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TECHNOLOGIES IN PHYSICAL EDUCATION: PEDAGOGICAL AND DIDACTICAL IMPLICATIONS

UTILIZZO DELLE TECNOLOGIE IN EDUCAZIONE FISICA: IMPLICAZIONI DIDATTICHE E METODOLOGICHE

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Abstract

The use of educational technologies (ET) in school setting is progressively modifying the epistemological structure of the disciplines, conditioning the development of the educational process, influencing methodologies and enhancing students' motivation and engagement in learning. In school setting, the use of digital tools combined with innovative didactic methods (i.e. "brainstorming", "flipped classroom", "cooperative learning", "role play", etc.) helps children and adolescents to develop life skills, emotional intelligence, divergent thinking, and solicit different learnings styles in order to generate links between different areas of knowledge, structure mental concept maps and provide significant learnings. This paper aims to illustrate the modern pedagogical and methodological implications of using technologies and game-based learning for the teaching of physical education, highlighting strengths and limitations.

L'uso delle tecnologie educative (ET) in ambito scolastico sta modificando progressivamente la struttura epistemologica delle discipline, condizionando lo sviluppo del processo educativo, influenzando le metodologie, sollecitando i fattori psicologici correlati all'apprendimento. L'utilizzo di hardware e software digitali in ambito scolastico, unitamente ad approcci didattici innovativi (es. "brainstorming", "flipped classroom", "apprendimento cooperativo", "role play", ecc.), permette a bambini e adolescenti di apprendere life skills, sviluppare i diversi ambiti dell'intelligenza emotiva, il pensiero divergente, sperimentare diverse modalità e forme di apprendimento al fine di (a) creare delle connessioni strutturali e logiche tra apprendimenti differenti, (b) strutturare mappe mentali di apprendimento e (c) rendere gli apprendimenti significativi. Il presente lavoro si propone di illustrare le moderne implicazioni pedagogiche e metodologiche dell'uso delle tecnologie e dell'apprendimento basato sul gioco per l'insegnamento dell'educazione fisica, evidenziando punti di forza e limiti.

Keywords

Physical education, teaching styles, game-based learning, non-linear pedagogy

Educazione fisica, stili di insegnamento, apprendimento basato sul gioco, pedagogia non lineare

Introduction

The Educational Technologies (ET) are defined as fields "concerned with the design, development, utilization, management, and evaluation of processes and resources for learning" (Luppicini, 2005). The Association for Educational Communications and Technology (AECT, 2018) gives a more comprehensive and functional definition of ET, concerning the study of facilitating learning and improving performance by the use of technological processes and resources. Tablet, e-readers, visual projector, virtual-reality, electronic whiteboards and 3D printing are just some devices used by teachers to enhance learning.

According to Burbules et al. (2020) new technology in education influenced methodologies, but also the concept and scope of education itself, enhancing student's motivation and engagement in learning (Oluwajana et al., 2019; Ninaus et al., 2019).

Likewise, during the last 20 years there has been a progressive rediscovery of the importance of the game in different educational setting. Despite *play* and *game* are often used as synonymous the two terms differ a lot: "play" defines unstructured activity, and it is common referred as spontaneous play, active free play, etc. (Houser et al., 2016), while "game" is used to refer to an organized and structured play, with specific rules to follow (McGonigal, 2012).

Game represents a key aspect to develop fundamental movement, behavioral, language and cognitive skills, enhancing brain structure and executive functions, not only through childhood and adolescence but also into adulthood (Truscott, 2020; Storli & Hansen Sandseter, 2019; Yogman et al., 2018).

In recent years, various approaches of game-based technology have been developed in developmental age, such as educational games, games-based learning and gamification, so that a clear terminological definition is needed.

According to Al-Azawi, Al-Faliti, & Al-Blushi (2016) educational games help to improve learning a certain subject: an example of educational game could be to spell a word, after providing its meaning. Games-based learning are games structured to facilitate learning (Whitton, 2012), while gamification refers to the use of game elements, mechanics and way of thinking in non-game contexts (Al-Azawi, Al-Faliti, & Al-Blushi, 2016). Game-based learning and gamification are not synonymous: in game-based learning game is used to enhance a certain learning, while in gamification all the learning experience is structured in a game form (Al-Azawi, Al-Faliti, & Al-Blushi, 2016).

An example could be represented by reinforcing mathematics learning trough a game based on fundamental operations (game-based learning) and by studying the history of the Roman Empire entirely in a game setting.

According to Rahmatova (2020), a game-based learning experience should be structured considering:

- Correspondence between learning objects and learners;
- Educational value;
- Purpose and significance;
- Time spent in activity.

