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ORIGINAL RESEARCH ARTICLE

# Technology to support sustainable education in physical education

**Francesco Tafuri[1,*], Emma Saraiello[2], Mattia Caterina Maietta[3]**

[1] *Heracle Lab Research in Educational Neuroscience, Niccolò Cusano University, 00166 Roma, Italy*

[2] *Department of Movement Sciences and Wellness, Parthenope University, 80100 Naples, Italy*

[3] *Faculty of Human Sciences, Pegaso University, 80100 Naples, Italy*

*** Corresponding author:** Francesco Tafuri, francesco.tafuri@unicusano.it

## ABSTRACT

Sustainable Development is an action programme of the European Agenda 2030 to protect people, planet and prosperity, this programme was signed by the governments of the member countries of the United Nations Organization in September 2015. All European countries recognize the importance of Education and Physical Education and how, as a consequence, schools can implement the goals of sustainable development using the various tools of increasingly digital and technological education. The paper proposes an examination of the literature and some of the technological tools known to date aimed at the didactic support of physical education aimed at the promotion of sustainable development. In addition, the work is enriched with an analysis of the current situation with an interview, administered through the Google Forms tool, addressed to Physical Education teachers working throughout Italy.

***Keywords:*** sustainable development; physical education; e-learning

## 1. Introduction

The European Agenda 2030 is oriented towards Sustainable Development and includes 17 development goals (Sustainable Development Goals-SDGs). In particular, it describes the global framework for nations' efforts to find common and innovative solutions to the increasingly urgent and insidious challenges facing the planet, such as climate change, the environmental crisis, poverty, environmental pollution, health, the health crisis, etc. In this panorama, education and training have a fundamental role to play in promoting resilient societies, able to respond effectively and jointly to the challenges of the planet. The 2030 Agenda recognises education as one of the main tools through which to teach and transmit the culture of sustainability, which encompasses four areas: human, social, economic and environmental, which if held in harmonious balance enable the full wellbeing of man and the planet to be achieved[1]. With this in mind, education, in an interdisciplinary vision, is called upon to design activities in a renewed way, including a sustainable perspective.

The ONU identifies education and in particular physical education as agents of change, through which a more sustainable world is to be built from the education of the younger generation. According to the Agenda 2030, the aim is to ensure, by 2030, that "all students acquire the necessary knowledge and skills to promote sustainable development through, inter alia, education for sustainable development and sustainable lifestyles, human rights, gender equality, the promotion of a culture of peace and non-violence, global citizenship and

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the appreciation of cultural diversity and the contribution of culture to sustainable development" (Agenda 2030, Goal 4)[2]. Thus, the process of education for sustainable development implies the transmission of values, attitudes, knowledge, and skills that make learners capable of facing everyday challenges, but not only from an individual, personal well-being perspective, but from a broader, global perspective that considers human, cultural, social, economic and environmental well-being. Thus, from a local perspective, like a centrifugal force, one extends to a global perspective.

Therefore, education for sustainable development takes on a fundamental role as a potential tool to empower civil society to make conscious decisions and act responsibly for the protection of the environment, the sustainability of the economy, and the promotion of personal and social well-being. Considering education for sustainable development in educational programmes, particularly through physical education, means laying the foundation for a sustainable future by educating young people who represent the people and citizens of the future[3]. In line with the 2030 Agenda, educating for sustainability means becoming a citizen of the world by taking a broad, global and multidisciplinary view in respect of human rights, the environment and different cultures. In this regard, a number of objectives that the school must bear in mind in the context of education for sustainable development have been indicated, such as:

(i) promote a relationship with the environment and the resources within it; (ii) promote a relationship with natural and socio-cultural diversity; (iii) promote awareness of the complexity of global challenges in order to promote conscious everyday action; (iv) promote critical thinking so that the real contribution of innovation and technology can be recognised.

The school, in order to promote sustainable development, must necessarily consider three thematic nuclei:

(i) Constitution, since the study of the Constitutional Charter and national and international laws plays a fundamental role in the knowledge of one's own and others' rights and duties in order to promote everyone's civic sense for the maturation of responsible and active citizens; (ii) Sustainable Development, to foster knowledge, relationship and protection of common heritage, goods and territory. In this context, education for health, correct lifestyles and inclusion with respect for the rights of all is fully included. In this regard, physical education plays a key role in education for sustainable development, which the UN[1] recognizes and promotes in order to achieve the Sustainable Development Goals. The fundamental role of sport and physical education in promoting education for sustainable development can be traced back to the fact that "it is based on the concepts of respect, understanding, integration and dialogue, and contributes to the development and fulfilment of individuals regardless of age, gender, origin, beliefs and opinions. Sport is a unique forum for action and reflection to transform our societies"[4]. (iii) Digital citizenship, which concerns the acquisition of the necessary skills to use digital tools, the use of the Internet in a conscious and critical manner, countering the language of violence and hatred. In this regard, the use of technology in physical education contributes to the promotion of sustainable development and to the promotion of innovative teaching that engages learners and conveys the principles of the European Agenda 2030.

Therefore, talking about sustainability means that schools must necessarily consider putting into practice programmes that foster the education of world citizens, in a broad and forward-looking perspective using effective and sustainable technological development. Promoting innovative education that considers sustainable development and makes use of technology means projecting teaching, schooling and education into today's globalized world, in which man is a citizen of the world; a world that connotes itself as a global village. According to McLuhan[5], to speak of a global village is to decentralize the point of interest and observation from a subjective, capillary view to a global, broad and collective view. Thus, it is a matter of educating the man who lives in a village in which the characteristics of that territory are present, but who is projected into a global vision in which the vision becomes common and general.

