, in order to solicit pupils' engagement and involvement (Clapham, Sullivan, Ciccomascolo, 2015).

Moreover, new technologies offer numerous possibilities for enhancing inclusive didactics:

- Multimodal Learning Materials: New technologies enable the creation of diverse and customizable learning materials that cater to different learning preferences and abilities. For example, multimedia presentations, interactive simulations, and digital textbooks can provide multiple modalities for accessing information, allowing students to choose the format that best suits their learning style.
- Personalized Learning Platforms: Adaptive learning platforms powered by artificial intelligence (AI) can analyze students' learning behaviors and preferences to deliver personalized learning experiences. These platforms can adjust the pace, content, and presentation of materials to match individual students' needs, promoting inclusivity by accommodating diverse learning abilities and backgrounds.
- Collaborative Online Learning Environments: Online learning platforms and collaborative tools facilitate interaction and collaboration among students, regardless of their geographical location or physical abilities. Features such as discussion forums, virtual group projects, and real-time chat enable students to engage with course content and peers, fostering inclusive learning communities.
- Accessibility Tools and Features: New technologies offer a wide range of accessibility tools and features to support students with disabilities. These include screen readers, text-to-speech software, closed captioning, and alternative input devices. By integrating accessibility features into digital learning materials and platforms, educators can ensure that all students can access and participate in the learning process.
- Virtual and Augmented Reality: Virtual reality (VR) and augmented reality (AR) technologies provide immersive learning experiences that can enhance engagement and understanding, particularly for students with diverse learning needs. VR simulations can offer hands-on learning opportunities in safe and controlled environments, while AR applications can overlay digital information onto real-world objects, providing additional context and support.
- Game-Based Learning: Game-based learning platforms and educational games leverage the motivational power of gameplay to engage students and promote learning. These platforms can incorporate adaptive features to adjust the difficulty level and scaffolding based on individual students' progress, making learning more accessible and inclusive.
- Mobile Learning: Mobile technologies such as smartphones and tablets enable anytime, anywhere access to learning materials and resources. Mobile learning apps and platforms can provide flexibility and autonomy for students with diverse needs, allowing them to learn at their own pace and in their preferred environment.

By leveraging new technologies in inclusive didactics, educators can create dynamic and accessible learning experiences that cater to the diverse needs and abilities of all students. However, it's essential to ensure that technology integration is done thoughtfully and with consideration for equity, accessibility, and inclusivity. Ongoing professional development and support for educators are also crucial to maximize the potential of new technologies in promoting inclusive learning environments.

The technological revolution also imposes new urgencies in the field of physical education, which is called upon to give shape to new teaching and learning experiences (Colella, 2016). In this sense, learning by means of technologies represents for physical education a methodology to support teaching for the implementation of new experiences and social practices that aim to produce new knowledge and new skills. In this context, physical education seems to have deep interconnection with the use of technological aids that can represent strengths for their affirmation (Robinson, & Randall, 2017). ICT, in fact, makes it possible to open teaching to learning modalities in which students, by participating in the process of knowledge linked to doing and experiencing firsthand, extend the domains of perceptual-motor work (Berthoz, & Jorland, 2004). Using technological aids, the body and the meanings attributed to it find full interaction.

The use of innovative technologies in the field of physical education has been directed towards the creation of authentic motor teaching-learning contexts (Colella, 2016). This aims to improve the quality and quantity of daily motor activities by offering engaging and fun activities. (Staley, 2004; Campos & del Castillo Fernández, 2016), on the other hand, they constitute a useful means of mediation and assessment of students' levels of learning and motor development. In the context of physical education in primary school, ICT allows the flexibility needed to improve and diversify the curriculum through the creation of engaging and fun learning contexts, with the aim of improving regular engagement in daily motor activities, promoting the drive to learn and encouraging the adoption of active lifestyles (Monacis et al., 2019). There are several studies that highlight the educational potential of digital aids in improving motor learning and enriching decision-making processes, developing perceptual skills and spatial-temporal orientation, and improving the acquisition of digital skills in relation to motor skills (Gallego-Lema, Munoz-Cristobal, Arribas-Cubero, Rubia-Avi, 2017).

