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articoli

The body between movement and virtual reality: the Just Dance game and the improvement of the ability to coordinate balance

Il corpo tra movimento e realtà virtuale: il gioco Just Dance e il miglioramento delle abilità coordinative dell'equilibrio

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Abstract

Educational games have had a significant impact on the organization of the sense of many social practices: they motivate and maintain attention in various contexts, the information they convey is made accessible to a large number of users, the forms of literacy they allow are multiple. The educational challenge of the digital era of educational games is that of engaging and promote effective learning, even in early and early childhood contexts. This contribution, based on the findings of an experimental educational protocol of motor education in kindergarten and through the observation of digital parenting practices, explore the relationships between the use of Just Dance Game and the improvement of children's coordinating skills. The improvement of balance competence is demonstrated.

Keywords: digital natives; learning; simulation; serious games; physical education.

Sintesi

I giochi educativi hanno avuto notevole impatto nell'organizzazione del senso di numerose pratiche sociali: essi motivano e mantengono l'attenzione in vari contesti, le informazioni da essi veicolate sono rese accessibili a un numero ampio di fruitori, le forme di alfabetizzazione che essi consentono sono plurime. La sfida educativa dell'era digitale dei giochi educativi è quella di un apprendimento coinvolgente ed efficace, anche in contesti di prima e seconda infanzia. Il presente contributo, a partire dalle risultanze di un protocollo educativo sperimentale di educazione motoria nella scuola dell'infanzia e attraverso l'osservazione delle pratiche di *digital parenting*, esplora le relazioni tra l'uso del gioco Just Dance e il miglioramento delle capacità coordinative dei bambini. Viene dimostrato il miglioramento della competenza dell'equilibrio.

Parole chiave: nativi digitali; apprendimento; simulazione; serious games; educazione motoria.

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1. Introduction

In recent decades it has become essential to promote a sound scientific culture in education systems (Moscati, 2018). To this end, the European Commission's *Horizon 2020* programme underlines the urgent need to innovate the teaching practices of science education, both to improve the positive approach towards the learning of science, technology, engineering and mathematics, and also to enhance the acquisition of the soft skills needed in the output profile of the contemporary student to become an active protagonist of socio-cultural change (Guedj & Ramjoué, 2015). The devaluation of the codes and languages of traditional communication now considered obsolete (Fiorani, 2006), goes hand in hand with the need to innovate educational environments and devices functional to learning in school and academic contexts (United Nations Department of Public Information, 2019). From the sociological analysis of contemporary educational systems emerges that, thanks to the technological hybridization of educational and formative contexts, it is possible to trigger a revision of the ways of teaching and learning new knowledge (Giordano Paredes, 2021). Among these *ways*, the approach of learning by playing keeps its relevance intact (Capra & Lovecchio, 2021). An example is robotics applied to education (Castellano, De Carolis, D'Errico, Macchiarulo, & Rossano, 2021; Di Stasio, 2021; Leite et al., 2013), useful not only to promote greater motivation to learning but also to support the development of sophisticated cognitive skills. In particular, Caci, Chiazzese, and D'Amico (2013), have shown that interaction with robots, favors the development of visual-constructive skills and reasoning in children. The visual-constructive abilities exercised during the assembly process of robots and the use of the correct Lego brick (perceptive discrimination by size, shape and color) are fully stressed. This brings out that virtual learning environments are a subject of particular interest in the area of human-robot educational interaction. It can therefore be said that the introduction of serious games in teaching contexts responds to the changing needs and new forms of communication of students, allowing above all a customization of the training path. In this way, effective learning, in which the learner becomes co-constructor of the activities carried out, is the protagonist of a multisensory foundation, useful for the acquisition of not only theoretical but also practical skills. Thus, didactic situations of edutainment, of learning by playing (Petti et al., 2022), favor long-lasting learning and, thanks to the application of new technologies, robotics and digital, combined with curricular disciplines, represent an educational solution, emotional, socio-relational and metacognitive. The additional value of serious games is, therefore, to interrupt the traditional teaching, placing themselves through the fun and enhancing at the same time the potential of the learners.