At this point, the school, understood as the primary place of education and training, cannot fail to consider these aspects; therefore, when addressing the subject of didactics, reference is made to the concepts of teaching and learning, paying particular attention to the context in which the two actions take place. In reality, teaching today involves cooperative learning that does not merely involve the transmission of content, but makes use of various tools such as technology. In fact, there is a training path using a set of technologies called e-learning in a common learning environment. In such environments, one learns in a relational way so that multiple perspectives are considered to achieve the same goal by using different skills as resources for solving a problem. In this environment, the teacher assumes the role of a facilitator of learning and no longer just an informational support, enriching himself with content. E-learning is a methodological system in continuous evolution, where the learner is no longer a passive element towards which information is poured, but becomes active and dynamic in the exchange, prompted by the tutor whose interest is to develop thinking and reasoning skills. Thus, it becomes a place of learning that can be used also and above all to convey the principles of the 2030 Agenda in an innovative way. In detail, in this environment the language of speech is made visible, through the intellectual movement of thought, in speech embedded in a spatial context which in our case is in the network, and relational which in our case is in the learning group. Any technology supporting speech has a function of integrating and expanding the original concept of communicative exchange, fitting right in with its current ecological nature, redefining the boundaries within which exchange moves but not denying the primary rationale and didactic-educational principles.

In the first instance there is an interaction of the learner with the teacher but then progressively there is a move towards freedom of thought. After all, the figure of the teacher-trainer-tutor also has among his tasks that of creating authoritative trust, he needs to maintain his position as a guide and at the same time as a stimulus so that his personality is at first a point of reference and only later to be refuted and overcome in an autonomous and original form. What is described is exactly what happens in e-learning when the tutor-teacher adopts the most suitable means so that, in the absence of direct contact, he finds ways to initiate a dialoguing relationship of trust such as a video-presentation in which one explains what one is going to do, what the objectives are, how the course will be articulated while the participants see the face of the interlocutor and listen to the voice.

The reason for promoting the use of technologies to support teaching and, more specifically, a place of learning such as e-learning, is traceable to the fact that the contemporary world is "theorized as a global, socially interconnected and evolved collectively, where knowledge is recognised as a strategic factor for the development of evolutionary processes"[6] and the space on the Net as a large, immense, "symbolic arena" in which "knowledge is proposed not so much as a gradual process of acquisition through a linear and defined path as it is above all as immersion, sharing, exchange, interaction"[7], in which it is possible to promote a didactics that among its objectives includes those of Sustainable Development "in a learning environment in which meanings are produced, put into circulation and negotiated by the subjects"[8].

Learning times are respected and monitored in order to identify the most suitable strategy for achieving the objectives, the language must be understood by the counterpart, in any case it is imperative to use a comprehensible, simple, sparse, fast, dynamic, subtle vocabulary with the use of questions capable of revealing what the interlocutor is being directed towards. In the e-learning training modality, the preliminary analysis of the target audience, the learning object, the training objectives must be evaluated in such a way that it is organically functional to the training action, taking into account the communicative mediation. Therefore, rules are also observed in this context so that there is no diversion of notions incapable of stimulating interest and planning teaching and didactic action with the sustainable development-oriented vision of Agenda 2030 in mind.

In e-learning we find a type of language that is fast, dry, immediate, precise in its use of terminology but simple in its communication, expressions that are explicit, comprehensible, imparting a rhythm and breaking down topics into several levels of depth[9]. The teacher, therefore, uses the methodology of problem solving through new technologies as set out by the strategic objectives of the Union in the official act of the European Council "Lisbon Strategy"; to sustain employment, initiate economic reforms and build social cohesion through knowledge, education, skills upgrading and sector upgrading. That is why it is precisely in the didactics of physical education that these types of approaches are most commonly encountered; after all, it is more usual to borrow the language of sport, which connotes itself as a common language throughout the world and is incisive by nature.

## 2. Modern technologies to support sustainable education

The National Digital School Plan (PNSD) is the main planning tool for the digital transformation process of Italian schools, introduced by Law 107/2015, article 1, paragraphs 56–59[10].

The current Plan was adopted by Decree 851/2017 of the Minister of Education, Universities and Research of 27 October 2016[11]. It consists of a total of 35 actions, divided into four areas of intervention:

- Connectivity;
- Environments and tools;
- Skills and content;
- Training and accompaniment.

The National Digital School Plan is financed from the resources annually allocated on the basis of Article 1, paragraph 62, second sentence, of Law 107/2015, with resources from the NOP "For Schools -competences and learning environments" 2014–2020, with resources from the investment fund for financing digital teaching labs[10]. Over the past five years, approximately EUR 1.9 billion has been invested in the digital transition of Italian schools in implementation of the National Digital School Plan (NDSP). Currently, the NDSP is engaged in a multi-level strategy for the adoption, in all schools, of digital curricula, European digital competence frameworks (DigComp and DigCompEdu), innovative teaching methodologies and innovative learning environments, fitting into the new scenarios designed by the National Recovery and Resilience Plan (NRRP) and the European Structural Funds[12].