Recent findings suggest the effectiveness of technology game-based didactic can improve children's language learning (Shadiev & Yang, 2020), mathematic and geographic competencies (Verbruggen, Depaepe, & Torbeyns, 2020; Bondarenko, Pakhomova & Lewoniewski, 2020), problem-based learning (Jin & Bridges, 2014).

The aim is to create a playful mindset that encourage, enhance and reinforces students learning experience, making it motivating and enjoyable. (Gómez-Carrasco et al., 2020a; Gómez-Carrasco et al., 2020b; Schmid, & Petko, 2019)

1. Technology in Physical Education: Physical, Cognitive and Emotional Engagement

In the field of physical education and health promotion, the use of technologies has reached great interest from researchers during the last years (Brickwood et al., 2019; Ludwig et al., 2018). The development of Exergames (EXG) and Active Videogames (AVGs), defined as digital games that required total or partial body movement in a physical activity form (Benzing & Schmidt, 2018), derives from the need to reduce the time spent to sedentary activities in children and adolescents (O'Loughlin et al., 2020; Fu et al., 2019).

The term *exergame* is composed by the word exercise and game, referred to physical activity and video interface engagement respectively. Exergames are activity game-based, and consequently have all the intrinsic characteristics of the game itself: purpose, rules, number of participants, roles of participants, action planner, participants interaction, feedback, results and voluntary participation (Stenros, 2016). According to Vaghetti et al. (2018) the differences between exergame and traditional game is in the intensity, modality and immediacy of feedback, and this is an important motivational factor.

Xbox® 360 Kinect, Nintendo® (Wii, Wii U, Wii Fit with Wii Balance Board, all Wii Sports Games), Konami® Dance Dance Revolution Sony Playstation® (PS4 Move), and all other consoles involving whole movement of body are classified as EXG or AVGs (Vaghetti et al., 2018).

Findings have showed the effects of exergames in physical education in improving cardiovascular health and aerobic capacity (Chaves Costa et al., 2020; Polechoński et al., 2019), physical activity levels (Williams & Ayres, 2020; Ramírez-Granizo et al., 2020) motor skills learning and development (McGann et al., 2020; Medeiros et al., 2020), enhancing motivation in learning and socio-relational skills both in children and adolescents (Rüth & Kaspar, 2020).

Effect of exergame on cognitive engagement, nonphysical factors and psychological correlates are well documented by international literature (Andrade et al., 2019; Joronen et al., 2017;).

Gray et al. (2019) assessed the effects of the use of a smartphone cognitive game-designed in physical education in a class of 10years old children, providing positive engagement, emotive experiences and emotional regulatory feedback after 5 weeks intervention.

Different human behavior theories have been applied to study adherence and pleasure in playing exergames and active videogames, in order to underline the main important factor solicited.

Pham et al. (2020), starting from the assumption that engagement in exergaming is similar to doing exercise improving personal physical health, applied the use and gratification theory (UGT), according to which socio-psychological needs are most important motivators of human behavior, to demonstrate that health consciousness and perceived exercise benefits are linked to need of exercise.

Quintas et al. (2020) explored the possible application of the self-determination theory and its sub theories, Basic Psychological Needs (BPN), Cognitive Evaluation Theory (CET), Theory of Organismic Integration (OIT) to assess respectively the innate needs of motivation and well-being (competence, autonomy and relatedness), intrinsic motivation and extrinsic motivation playing exergame. Furthermore, the Dispositional Flow, that is the state of maximal concentration that facilitates performance on a specific task, and academic achievement in PE were also evaluated. Results showed positive changes in intrinsic motivation, external regulation, dispositional flow and basic psychological needs after exergaming interventions in primary school children (10-12 years).

2. Technology and Adapted Physical Activity

Recent findings have solicited the great associations and the effects of physical activity, physical fitness levels and healthy lifestyles on the cognitive development and the learning

process in children and adolescents (Jirout et al., 2019). The growing interest in exergame in physical education derives from their great versatility and the wide heterogeneity of the fields of application.

Studies in the field of *Adapted Physical Activity* (APA) show the improvement of gross motor skills acquisition in children with developmental disorders (Page et al., 2017), while Bonney et al. (2017) found that motor skills acquired in virtual reality are similar transfer to real world in both children with developmental coordination disorder and children with typically developmental development.