2. The New Dimension of Learning and Educational Technologies

In particular, the so-called serious games represent an evolved proposal of e-learning, so as to make it the current frontier of learning mediated by technology (technology-mediated learning). Serious games or simulation games are based on computer platforms, in which the player interacts with virtual scenarios and other characters, led by artificial intelligence or avatars of other human players. Players make choices and make assumptions to test themselves and to demonstrate specific knowledge and skills, to orient themselves in the situations proposed by the game and with the aim of achieving certain goals. The virtual scenarios are very different, from reconstructions of a historical era, to those that evoke situations typically school, business, military, up to the invention of unknown planets populated by aliens. The research on the mechanisms and effects of serious games mediated

by computer platforms even at the beginning, is followed with interest by a growing literature (Cannon-Bowers & Bowers 2010; Ma, Oikonomou, & Lakhmi 2011; Michael & Chen, 2006). Proponents of the use of serious games show that they allow a rediscovery of the educational potential of the game and especially, simulation, necessary for learning from early childhood. Through play, "children explore and acculturate the world through play, extend their skills and competences, and experiment with possible selves" (Ritterfeld, Cody, & Vorderer, p. 4, 2009). Thus, learning by playing, is a concept that can be extended to adults without any age difference. In fact, the strength of the game is that it has multiple functions and, above all, has an undisputed value for the purposes of learning and the intellectual well-being of learning (Mariotti & Marotta, 2020). Through play, functions such as memory, attention, concentration, reasoning, problem-solving and decision-making are exercised (Anolli & Mantovani, 2011). The use of the symbolic game, allows you to create specific behavioral settings in which to play the role of different characters, thus experimenting with skills, emotions and with educational robotics also a specific value of competitiveness. Serious games represent a turning point in relation to the different ways of using information technology in education that, as is the case with traditional e-learning, have often reproduced the teaching transmission, providing content with many combinations of text, images, video and audio, but also with limited interactive possibilities with the teacher and other students. Nevertheless, the availability of interactive platforms, through forums and blogs, are in the concrete practice of e-learning and especially in distance learning, difficult to interact, between those who learn and those who seek to involve in the interactive processes of operation and shared discovery. The serious games have been shown to overcome the limits in terms of involvement and teaching, the simulative mind called to puzzle solving, because it through the game, imagines scenarios and possible options and thus learning through hypotheses, operating and seeing the consequences of the adopted behaviours. Therefore, the educational challenge of the digital age, to which serious games appeal, is for engaging, effective and efficient learning. Such learning, regardless of the technology used, presupposes the existence of appropriate training methods, motivating contexts and relationships, and what English language literature calls learner-centredness (Spector & Merrill, 2008). The playability, the interactivity in the approach to the game, the comprehensibility of the objectives to propose and achieve and the usability of the abstract media, determine the attention of the subjects to the point of finding effects typical of the flow experience, losing the temporal dimension in favor of the attentive abilities and the educational-media experiential control. In fact, the positive responses verified in reference to learning are above all, the increase of the ability to explore and the propensity to acquire interactively new knowledge. An interpretative/application model for the design of the experimental game was provided, in 2015, by Kiili, Devlin, Perttula, Tuomi, and Lindstedt. In this model, the learner is guaranteed the acquisition of skills and knowledge through direct experience with the gameplay. In addition, a socio-constructivist approach through collaborative groups in the use of gameplay makes effective lessons also through online conversations or focus groups. In fact, the interaction with the system allows you to consolidate previous knowledge and then acquire new ones, and also, to master the system, whose user develops digital skills and gaming skills applied to problem solving. It is important to define what is meant by serious game, edutainment and didactic game. The former are educational games attributable to the playful method, characterized by the fusion of fun and learning goals (Guillén-Nieto & Aleson-Carbonell, 2012). Edutainment, on the other hand, corresponds to a group of didactic strategies resulting from the union between education and fun in the learning phase. The singularity of such methods lies uniquely in proposing learning as a recreational means. Recent experiments, ensure edutainment greater educational