The transversal potential of digital in the classroom was reaffirmed by the 2007 National Digital School Plan (NDSP), which, through three main actions (LIM; Cl@ssi 2.0; Digital Publishing), aimed to modify learning environments in order to make teaching increasingly workshop-based and to stimulate experiential learning, based on a plurality of multimedia languages and on a network logic, capable of welcoming multiple contributions and shared responsibilities (MIUR: Italian Ministry of University and Research). Didactic innovation through digital technologies necessarily passes through the initial and in-service training of teachers who are called upon to reformulate traditional teaching-learning methods in the light of the potential that ICTs offer in terms of pedagogical accessibility and inclusion. The need for innovative ICT training is also affirmed by the European Commission, in the framework of the Europe 2020 Strategy (2015/C 417/04), recognizing the opportunity to train teachers to cope with the individual needs of learners, due to their increasing heterogeneity and coming from different social, cultural, economic and geographical backgrounds.

The current rationale is not only moving in the direction of catching up and assistance but also, and above all, in the direction of preventing school drop-outs and educational failure. The commitment is therefore directed towards the optimal use of innovative pedagogies and ICT tools[13]. EU schemes such as eTwinning, School Education Gateway and the Electronic Platform for Adult Learning in Europe (EPALE) were created with precisely these purposes in mind. However, the network problem should be highlighted because it exists

in Italy in several areas and regions, as revealed by the surveys conducted by the European Commission within the Digital Economy and Society Index, in which Italy ranks 25th (out of the 28 European countries) in terms of connectivity, Italy even ranks 27th[14]. The current competence-oriented education and training model and the imperative to integrate ICT into teaching and learning processes intensifies the need and challenge to rethink schooling from an integral, complex and global perspective.

The competence-based approach becomes a reference for pedagogical innovation[15,16] and a key player in the reconfiguration of the education system[17]. This new learning paradigm emphasises pedagogical practices and activities and social capital[18,19] as key aspects for overcoming institutional habits[18] in order to foster sustainable education and thus a healthy, inclusive and respectful lifestyle for others in a meaningful and effective way through the tools that new technologies make available.

Some of the aspects that the teacher must consider in his or her teaching programme that includes the use of technology are the promotion of the critical dimension and problem-solving in a reflective, sustainable manner and, last but not least, the encouragement of self-learning. In this way, as recommended by the UN, the motivational processes, critical thinking and civic sense of each individual as a responsible and active citizen are stimulated. Study paths should focus on the individual and his or her learning needs and enhance extracurricular experiences, stimulating both the critical dimension and problem-solving. "Online sharing and collaborative learning tools make it possible to disengage from the constraints of place and time and a broader customisation of learning paths, while enhancing individual contribution"[20].

Personalization means allowing each pupil to grow in accordance with who he or she is, i.e., a person who must be accompanied in realising his or her potential in order to achieve the excellence of which he or she is capable. One assumes that there are different "types of excellence"[21] and that every man can be exceptional in something if he meets an educator who believes in him. The teacher is responsible for facilitating meaningful learning processes also by using teaching tools and strategies capable of enhancing resources and "excellence", of responding to students' specific needs, constraints and characteristics. The Organization for Economic Co-operation and Development (OECD)[22] argues that the effective, sustainable and responsible use of multimedia platforms contributes to cultivating students' global competence by helping them capitalize on digital spaces, better understand the world they live in and responsibly express their voice online. Certainly, this requires capacitating educational contexts with respect to both infrastructure and the availability of the necessary technological tools, as well as the training of teachers, who are called upon to become promoters of innovative, sustainable and multidisciplinary teaching[23].

All this contributes positively to the construction of learning communities, including virtual ones[24] capable of promoting the inclusion of each and every one and fostering the development of knowledge, values, skills and abilities proper to global competence, which requires understanding and appreciating the perspectives and worldviews of others and engaging in open, appropriate and effective interactions for collective well-being and sustainable development[25]. In this way, making use of modern technologies in education means contributing to equitable and inclusive education and learning opportunities for all[1] and supporting today's young people in facing the challenges of society and the planet that, above all, require flexibility and personalisation. Of considerable interest are all the teaching work approaches defined as innovative, which through the adoption of techniques and technologies ensure the centrality of the student, whether disabled or able-bodied, stimulate their active participation and improve learning and training levels.

### 2.1. Technology in support of motor sciences

Technology applied to education represents a tool capable of amplifying the opportunities and strategies of the complex system that is teaching-learning. This system involves two parties in a relationship, and thus in

a two-way exchange, namely the teacher and the learner who becomes an active builder of his or her own knowledge. Technology multiplies human capabilities pointed out, "tools acquire their significance as amplifiers of human capabilities and complements to people's activities"[26], changing their form, structure and character.

From an educational point of view, technology can then be considered a tool that makes it possible to carry out activities capable of stimulating learning, as it facilitates the processes of thinking, exploration, discovery, construction of new meanings and knowledge, also making possible interaction, comparison and virtual collaboration not only with the software but also between user and teacher and/or group of users in training. Learning is the result of thinking[27–29] and such tools involve the person to the extent that they "directly bring cognition into play" as they predominantly interface with thought, imagination, feelings.