However, this need for change, on the one hand, can represent a highly critical element in teachers' teaching and consolidated practices, and on the other hand, it can and must emerge as a favourable opportunity to over-

come some intrinsic limits of the discipline (lack of motivation, consideration by other teachers/pupils/parents, etc.) (Grissom, Ward, Martin, & Leenders, 2005).

According to Barron, Orwig, Ivers, and Lilavois (2001), the introduction of new technologies in schools represents an extraordinary opportunity for students to keep their students' motivation and *digital mindset* alive in a multisensory and diverse world. They suggest that new technologies affect many aspects of our daily lives and their integration into the school curriculum is no longer a luxury but must be understood as a necessity that determines 'survival' in a future that will be driven and supported by technology" (Barron et al., 2001).

The authors argue that including technology within the training process allows you to: i) Promote active learning; ii) Promote critical thinking; iii) Offer diversity, self-paced learning, and individual growth; iv) Motivate and inspire learners by making learning motivating and relevant; v) Provide flexibility to pupils with special needs; vi) Promote cooperative learning and increase teacher-student interaction; vii) Improve communication skills; viii) Provide information through multisensory channels (support learners using different teaching styles); ix) Helping learners build cultural bridges.

The growing debate on the importance of physical education in the framework of the Italian education system has brought to light, among the various challenges faced, that the modalities and approaches currently used in teaching practice arouse minimal involvement among students and consequently appear inadequate in terms of educational effectiveness (NASPE, 2009). The real critical point, in this sense, becomes that of knowing how to make the most of the potential of ICT, in order to implement traditional teaching practices. In this regard, in the USA the National Association for Sport and Physical Education-NASPE (2009) has published guidelines for the appropriate use of educational technologies in Physical Education. They essentially refer to the use of educational technology that is aimed at: i) Improve the quality of teaching; ii) To complete, without in any way replacing, the effectiveness of teaching; iii) Provide learning and education opportunities for all learners; iv) Serve as an effective tool for storing learners' data related to curricular objectives. Consequently, the challenge to which the School is called to respond today concerns first and foremost the preparation of the teaching staff, but also and above all the need to evolve from a teaching model centered on the contents to be learned to one in which the student's activity, the modulation of the paths and the collaborative dimension are central (Gashaj, Dapp, Trninic, & Roebers, 2021).

Realizing a participatory knowledge of the body

In contemporary educational discourse, according to the perspective of *Embodied Cognition*, the human being is an indissoluble unity, constituted in its unity of mind and body and as such must be understood in its entirety, in order to build a participatory knowledge of the body itself that allows one to experience acting in the world through the perception of one's own sensations and emotions (Damasio, 1995). Cognition is, therefore, a phenomenon structurally inseparable from corporeality, embodiment, and in particular from its sensorimotor bases, so that there can be no cognitive activity without a living body (Lakoff, & Johnson, 1987).

This orientation of educational action in the field of education argues that mind and body are closely interconnected to the point that the bodily dimension plays a significantly important role in the way we learn and teach. Embodied cognition, as a theory of learning, is based on the idea that cognitive mechanisms are deeply linked to human processes of interaction with the environment (Gomez Paloma, & Damiani, 2015). As a result, the body takes on a central role in shaping the mind to the extent that we experience, understand, and act in the world through our bodies. In this way, cognitive functions are influenced by the person's experiences with respect to the environment in which he or she is inserted. The diffusion of new technologies has reopened a strong dialogue on the possibilities of embodiment, with the advent of virtual worlds, the body and the meanings associated with it, rediscover a profound process of interaction (Fedeli, & Rossi, 2011).

The virtual world, in fact, allows a deep immersion of the students thanks to a multisensory involvement and the opportunity provided to the subject himself to build his own world, adapt it to his own needs and make it live through the movement of his body. Reviewed from a neuroscientific point of view, this phenomenon finds a connection with the concept of "*Umwelt*" (Berthoz, 2009), i.e. the specific sensory environment of an individual where the action developed by the body in motion is the result of every form of perception.