effectiveness in its implementation to e-learning, since it can ensure the achievement of transversal skills useful for solving concrete and real problems. Jain (2011) points out that, the use of media tools, use the logic of simulation to train, prepare and educate the adult population in the exercise of their profession. Even from a pedagogical point of view, learning through the game certainly improves the skills of the learner and the class thanks to cooperation, the team play and the competition that generates the conflict useful to motivate individuals to overcome the challenges or performance aimed at maintaining the status and role acquired until then. (Anderson & Shattuck, 2012). Last description concerns the didactic games, in which you acquire skills applicable to real life contexts. This concept of simulation is much discussed in contemporary literature. It refers to four different interpretative models: the systemic model: the simulation of which provides feedback to players in their learning environments. The dynamic model: characterized by continuous feedback and places of interaction with constantly evolving players. The simplified model: in which there is not a faithful and articulated representation of reality, but only one possible. And finally the precise and valid model: this reproduces and represents in an original way the same physical and functional characteristics. Today our society is characterized by easy communication but, capturing attention, it has become very difficult, in fact the conception of time and space have changed and the speed increasingly regulates society, and it is for this reason that more and more smart services are required. Serious games respond to these new demands of scholastic and academic users. Educational games motivate and maintain attention in various contexts. Thus, the information is not only accessible through a limited number of learners, the forms of literacy are diverse and complete, the messages produced can reach any place in the world and usable at any time. Serious games have the potential to change user behaviors, attitudes and habits, and to promote learning using various persuasive strategies (Orji, Mandryk, & Vassileva, 2017). The analysis of De Serio and Toto (2020), aims to educate emotions through fun. Among the main themes of this research are bullying, cyberbullying, respect for the plant and animal world, as well as shared spaces, integration and racism. Context based learning, or CBL, is another contemporary method based on simulation. This, replaces theoretical concepts with real life examples, in fact this attempt replicates the environmental and social situations aimed at ensuring the acquisition of new knowledge. The assimilation of knowledge is determined by the collective activity of people united by the same educational purposes (Merriam & Baumgartner, 2020).

3. Early Childhood and Use of Digital Technologies

To analyze the relationship between children and new technologies it is useful to remember the definition of Livingstone, Bedroom Culture, or a culture that shapes children without them leaving the bedroom and without there being a link with adults (parents and teachers). Defining *digital natives* as a function of birth in a given era would not take into account the geographical context, cultural and social in which a child is born and could lead to neglect the existence of a digital divide within even the most economically developed countries. In fact, it is important to avoid considering these abilities as *innate* in childhood, since we must consider them as familiarity rather than competence. If in fact the familiarity that the new generations have with technology is undeniable, the competence in their use is built instead laboriously, through a literacy that can only come from the school world and the family context. Riva (2014) also notes, specifying that one can speak of digital natives only if one considers such an expression as an ability in the use of technologies and not in anagraphic expressions. In fact, to date, the generational groups that have come into contact

with the digital world have been described in four categories: Baby Boomers, Generation X, Generation Y and Generation Z. Each of these has related in a different way to technology, developing different skills and behaviours. With this term are indicated all those who were born from 1996 to the present in the Western world. In particular, unlike previous generations, the *post-millennials* do not know at all a life without digital, as for them technology is a natural presence from an early age. It is the most globalized and hyperconnected generation in history. In fact, most of their relational life takes place on social platforms, which therefore significantly affect their socialization process. It then emerges, as the generational band Z, introjects characteristics and potential of social in a personal way. Finally, other authors (Arcuri 2008; Roversi 2001; Wallace, 2000) have highlighted a significant inequality of skills related to the use of new digital technology between adolescents and adults: a real generational gap that has consequences on the communication skills between the different generations to use them. However, we must exploit all the potential that technology offers us and above all the confidence that young people have with the same computer tools and with the use of the same and the associated software to convey information and positive messages and that even allow the achievement of important objectives. An example could be weight management programs on the Internet platform and on social media, smartphone apps and active video games that can assist in educating overweight and obese children (Christison & Khan 2012; Whittemore, Jeon, & Grey, 2013). These interventions are easily accessible, inexpensive and save time, allowing the child to engage independently from home in total anonymity. Because children spend a considerable amount of time on their technological devices, playing active video games, exergaming allows them to become more active and consume more energy. In fact, in exergaming video games are used to exercise at a moderate intensity by improving physical activity levels, as well as being fun (Daley, Copeland, Wright, Roalfe, & Wales, 2006). To date, most research has focused on the effectiveness of technology-based interventions as a primary prevention of childhood obesity. For example, Chen and Wilkosz (2014), evaluated the effectiveness of technology-based interventions for the prevention of obesity in adolescents, but little has been researched on the impact of physical activity through technology-based interventions, for weight management in overweight or obese children, as well as for improving coordination skills. It is important, therefore, to have in this age phase for young people, also and above all a pedagogical vision of motor activities, which clarifies the responsibilities of educating to the movement, through the media, focus of the research covered by this article. The school, as an educational agency, has the opportunity to reach potentially everyone and, as well as the family, can support and strengthen what has been started in school classes of all levels. At the moment, Motor Media Education, is not yet sufficiently used in Italy, but entrusted more to the initiative of individual teachers or institutes. In any case, it is recognized as useful and urgent, especially from primary school, to secondary school. The principles set out by Buckingham (2006) augur well for verticality in the curriculum of young people. In light of the above, it is possible to encourage the initiation of a process of education to the movement through the media from early childhood. Therefore, the design of Motor Media Education pathways in kindergartens does not translate into the inclusion of digital technologies or multimedia content in services, but can lead to produce reflections on the role of communication and the importance of languages through gradual paths of motor education. In kindergarten it is then possible to take paths oriented to the use of video games, trying to enhance the emotional, playful, creative and productive aspects. The video game inserted in the curricular programs of motor activities will dispel the common and imperishable concept of the video game that causes sedentary. In fact, the exergame predict the movement of all or part of the human body, effectively transforming the gamer, as such, in controller.