It is not improper, then, to speak of psychotechnology's: that is, devices that activate and structure profound elements of knowledge, consciousness, and sense of self, which broaden and give substance and articulation to the subjectivity of the individual and the group[30]. Integrating technologies into traditional didactics is useful, therefore, to promote meaningful learning and for this reason it is important to use them not only as content containers (repositories) but above all as learning mediators, cognitive tools, intellectual partners to stimulate learning by doing, as a social medium to facilitate conversational, collaborative, reflective, contextualised, intentional and constructive learning[31]. The teacher will have to rethink didactic strategies to employ those capable of fostering knowledge construction processes[32], oriented towards realistic and meaningful tasks[33], which stimulate the relational dynamics of a community that is not circumscribed but is immersed in a broad global panorama and that cooperates, collaborates and compares[34] negotiating meanings to produce contents and learning. Technologies enter such a system by reinforcing the prerogatives of the traditional didactic model based on face-to-face teaching and learning by reading and not as a substitute for or in opposition to it[35].

They are to be understood as enhancers/intensifiers of traditional didactic tools to intercept, encourage, promote, valorize, through their pedagogically grounded use, personalised and specific training paths, thus promoting education for understanding[36] and thus learning that originates from thinking in terms of constellations and correlations of concepts[37] facilitating the development of competences proper to a well-made head[38]. With respect to what has been said and analysed about the role of technology in education, we would like to put a lens on what topics and objectives can be dealt with in an innovative way within the discipline of exercise science.

New technologies applied to the sporting context are inexorably revolutionising both high-level practice, sports education, educational thinking and even theories of education. This changed global vision of the sporting phenomenon has influenced, and will undoubtedly increasingly influence, sports education, moving it far away from traditional methodologies. The field of science and technology in recent decades has strongly influenced all major aspects of human life and any formal, informal and non-formal learning context is no exception. Like the other sectors, the sport-motor sector is also affected by technological influence; therefore, thanks to numerous innovations due to research increasingly directed towards the use of technology in sport and motor activity, many positive aspects have been generated from the use of technology in motor and sport activity.

Whether it is amateur or competitive practice and competition, whether it is amateur or professional motor activity, there is now almost always a technological component, large or small, to characterize sporting activity. This phenomenon is now well established and the technological aspect is unlikely to be dispensed with as it has already brought about benevolent changes in the entire sports sector. In fact, one of the technological

innovations that has certainly been the most successful are wearable devices, whose convenience and simplicity to wear has simplified their diffusion. In addition, they have met with great interest not only in the professional sporting world, but also and especially in the amateur world, allowing people to receive information on their health and training status in real time.

It must be remembered that technology is not a substitute for motor and sporting activity, because if an athlete takes advantage of all the benefits of scientific innovations but does not train properly, he or she will never achieve the desired goal. Therefore, sport and technology must work together so that both can develop properly and so that technology does not take over from motor practice in everyday life. In this regard, education for sustainable development involves the promotion of critical thinking in order to enable people to recognise the benefits of technological development and at the same time recognise the risks of irresponsible and imprudent use of new technologies and digital systems. In detail, as far as the didactic field is concerned, the study on the didactics of motor activities can also make use of other types of tools, such as computers, video cameras and video analysis software; within the didactic field, technologies in general make it possible to follow the development of students' motor skills more accurately and to intervene through the remodelling of motor programmes.

These technologies are, in fact, able to provide support for the design and reshaping of teaching action, recognising scientific dignity to the processes of student assessment in the motor field. From what has been said so far, it is clear that technological tools can play a central role in the teaching of motor activities, enabling a didactic design of physical education taking into account the objectives of sustainable development, including, in detail, the promotion of quality education and the promotion of health and well-being. Therefore, from a didactic point of view, the contents that can be covered are: movement and motor skills, the various sports disciplines, the game-sport, sport and society, expressiveness, health and well-being, safety and prevention, i.e., we can range over all the objectives of motor sciences, taken from the National Curriculum Directions. For example, for "motor skills", the pupils can invent an original physical test, make a video, create an evaluation grid (following the teacher's instructions), give themselves a grade; for "spatial orientation", we can download the "Adidas running by Runtastic" app, make a drawing with the trajectory of the run performed and send the photo to the teacher while developing imagination and creativity, which are transversal objectives as per the European indications on the skills to be acquired; study the human body via Wordwall.net which allows us to create a virtual room and send the link to the students, where the teacher proposes and initiates the work and the students interact.

Highly motivating and engaging is a sports "challenge" where each student can invent a sports challenge, record the video, have his or her classmates send the video and edit the work and then submit it to the teacher. With "Learningapps.org" an account is created and students can access it, different types of games can be produced such as crosswords, memory, cruci puzzles, quizzes like the "millionaire". To involve students, virtual tournaments can be organised online via e-sports, i.e., via the mobile phone (as an inclusive tool since everyone has one), choosing a multiplayer game, the challenge is made; remember that e-sports have become a part of the Olympics! For expressiveness on "www.drawize.com" it is possible to create a virtual room, the teacher enters the keywords, sends the link to the students and the game is played: in turns the students draw and the others try to guess. Also, for the objective "health and wellness" we find several free applications such as "Samsung Health" where we find the pedometer and recommend it to the pupils to check the goal of 10,000 steps per day.

Pedometers are motion sensors capable of recording acceleration and deceleration along a direction of movement and are normally used to estimate or the number of steps in a given time. "Fat Secret App" that allows you to enter the food ingested during the day and provides calorie calculations and nutritional values.

"Save a life and first aid App of Italian Red Cross", useful for health and well-being and civic education goals. Students of all age groups are attracted to smartphone apps; therefore, it is good to exploit them in teaching PE, optimising results and obtaining more accurate data; not only that, they themselves can analyse their own training data. Another app used with smartwatches is, for example, "Polar Flow" with integrated GPS: it tracks the activity performed and instantly displays the results.