Regarding the virtual environment, the concept of embodied simulation also finds its own logic of connection. It concerns the brain's ability to activate the same nerve circuits responsible for controlling the execution of a motor gesture, through the simple observation of other people's actions or behaviors.

This activation is able to produce an automatic simulation called, in fact, embodied simulation (Gallese, 2005). This process is responsible for those

forms of learning that are activated when the behavior of an individual who observes changes according to the behavior of another individual who acts as a model. In the reflection on the use of *didactic mediators* of a technological nature, this assumes relevance in the light of a learning that is substantiated in a way in which the student learns by participating in the process of knowledge related to doing and experimenting in the first person, extending the boundaries of his perceptive-motor work (Riva, 2004).

Adopting the paradigm of embodied cognition with respect to the implementation of new technologies in the field of physical education teaching has extraordinary implications in educational paradigms, as this perspective necessarily implies re-design and re-planning of learning processes (Dourish, 2001). Within the school context, ICT is proposed as a critical model of learning/teaching towards didactic traditionalism that solicits and pushes towards new educational strategies, opening up to new interdisciplinary dialogues that emphasize and promote different integrated skills for the improvement of school processes (Gomez Paloma, 2013). For this process to occur, however, it is essential that there is a concreteness of the experiences and actions put in place in order to achieve solid learning objectives (Glenberg, Witt, & Metcalfe, 2013). In this perspective, the integration of new technologies in the teaching of physical education participates in the creation of those *embodied-based* learning environments in which the dialogic relationship between body-mind-virtual environment makes it possible to promote personalized teaching oriented towards the conquest of self-efficacy, autonomy, know-how and being of pupils (Holland, Wilkie, Bouwer, & Mulholland, 2011).

The creation of learning environments that incorporate embodied experiences, centered on individuals' awareness of their own corporeality and recognition of creative thinking in action and movement, can play a crucial role in improving not only motor competence, but also in promoting the development of various cognitive abilities (Jenson, & de Castell, 2009). The transfer of disciplinary contents through bodily experience facilitates the accessibility of different knowledge, which can be simultaneously linked to different cognitive and sensory-perceptual pathways. The body actively participates in problem-solving processes, facilitating the adaptation of different approaches to knowledge. It plays a crucial role in offering teaching support and creating a dynamic learning environment where different areas of knowledge, skills and personal development can be explored through participatory teaching. (Block, 2008). It is in this way that it is possible to create, through technological tools, a learning environment in which disciplinary and transversal skills are enhanced which, starting from subjectivity, from the individual needs of the person, from his bodily-

cognitive and emotional inseparability, leads to the construction of educational success. In this interpretation, physical education becomes a means of facilitation to modulate and promote privileged channels for access to knowledge (Beyerbach, Walsh, & Vannatta, R. 2001).

The introduction of ICT into teaching also presupposes the reorganisation of some established practices in schools. Specifically, it is a matter of reorganizing time, space and abandoning the rigidity and detachment that often characterize the relationship between teacher and students (Bottino, 2015). It means, therefore, rethinking teaching time in a more flexible and less linear way, without precise boundaries between teaching time and learning time. The space of teaching changes, the "reality" in which the various protagonists of the training intervention act changes.

A didactic approach supported by ICT makes it possible to facilitate and sustain experiences, involving the subject in interesting and motivating activities, which activate the awareness of acting thanks to the presence and awareness of oneself.

The role of immersive technologies in inclusive education

The new "*immersive*" virtual reality technologies open a world of new possibilities in the context of training and learning, allowing an *embedding experience* thanks to the use of devices that would give access to content-rich realities. Like the real world, virtual reality allows a total involvement of the body, which allows us to know the world through a learning process that exploits experiential modalities in which the body's perception and action skills interact in favoring the processes of cognition (Sibilio, 2002).

In the context of ICT, exergames have instrumental and applicative characteristics that make them suitable for carrying out physical education lessons. In a review of the literature on computers and video games applied to motor activities, Papastergiou (2009), argues that computers and video games can have a significant effect in improving the psycho-physical well-being of children. Coshott, Thin, and Young (2009), define exergames as "*that positive experience of effort obtained by combining exercise and multimedia games (software and hardware)*."