Benzing & Schmidt (2019) assessed the effect of 8-week exergaming practice on executive function and motor abilities in children with ADHD (attention deficit hyperactivity disorder), showing significant positive effects in both domains. The study of Peña et al. (2020) proposed a novel exergaming approach to vestibular therapy in children with autism, evidencing a higher psychological and physical engagement than children following traditional therapy. Caro et al. (2020) analyzed structural differences between traditional and commercial exergames and exergames designed for children with ADHD, showing (a) higher percentage of aimed limb movement, and (b) higher percentage of verbal assistance in exergame for ADHD children.

Staiano et al. (2018) suggested that exergames could have positive effects on BMI (body mass index) management, cardiorespiratory fitness and physical activity levels in overweight/obese children.

However, not all studies are in agreement with positive and effectiveness in practicing exergame, showing no significant results for this kind of intervention (Benzing et al., 2020; Hwang et al., 2019), and future research are needed to explore all the potential that technology can provide to health and physical education. At the moment, exergames and active aideogames intervention should be considered as a tool to support traditional therapy and physical activity intervention, and not replace them at all.

3. Implications for Teaching Physical Education

In school setting, the use of technologies combined with innovative didactic methods (i.e. "brainstorming", "flipped classroom", "cooperative learning", "role play", etc.) helps children and adolescents to develop personal, critical and logical thinking (Rahmatova, 2020), problem solving (Pratama & Setyaningrum, 2018) and collaborative decision making (Shadiev & Yang, 2020), in order to: (a) generate links between different areas of knowledge; (b) structure mental concept maps in which previous learnings are adapted and integrated by newest; (c) provide significant learnings (Moreno-Guerrero et al., 2020). Using technology and modern didactic strategies, teachers can ensure the quality of the educational process.

The use of digital tools in physical education is progressively modifying the epistemological structure of the disciplines, conditioning the development of the educational process.

Advances in physical education requires teacher not only to promote motor skills learning, increase physical fitness and acquire motor competencies, but also to expanding the opportunities with which children learn and play.

The increase in sedentary habits, the lower levels of physical and sports activity, and the consequent reduction of personal motor skills repertoire, linked to the increase in screen time of children and adolescents, allows to re-define the role of technologies, as educational technologies.

Through the use of technologies, in a pedagogical and methodological perspective, teachers can add to the "traditional" set of contents and equipment proper used in physical education, new environment and "virtual" learning tools, influencing the way in which students learn and play, and enhancing students' motivations and perception of self-perception. The great versatility and possibility offered in structuring an exergame led teachers to adapt intensity, duration, quantity, quality, intervals between series and repetition, executive difficulty performing a motor task.

In structuring a motor task, however, teacher should adopt different teaching styles, classified in reproductive or direct and productive or indirect, mediating the educational relation, according to greater or lesser degree of students' decision-making autonomy (Mosston & Ashworth, 2008).

Findings in education and neuroscience reveal that (a) the use of different teaching styles solicit more linked learning styles, that is the way in which children learn something new (Ridwan Sutresna & Haryeti, 2019; Colella, 2019), and (b) different learning styles develop specific and multiple cerebral cortex areas, suggesting their integration to enhance the learning experience (Dantas & Cunha, 2020).

For example, according to international guidelines children and adolescents should be active for at least 60 minutes (1 hour) or more in moderate-to-vigorous physical activity daily (US Department of Health and Human Services, 2018). In structuring an exergame activity teachers can introduce higher intensity activities (i.e., playing martial arts, run, jump, etc.) for a variable time interval, favoring compliance with international guidelines.

Furthermore, another important feature is the possibility to selecting which skills to learn (i.e., jump on one foot), and how to learn them (learning by imitation, by conditioning, etc.). The non-linear didactic approach (Chow, 2013) determines specific methods of learning, by discovery, problem solving and also has a strong impact on intrinsic motivation and enjoyment.

During exergames children interact with environment and other participants virtually, so in an ecological and non-linear pedagogical view, learning takes place with the body and through the body in a virtual environment, as an *expansion* of reality.

Conclusion

The international literature highlights some areas of application of educational technologies in teaching physical education, improving the quality of learning, and developing psychological factors related to motor activities, such as motivation, enjoyment and personal engagement. Educational game-based technologies allow the teacher to re-define the use of video games to promote motor activities in a natural and virtual environment, expanding the set of contents and equipment traditionally used in physical education and school motor activities and diversifying environments for the qualitative improvement in teaching process.

The metacognitive approach to educational technologies in physical education can expand teaching process, developing possible strong connections and relations between other disciplines (mathematics, foreign language, geography, history, etc.) to create an educational continuity of skills and learnings, following technological and socio-cultural evolution, and mobilizing motivation and attraction to physical activity in students.

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