Equally useful and easy to use is the "Jumpster-Vertical Jump", just hold it in your pocket and jump to get a jump measurement and keep track of your best jumps, recording personal records. The different technologies proposed each have their own strengths and weaknesses. Subjective methodologies for assessing the level of physical activity are the most widely used tool, due to their simplicity of design, definition and use, as well as their relatively low cost. Objective methodologies are an appropriate tool for assessing movement patterns, especially in the transitional periods present in the motor development of each child.

Information technology and modern technologies are now an indispensable element of society and are asserting themselves within these educational paths, even more so, paradoxically, than physical education itself. It is necessary to encourage young people to carry out motor and sporting activities, both inside and outside the school context. For this reason, in addition to the IT solutions proposed in the educational context, it would be appropriate to include instruments such as the Nintendo Wii™ or the Xbox Kinetic™, both of which are Active Video Gaming tools, used by students to improve their awareness of their aptitudes in the various motor and sporting activities, providing them with precise and punctual feedback on what really characterises their activities. Teachers, on the other hand, can make use of this technology both to monitor, even remotely, the activities their learners carry out outside school hours, and to support or revise the proposed assessment of the exercises being tested. For example, the Xbox Kinetic™ tool is equipped with video cameras to provide the teacher with a qualitative analysis tool.

### 2.2. Analysis of technology use by exercise science teachers

### Survey methodology and instruments

In order to obtain a clear picture of the situation and to analyse the state of the art with regard to the use of technologies in the teaching of motor sciences in schools, an anonymous questionnaire was administered to fifty teachers at different school levels located and working in the country. Through the information obtained from the questionnaire, which was administered via the Google Forms tool, the aim is to clearly analyse how and whether school teachers use technology in education in the field of motor sciences. Education in the use of modern technologies is thus among the objectives to be pursued in order to raise the quality of education by giving students the opportunity to acquire the necessary life skills and knowledge to consciously use the various digital tools and functions.

In addition to what has been said, the analysis conducted has been elaborated from a perspective that includes the concept of Didactics 3.0, by which we mean a real information revolution, where the cornerstones are the computer lab, the constant presence of the interactive whiteboard, the transition from transmissive to interactive type lessons, promoting an interactive didactics that includes the creation of multimedia products such as blogs, wikis, social and cloud, together with the use of aids such as Google Drive, Dropbox and therefore shared material. Such aids can influence the collaborative construction of knowledge, problem solving in a context increasingly characterized by the presence of heterogeneous class groups with respect to age, gender, ethnic origin, etc., and foster the flexibility necessary for the diverse and increasingly complex needs of pupils[39]. Thus, the purpose of this survey is to find out whether teachers actually use technology to support teaching and whether they are aware of how to use ICT by following and monitoring the

teaching/learning process and are able to identify the effectiveness of the tools used according to the educational planning of motor sciences.

The questions that were put to the exercise science teachers have the following response options: a short answer, a long text answer and the remaining four with a choice answer: Yes; No; Somewhat; A little and Don't know. The first question concerns the years of teaching in exercise science, with the aim of getting a clear picture of the experience of our sample (**Figure 1**). The next questions are:

- Are you familiar with technologies to support teaching?
- Do you find technology useful and therefore use it in your lessons?
- Are educational support technologies an effective teaching method?
- Are new technologies useful for the development of pupils' skills and do they stimulate their curiosity?
- In your experience, have technologies improved your teaching methods and the quality of teaching in exercise science?

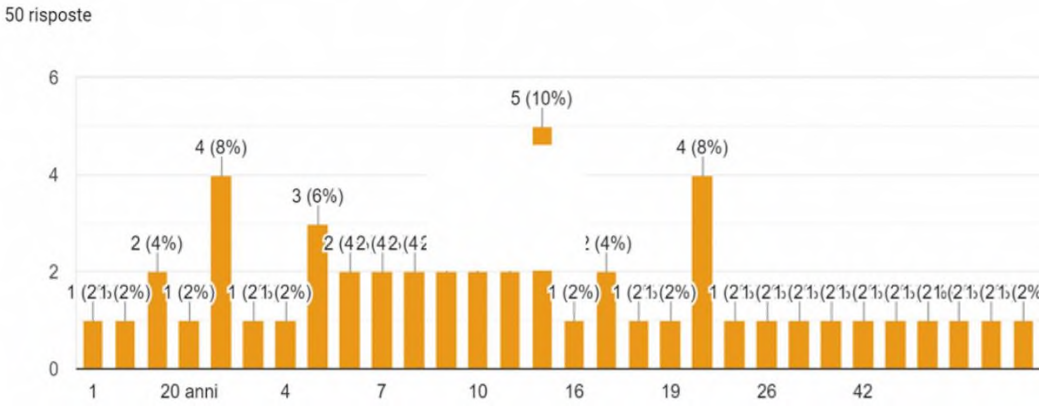


**Figure 1.** How many years you've been teaching physical education?

To the question "Are you familiar with educational support technologies?" almost all answered Yes, while a very small percentage admitted they were not familiar with them. From this first question emerges a widespread awareness of the need to keep up with the times and to offer high-quality education that involves everyone in the teaching/learning process. In fact, by National Digital School Plans, we mean a series of legislative interventions linked to certain school reforms from 2008 to the present day. These interventions include the introduction of the interactive whiteboard (LIM) in the classroom and precisely a new didactic approach as mentioned above. Obviously, the teacher must also possess digital competences adapted to the professional role in order to improve teaching and the learning process. Specifically, the teacher must know how to design activities with ICT, structure new didactic paths with the use of ICT, realize didactic contents always with the use of technologies[16].