Exergames can be classified as a category of video games in which the interaction between the player and the game is facilitated using a handheld device or by the physical movements performed by the individual and captured through special human-machine interface technologies (Wenz-Gross, Yoo, Upshur, & Gambino, 2018).

The experience provided by virtual reality leads to a phenomenon of deep immersion of the student thanks to a multisensory involvement and the opportunity to build their own world, adapt it to their needs and experience it through the movement of their body. Using exergames, the student is involved in the learning process within digital environments. The spread of virtual reality has provided new interpretations of the concept of embodiment, particularly in relation to the possibility of creating a new virtual body (avatar) allowing people to incarnate in bodies that are different in structure, size, and morphology from those of real bodies (Pasco, Roure, Kermarrec, Pope, & Gao, 2017). The *avatar*, i.e. the 3D graphic representation (three dimensions: length, width, depth) of the virtual character, can promote the learning processes conveyed by videogames by taking on a dual guise. In fact, it can represent the model to be learned, or the 3D representation of the user so that he can reproduce his motor actions. These two avatars can coexist in the same digital place just as the teacher and the student coexist in the same classroom or in the same gym (Sgrò et al., 2016). The avatar thus becomes an embodied entity interacting with a 3D environment that the student himself helps to create. Interpreted in a neuroscientific key, the avatar brings to light the meanings attributed to the body, highlighting the mind-body-virtual world relationship in enactive knowledge processes (Rossi, 2011). Reading the didactic relationship and ICT from the perspective of enactivism requires recognizing the body as a tool that allows the individual to immerse himself in the virtual situation, live it and feel it on himself (Marsh et al., 2009). It is in this scenario of *participatory corporeality* that virtual reality allows a vision of the body considered as an integral part of the learning process conveyed through new technologies.

In this context, a perspective focused on physical literacy suggests that motor and digital literacy play a complementary role in counteracting the increase in sedentary behaviors. The correlation between physical literacy and digital literacy (Gilster, 1997) is rooted in the concept of game-based learning, which postulates that play acts as a mediating factor in the learning process (Colella, & Monacis, 2022). In this sense, it is possible to take advantage of activities that involve the use of digital devices in order to improve the gaming experience aimed at increasing the effectiveness of learning processes. The use of exergames makes it possible to implement a concrete opportunity to vary and enrich the curricular program in the field of physical education in primary school (Fiorentino-Holland, & Gibbone, 2005).

Papastergiou (2009), suggests that exergames provide the following advantages to the physical education lesson: i) They increase motivation to

exercise; ii) They help overweight children to improve their physical condition; iii) They support traditional teaching methods through the use of fun and engaging tools; iv) Promote the adoption of active lifestyles; iv) They promote the understanding of physiological concepts related to human movement; vi) They contribute to the improvement of skills and the learning of motor skills; vii) They offer different levels of difficulty (inclusion); viii) They allow the practice of motor activities in a safe environment; ix) They promote social interactions and teamwork through multiplayer modes.

The main elements that have the potential to improve the levels of daily motor practice of children and young people, encourage their learning and promote active lifestyles, derive mainly from the active participation required of students. This aspect perfectly aligns these video games with the fundamental principles that form the basis of the theoretical framework within the educational-training process. In addition, they constitute a teaching strategy that can meet the criteria of complexity, social interaction and authenticity that identify them as an adequate tool to support the teacher's didactic action (Lindberg, Seo, & Laine, 2016).

Therefore, it is clear that the integration of activities proposed through digital devices within the school curriculum makes it possible to improve motor learning and enrich decision-making processes, develop different skills, including perceptual skills, bodily self-awareness, spatial-temporal orientation, fine dexterity, hand-eye and eye-breech coordination, and, more generally, improve the acquisition of digital skills in relation to skills (Santoianni, Ciasullo, & Silva, 2023). The use of technologies is, therefore, positively correlated with the promotion of learning experiences capable of improving school performance and the cognitive functions associated with it, such as the ability to solve problems, formulate hypotheses, associate, integrate and memorize different information, recognize action patterns, understand cause-effect relationships.