Human body-controller in motion guarantees a kinetic entertainment in the living room of the house. Doing Motor Media Education from early childhood, therefore, means responding to the task of citizenship present in the 2030 agenda. In particular, Goal 3, *Ensuring health and well-being for all ages*. The school, is in support of the ideas of development and progress, is guarantor of the idea of respect for themselves and the other. So, education to responsible and conscious actions can be structured from early childhood and thanks to the sciences of the movement you can use the tools for an increasing participation in public life, an ability to interact with reality in an active, responsible and creative way.4. Experimental Educational Protocol of Motor Education in Kindergarten

In evaluating and analyzing the effects that digital games can cause in children, we researched the effects of the Just Dance 2022 game (GJD) as part of a project in favor of movement and improvement of coordination skills. The video game is perfect for training in a fun way and was used to stimulate the motor activity of children of a kindergarten in the province of Naples in Campania. This project, in addition to exploring the potential of the game in involving children in the movement, aims to observe digital parenting practices during early childhood and the relationships between the use of GJD and the improvement of a coordinating capacity, such as balance (Peirolo & Leone 2017). A nursery school was used as a sample and specifically 40 children of about five years, of which 29 girls and 11 boys, for a total of three classes involved. The research lasted six months and in the first phase a questionnaire was administered to the parents for the collection of socio-personal data. The second phase, however, was organized in two weekly meetings, lasting 60 minutes, in which children had the opportunity to use the GJD freely. This phase was aimed at observing behavior and attitudes during the use of the video game. In the third and final phase, all children were tested for balance (Henderson & Sudgen, 1992). The balance test was: on a leg with closed eyes, to stork (aC). In this randomized trial, the children were divided into two experimental groups. Group A used GJD twice a week and 60 minutes each time. And group B, control, who did not have a chance to use the game. The two groups of children had the same social and economic background and the same age (five to six years)) all belonging to the same school. The children were randomly assigned to one of two groups: group A (n=20) and control group B (n=20). All parents provided informed consent. The goal of the activity was the assessment of Balance through the motor test: aC position to be maintained for 1 minute with eyes closed using the preferred lower limb (Figure 1).

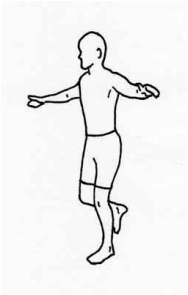

Figure 1: Balance position in monopodal support (from www.nebula-physio.co.uk).

- Only group A practiced the GJD activity for 60 minutes, repeated two days a week for 24 weeks;
- The ability to perform the coordination exercise (number of errors) was measured at both groups, both at the beginning (pre-test) and at the end (post-test) of the study;

- The evaluations, carried out through the motor test aC, were carried out at the beginning and after 24 weeks;
- The participants performed three tests for the aC test and so we used the average of three consecutive measurements.

The results are presented as standard deviation mean (Figure 2). Group A showed significant improvements in motor test aC, while group B did not.

- Group A (which used GJD) significantly improves the executive function;
- Group B did not improve executive functions in the post test (Figure 3).