Thus, digital competence, i.e., the ability to use technological tools for work and leisure, is defined as follows: "It is the competence of those who know how to use new technologies with familiarity, for the purposes of education, training and work. By way of example, the following are part of this competence: computer literacy, online security, digital content creation"[12]. Thus, for pupils, information and communication technologies must be the medium to be used consciously both in leisure time and in education. Thus, education for sustainable development, in this context, has as one of it aims the promotion of critical thinking from which derives the capacity for a conscious and critical use of technology-related tools and functions.

To the question "Do you find technology useful and therefore use it during your lessons?" a good percentage of teachers responded positively (**Figure 2**). It emerges from the graph that 50% consider the use

of technologies during PE lessons to be useful, 12% consider them to be useless; 20% consider the use of technologies to be not very useful, 16% quite useful and the remaining 2% do not know the usefulness of using technologies during PE lessons. This shows that, according to the sample, at least 50 percent use and consider useful technology during the physical education lesson, which underlines the widespread awareness of the importance of this tool to support teaching, which is necessarily called upon to renew its programmers in step with technological, cultural and social development. It is about going in the same direction as the world is going, planning and using effective teaching tools to train and educate the citizens of the world. For this to be possible, effective didactics is required, and in educational practice it is indispensable that the subject being educated is himself aware of the process of change he is experiencing.

An effective teaching method is one in which the learner is always involved and motivated[40]. Motor activity can create an atmosphere of cooperation between peers and fair competition in order to incentivize the learner to continuously improve[41]. But in order for the objectives, in general related to motor activity and specifically to the education and training of the individual with the transmission of universal values, to be fully achieved, it is necessary to implement a didactics that uses effective tools to carry out programming that considers the centrality of the learner but projected into a broader perspective, which is global, sustainable and forward-looking[42].

Therefore, through motor and sports education using technological and innovative tools, it is possible to promote the transmission of universal values that naturally affect learners with a wide resonance.

Therefore, it seems reasonable that the benefits of a sustainable and conscious education are not only limited to the personal sphere, but extend from a social, relational and global point of view by empowering learners with the appropriate skills and competences to cope with every day, social, territorial and global challenges.

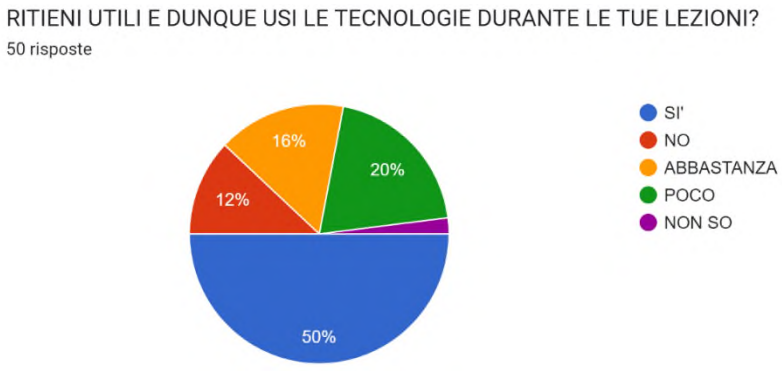


**Figure 2.** Do you find technology useful and therefore use it during your lessons?

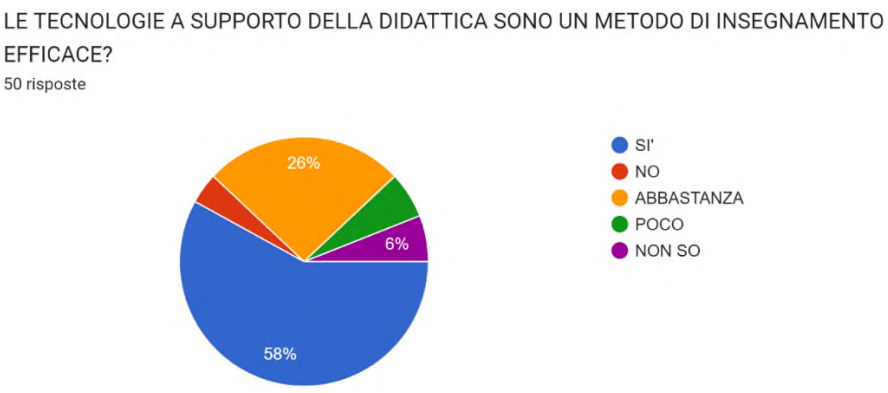


**Figure 3.** Is technology supporting teaching an effective teaching method?

It was asked whether: "Is technology supporting teaching an effective teaching method?" and the result was YES for 58 %, TOO MUCH for 26%, DON'T KNOW for 6%, POOR for 6%, NO for 4% (**Figure 3**).

To the question: "Are new technologies useful for the development of pupils' skills and do they stimulate their curiosity?" 70% answered YES and 2% NO, VERY much 14%, SOME 4%, and 10% DON'T KNOW (**Figure 4**).

Concluding with 52 per cent of teachers answering YES to the question "In your experience, have technologies improved your teaching and the quality of motor science teaching?" and NO to 4%, TOO MUCH to 24%, FEW to 12%, DON'T KNOW to 8% (**Figure 5**).