The Exergames plays a significant role in inclusive education since they promote physical activity while engaging in gameplay. Inclusive education aims to provide opportunities for all students, including those with disabilities, to participate fully in educational activities. Exergames can be adapted to accommodate different abilities, allowing all students to engage in physical activity and benefit from exercise. Many exergames likewise offer accessibility features that can make them more inclusive. For example, customizable difficulty levels, adjustable game speeds, and alternative control options (such as using motion sensors, controllers, or touch screens) can help accommodate diverse needs and abilities.

Exergames often feature immersive and interactive gameplay experiences that can captivate students' interest and motivation. Inclusive education

emphasizes creating learning environments that engage all students, and exergames can be a valuable tool for achieving this goal by making physical activity more enjoyable and stimulating. Moreover, they can facilitate social interaction and collaboration among students, promoting teamwork and communication skills. Inclusive education emphasizes the importance of fostering positive social relationships and creating an inclusive community within the classroom. Exergames provide opportunities for students of all abilities to interact and cooperate while participating in physical activity together.

Exergames can be integrated into educational curriculum to enhance learning outcomes. For example, exergames that incorporate educational content or require problem-solving skills can be used to teach subjects such as math, science, or geography in an engaging and interactive way. Inclusive education seeks to provide diverse learning opportunities that cater to the needs and interests of all students, and exergames offer a dynamic and inclusive approach to learning.

Overall, exergames have the potential to promote inclusivity in education by providing opportunities for physical activity, offering accessibility features, engaging students in interactive gameplay, facilitating social interaction, and integrating learning experiences across diverse abilities and interests.

New technologies as an assessment tool

The integration of technological tools within physical education programs is fundamental, as it affects both the traditional methodologies of carrying out lessons and the evaluation of the specific learning outcomes of the discipline. In the second case, they represent a means of measurement and evaluation of an objective and quantitative type, compared to the traditional subjective and qualitative approaches (diaries, diaries, questionnaires, and surveys) that have always characterized the evaluation process of primary school in the field of physical education. The latter approaches, despite being widely spread and used, since they are based on the teacher's observation, have shown limitations in the correct identification of some determinants of the motor development processes of each student (Sgrò, Quinto, Pignato, & Lipoma, 2016). In fact, precisely because they are subjective, they can be influenced by factors such as memory, race, culture, or socioeconomic status of the sample under examination (Colella, Morano, & Bortoli, 2007). Objective tools, on the other hand, are more precise methods since they are not influenced by human factors.

The evaluation of motor activities is a moment as important as it is complex due to the multidimensional nature of motor activity itself. In the school environment, it becomes even more complex when the recipients of the evaluation action are children, and the objective is represented by the measurement of performance parameters during the performance of usual activities during the hours of physical activity performed at school.

In recent years, several scientific research have highlighted the importance of integrating digital aids with established qualitative approaches (Zhu & Cole, 1996). This integration makes it possible to identify at an early stage any difficulties on the part of the learners in the learning processes or, even more so, in their developmental processes. Among the technologies supporting the assessment processes, *Smart Wearable Systems* (SWS) and *Fixed Position Systems* (SPF) (video technology) play a leading role.

Smart Wearable Systems are smart, electronic, and technologically sophisticated devices with computational capabilities. They can be worn by students and are able to interact directly with the body. In recent times, there has been a growing trend in the use of wearable motion sensors, mainly attributed to their convenient handling and cost-effectiveness for non-invasive monitoring of motor activity parameters in real-time (Majumder, Mondal, & Deen, 2017). These devices can establish connections with various other devices, such as smartphones, using the wireless network system or Bluetooth technology. This allows for instant data discovery, collection, and sharing without requiring any kind of human intervention. Their main function is to record and visualize the functional parameters of the wearer, through sensors that allow you to monitor the movements and actions carried out. They represent a new technological frontier with great potential in terms of evaluation, as they can provide useful data to teachers to plan activities based on objective measurements, ensuring that each student has the opportunity to develop his or her skills and abilities to the fullest (Ladda, Keating, Adams, & Toscano, 2004; Duncan, Birch & Woodfield, 2012). Among them, IMUs (Inertial Measurement Units) or inertial sensors are able to measure the accelerations, angular velocities and orientation, with respect to the Earth's magnetic axis, of the body.