Tabella 1 – Just Dance and Balance

	Errori 10	Errori 9	Errori 8	Errori 7	Errori 6	Errori 5	Errori 4	Errori 3	Errori 2	Errore 1	Errore 0
Pre A	4	5	3	2	2	3	1	0	0	0	0
Post A	2	2	1	2	1	1	1	3	2	3	2
MEDIA	3	3,5	2	2	1,5	2	1	1,5	1	1,5	1
DEV/ST	0,82	1,22	0,82	0	0,41	0,82	0	1,22	0,82	1,22	0,82
Pre B	5	5	2	2	2	2	2	0	0	0	0
Post B	5	4	2	1	3	1	2	0	0	0	0
MEDIA	3,46	3,45	1,97	1,50	1,65	1,64	1,17	0,95	0,64	0,95	0,64
DEV/ST	1,04	0,64	0,48	0,41	0,57	0,41	0,39	0,45	0,30	0,45	0,30

Figure 2: Just Dance and Balance: table of results presented as standard deviation mean (our elaboration).

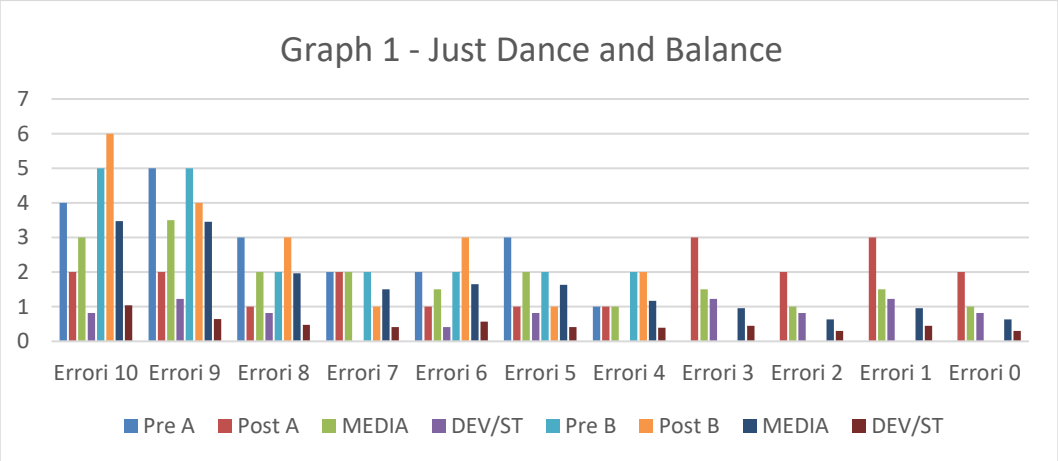

Figure 3: Just Dance and Balance: graph of results (our elaboration).

5. Educational impact of research

As we have seen, a discussion that questions the existence of the digital natives risks losing sight of the pedagogically most relevant issues in the education of the movement. Childhood is a fertile age group compared to adults, for the simple reason of being immersed in new contexts. The purpose of this Experimental Educational Protocol of Motor Education in Kindergarten was to evaluate the effectiveness of interventions based on technology, in particular the effects of the active video game Just Dance Game 2022

(GJD) to address the issue of movement and improvement of coordination capabilities. However, it has not been possible to carry out systematic reviews on this subject, as there is no research, especially in Italy, aimed at the same objective, of motor education through video games, with the improvement of coordination capacities as its main focus. A recent study dealt with the relationship between videogame and motor activity, with disability as an objective (Nardone, Caselli, & Soriani, 2022), as well as the theme of the use of serious games in education and teaching (Peconio, di Furia, Lombardi, Toto, & Limone, 2022). A final example, starting from sustainable development, which within the 2030 Agenda sets out the objectives to be pursued within the policies of the 193 UN Member States, the theme of the Digital School in the National Plan for Sustainable Development through a new type of training that takes into account not only the sphere of STEM, educational method that includes Science Technology Engineering and Mathematics in a single disciplinary field, but also technology and in particular robotics, the environment and the digital for the ideation of a product with which to interact and observe and able to communicate to today's small users how to protect their home to become and educate good adults of tomorrow (De Giglio, 2020). The study carried out in the present research has evaluated, therefore, the effect of the intervention of video games, on the improvement of the coordination skills demonstrating that it is possible to develop the ability to balance through the use of GJD, verified with the motor test aC. The Error Score shows how the group, which had been assigned a surgery without the use of GJD, therefore not technology-based got a higher error average in all measuring ranges. The study also showed a statistically significant average difference for the intervention compared to the control, highlighted as the technology, and therefore the video games, used within a school context, can improve the coordinating skills of balance, using a more creative means, but especially close to the digital natives or generation Z.

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