**Figure 4.** Are new technologies useful for the development of pupils' skills and do they stimulate their curiosity?

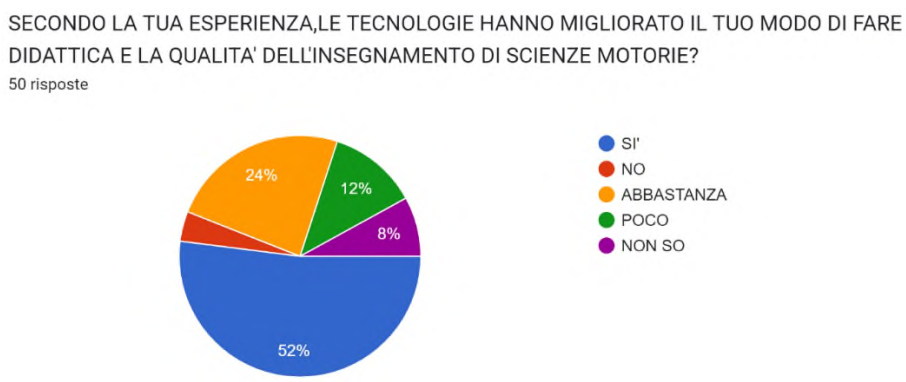


**Figure 5.** In your experience, have technologies improved your teaching and the quality of motor science teaching?

## 3. Results

The years of teaching of the interviewed sample ranged from less than one year to more than twenty years, the teachers responded from several Italian regions. From the analysis conducted, as can be seen from the graphs shown, it emerges that a good proportion of teachers are aware of the educational potential of technology, making it an integral part of their teaching of motor sciences in a functional way. The analysis shows that technology has a positive influence on the teaching of exercise science; in fact, 52% of the respondents responded positively to the question that they wanted to investigate the improvement of the teaching/learning process achieved through the use of technology in the teaching of exercise science.

This demonstrates the need to further implement the use of technology in view of its teaching effectiveness. Therefore, technology, understood as an integral part of educational programming that takes into account the different needs and characteristics of learners, should be identified in a broader and more comprehensive compensation perspective that can influence and enhance the growth and development process

of each individual. A further finding to emerge from the analysis conducted is that 12% consider them to be useless and 20% consider the use of technology to be of little use, which shows that a percentage of teachers use technology very little and do not integrate it into their lessons despite the fact that students, whom we can define as digital natives[43,44], easily use iPods, mobile phones, apps and other technological tools and finally, a very small percentage admit to not knowing about technology to support teaching. Therefore, it is clear that constant teacher training is necessary to keep up with the times, to design teaching that also follows global objectives, in order to offer an integral educational and training offer of quality, which considers every aspect of the learner and as well as citizen of the world. Thus, adequate teacher training would go a long way to solving problems encountered with respect to the use of IT tools and the difficult integration with the various teaching plans by teachers.

The situational analysis describes and analyses the current situation of exercise science teachers in schools of different levels and grades, and the data obtained from this research serves as a starting point for future developments in the area of sustainable education characterized by the use of technology in exercise science.

# 4. Conclusions

The school, as a formal learning community, has specific traditions and responds to precise socio-educational dynamics, so it is necessary to incorporate the context in which teaching practice develops into the analysis. Hence, the transformation of the teaching and learning process, called upon to effectively integrate new technologies into traditional models, implies a change in teachers' conceptions, attitudes and habits, as well as a new school culture and structure. A more widespread dissemination of knowledge of the most suitable software and hardware for teaching purposes is hoped for; a common reflection on the use of computer aids in school activities is also aimed for pupils with disabilities, with SLD and with SEN. Given the vase landscape in which the school operates, one must aspire to a general ability to use IT tools, as envisaged by the NDSP (National Digital School Plan).

In this regard, one of the objectives of sustainable development is education for inclusion, respect for everyone's rights, and it is the school that must guarantee this education also through personalized and individualized teaching with a Personalized Education Plan, the PEP, provided for in Article 5 of Decree 5669/2011[45]. This plan provides for the use of compensatory and dispensatory didactic and technological tools to replace or facilitate the performance required in the skill that is deficient; from this perspective, technologies are placed as a tool and operational support for innovative, sustainable and effective teaching without replacing the teacher or annulling the teacher/learner relationship[46].

In detail, as far as sustainable education is concerned, which, as we have seen, can be promoted by applying innovative and technological didactics to the motor sciences, teachers need to be constantly updated in order to plan their didactics with global objectives in mind, to fully educate mankind and by using effective and innovative tools that make didactics interactive and functional to the objectives to be pursued[45]. In this regard, with regard to the teaching of motor sciences to which the use of technology is applied, it is one of the tools through which to foster and cooperate to promote the achievement of some of the goals of Agenda 2030, including:

- "By 2030, ensure that all students acquire the necessary knowledge and skills to promote sustainable development through, inter alia, education for sustainable development and sustainable lifestyles, human rights, gender equality, the promotion of a culture of peace and non-violence, global citizenship and the appreciation of cultural diversity and the contribution of culture to sustainable development".
- "By 2030, substantially increase the number of young people and adults with the necessary skills, including technical and vocational skills, for employment, decent jobs and entrepreneurial capacity".