The various components supplied, such as accelerometers, gyroscopes and magnetometers, can be used independently or in combination. These devices include watches (smartwatches), T-shirts, shoes, pants, belts, headbands (smart clothing), glasses (smart glasses). They can detect and measure different parameters, in the spatial, temporal or frequency domain of motion, which can then be analyzed by algorithms that return information. Among SWSs, heart rate monitors, pedometers, and accelerometers are the most used sensors. In particular, Rowe et al. (2004), argue that pedometers,

tools capable of counting the number of steps taken by an individual (Montoye et al. 1996; Freedson & Miller, 2000; Oppert 2006), possess characteristics that make their use in physical education appropriate. In fact, they: i) They are non-invasive; ii) They are easy to use; iii) Most pupils, regardless of age, could be trained to use it very quickly; iv) They are cheap.

The latest generation models, in addition to quantifying the steps taken while walking or running, provide additional data on stride length, height, mass and energy consumption. However, these devices do not allow to evaluate the intensity of movement and the activities performed in a stationary position or with minimal vertical displacement (Collella et al., 2007; McCormack, & Giles-Corti 2002; PCPFS 2004; Ozdoba et al. 2004).

In a study involving pupils with special needs, McCaughtry, Oliver, Rocco, Dillon, and Martin (2008) showed that pedometers were found to be helpful in promoting increased daily physical activity in school-age children.

Another form of technology used to improve pupils' activity levels is accelerometers (Scruggs, Beveridge, & Clocksin, 2005). An accelerometer is a sophisticated instrument that can measure the movement of the human body. Using a piezoelectric transducer that exhibits bending characteristics when subjected to a force applied in a specific direction, this device quantifies the acceleration of a specific body segment with respect to one or more axes (Sirard, Ainsworth, Mclver, & Pate, 2005). During a movement, the body segment undergoes accelerations and decelerations that lead to the transducer flexing. This deflection determines the generation of a potential difference theoretically related to the applied force and, consequently, to the energy consumed (Colella et al., 2007; Montoye et al., 1996; Melanson, & Freedson, 1996; Westerterp, 1999; Oppert, 2006). Its use makes it possible to evaluate the energy consumption of the activities performed, the movements of the body district to which it is applied (usually the hip, wrist or ankle) (Mezzani, & Giannuzzi, 2000) and to define individual behavioral profiles related to motor activity, as it is able to measure the total quantity and intensity of motor activity itself (Colella et al., 2007; Freedson, & Miller, 2000; Oppert, 2006).

The SPF, mainly based on the use of video footage, is a useful and validated tool for monitoring even complex activities (Cippitelli, Gambi, & Spinsante, 2017). However, they restrict the user's movement within a specific range.

Through video technology it is possible to conduct a highly qualitative study of students' motor performance as they help to understand the phases of motor learning and didactic-methodological strategies (Bortoli, & Robazza, 2016).

Specifically, it allows for the following actions (Colella, & Vasciarelli, 2020): i) Visualization of the motor task; ii) *Feedback*; iii) Critical reflection; iv) Evaluation and self-evaluation of activities; v) Absence of time and space constraints; vi) Increased motivation and commitment; vii) Active involvement in the process of discovery and problem-solving; viii) Improved performance.

Video technology can have a significant impact on teaching-learning processes as it allows the teacher and the student to review a motor or sports gesture and receive feedback about the correct performance of the motor action. Through its use, it is possible to obtain greater involvement of the students, increasing their motivation.

Conclusions

The growing interest in methods and tools to improve learning has brought to light new dimensions in the area of research in the educational field, in order to find advantageous pedagogical implications that are functional to the training of the student. In the context of teaching-learning processes, research conducted on a neuroscientific and pedagogical level has highlighted the significance of *corporeality* in its action in movement. The great *mismatch* between the new skills required by the world of work and the training guaranteed by the classical school system represents a powerful spur in the intent to develop innovative teaching models capable of offering new opportunities to implement and monitor the effectiveness of the teaching process. In this context, new technologies have the potential to revolutionize inclusive didactics by offering innovative tools and approaches that cater to diverse learning needs.

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