- "Building and adapting school facilities so that they are suitable for children's needs, disability and gender differences and provide safe, non-violent, inclusive and effective learning environments for all".

Within this framework, the teaching of motor sciences, making use of new technologies, allows for an equitable and inclusive education, creating learning opportunities for all, acting as a support for young people to face daily challenges, which must be read from a global perspective, as education for sustainable development promotes awareness of the effect of one's actions with respect to others and the planet, and thus means guiding children towards conscious and healthy choices. This requires, first and foremost, an educational programme that is flexible, sustainable and effective by placing the learner at the center and encouraging the acquisition and development of transversal and transferable skills in other contexts of life. Therefore, enriching didactic effectiveness is the use of technology, and given the technological development that characterizes our times, school didactic-motor processes are not excluded from technological influence, they, like the other fields of didactics, require specific tools that are compatible with their organizational, technical and legal constraints and that can be used through the application of methodologies that provide objective feedback that can be of help to the expert eye of the physical education teacher. Therefore, the analysis carried out helps to understand how a good part of school teachers use technology, but at the same time it is necessary to implement this use in order to enrich and raise the quality of the training and educational offer, as the school is called upon to interact with the territory to seek confrontation and cooperation between different subjects, between the world of school and the non-school world, understood as fundamental conditions that allow it to offer an extensive, sustainable and transversal education. The teaching of exercise science if well designed from a sustainable perspective, with innovative operational tools, enables experiential learning, equipping learners with the right resources to live as active citizens. Indeed, beyond the school walls, pupils interface directly with the world in all its nuances, as a whole and especially in its complexity, and in this regard, schools must offer quality education that provides learners with the opportunity to take a broad, global and multiple view; and at the same time to have the necessary tools to respond to the issues it will have to face on a daily basis. Thus, it can be said that an education and teaching programmer that favors forms of experiential learning through confrontation with the outside world and thus taking a global view[47,48], favors sustainable development consistent with the goals of Agenda 2030 designed to raise the quality of life of people and the planet as a whole.

The psychoeducational implications derived from this work may be summarized in 6 important roles that technology plays in education, namely: Enhances creativity and innovation, improves collaboration and communication, supports personalized learning opportunities, teaches students how to be responsible online, makes learning more fun, prepares students for the future. Technology, in fact, improves the learning experience by providing students with the tools and resources necessary to reach academic achievement. Technology has opened up a world of opportunities for students to be creative and innovative. With access to a wealth of information and resources at their fingertips, students can experiment, explore and bring their ideas to life. This type of hands-on learning is much more engaging and enjoyable for students and helps to foster critical thinking skills. Moreover, one of the main benefits of technology in education is personalized learning. With online resources and educational software, students can find information that is tailored to their needs, interests, and learning style. It is possible to claims, in fact, that technology has revolutionized the way students, teachers, and administrators communicate and collaborate, sharing ideas, working on projects, and staying connected no matter where they are. At the same time, teachers can teach students learn how to be responsible and make positive impacts in the digital world. The classroom becomes a mini version of the online world where students get to practice communicating, searching, and interacting with others. Incorporating technology in the classroom can not only make learning more interesting, but also help to reinforce the material

taught. One innovative teaching method, Game-Based Learning (GBL), involves using interactive games and leaderboards to deliver lessons, making the learning process much more engaging for students. Lastly, technology is a meaningful tool for preparing students for the future. The workforce is rapidly evolving, and technology is playing a crucial role to prepare students to be equipped with the skills they need to succeed in the digital age[49,50].

In conclusion, the innovative didactics of motor science teaching, starting from schools of all levels, promotes and encourages sustainable education in learners, i.e., that process of cultural recognition and acquisition of awareness with respect to inclusion and respect for the rights of all, human and social wellbeing, the promotion of a civic sense and the protection of the environment in order to spread a sense of belonging, love and care towards a common good such as our planet[1]. Therefore, this means educating for sustainability by promoting conscious choices oriented towards wellbeing, health, inclusion and sustainability in a global and no longer sectoral and selfish vision.

However, despite the several advantages of educational technology, the limitations should be considered as well. The most important limitation is that technologies are not able to solve all of our problems. The human brain is able to think in many different ways and there are certain things that technologies cannot do, such as come-up with new and original ideas.

Another limitation of technology in education is that it leads to tech disparity. Tech disparity refers to how much access students have to the necessary devices. The differences in access can be seen between school districts, or among students in the same school, where students from wealthier families having greater access. The final limitation of technology in education is that sometimes teachers may not want to take virtual classes because they not feel like real learning. They prefer classes in person so that they can learn more about their students, while also being able to see how much they knows about a subject.

Therefore, it is of paramount importance that future research will be direct towards a greater understanding by the teachers of how technology can improve their lessons through the right balance between traditionally teaching and innovative teaching. Moreover, it would be interesting to analyze the implementation of virtual and augmented reality, artificial intelligence and machine learning in the school environment as an integral part of the education experience, allowing students to immerse themselves in interactive, 3D simulations of real-life scenarios. In particular, artificial intelligence could play a significant role, with chatbots and AI-powered tutors providing instant feedback and support to students. While, machine learning could help to personalize the learning experience, making it more effective and efficient.

## Author contributions

Conceptualization, FT; methodology, FT; data curation, ES; writing—original draft preparation, FT; writing—review and editing, FT; visualization, ES; supervision, MCM. All authors have read and agreed to the published version of the manuscript.

## Conflict of interest

The authors declare no conflict of interest.

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