A theoretical approach to the use of information and communication technologies in Physical Education

Un enfoque teórico para el uso de las tecnologías de la información y la comunicación en la Educación Física

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Abstract: Today's fast-changing World imposes new challenges in all aspects of our lives. Most prominent changes have been observed in information and communications technology (ICT). These changes imposed new challenges for the education system, schools, and especially for teachers. Keeping up with the pace of these developments has gained an increased popularity in today's digital culture, and in consequence academic interest increased significantly on using smart and modern technologies in the field of Physical Education. So far a reasonable amount of research has been done to study technology integration in teaching and learning environments. Yet, more effort needs to be spent for the claims and research within the realm of Physical Education. This paper therefore tries to present a short overview on the topic, the approaches, tools and studies about the use of technology in the field of PE.
Keywords: information and communication technologies, physical education, sport sciences.

Resumen: El mundo cambiante de hoy impone nuevos desafíos en todos los aspectos de nuestras vidas. Los cambios más destacados se han observado en la tecnología de la información y las comunicaciones (TIC). Estos cambios impusieron nuevos desafíos para el sistema educativo, las escuelas y especialmente para los docentes. Mantener el ritmo de estos desarrollos ha ganado una mayor popularidad en la cultura digital actual, y en consecuencia el interés académico aumentó significativamente en el uso de tecnologías inteligentes y modernas en el campo de la Educación Física. Hasta ahora, se ha realizado una cantidad razonable de investigación para estudiar la integración de la tecnología en entornos de enseñanza y aprendizaje. Sin embargo, es necesario dedicar más esfuerzo a los reclamos e investigaciones en el ámbito de la Educación Física. Por lo tanto, este documento intenta presentar una breve descripción general sobre el tema, los enfoques, las herramientas y los estudios sobre el uso de la tecnología en el campo de la educación física.
Palabras Clave: Tecnologías de información y comunicación, educación física, ciencias del deporte.

Introduction

Information and Communication Technology includes all of the components of modern computing and all devices, such as computers, the Internet and other networking components, and electronic delivery systems such as radios, televisions, and projectors and today's widely used ICT pieces such as, smart tools (mobile phones, applications), artificial intelligence and robotics, all enabling us to interact with the digital world (Iheanacho & Rufus, 2013; Fu, 2013; Yıldız, 2016). Currently, the innovations in the field of Information and Communication Technologies (ICT) and the digital transformations have been the 'hot topic' of recent debates in scientific fields (Majchrzak, Markus ve Wareham, 2016; Nauwerck, Cajander, & Lind, 2017). These debates mainly focus on the use of ICT to develop the field knowledge of young people by supporting and reinforcing the exploration of the techniques and means that fit today's digital youth culture (Casey, 2017). The awareness and concentration of academics in the field of sports and Physical Education about

the use of ICT started in the beginning of 21st century (Thomas & Stratton, 2006). It should be kept in mind that, in contrast to the supporters of the technology use, there are also opposing critiques against the use of information and communication technologies most of which routed on the idea that ICT's increase the sedentary among the young generation (Durant et al., 1996; Pate et al., 1997; Silverstone, 2017). However, it is vital to understand that technology already exists and will inevitably exist forever. New tools come up steadily making it nearly impossible to keep pace with. Even the definition of ICT continues to grow and change in itself, as such; computers and telephones have been the components of ICT for decades, while others, such as smartphones, digital TVs and robots joined recently. The implications of this modern computing systems are entering in our social life, where first users are children.

Children who already have high competencies in the use of information technologies, further train themselves through playing computer games and eSports, while many adults are not aware of the emergent technologies (Wagner, 2006). Wagner (2006) implies that this is a current social-technological generation gap which is steadily widening. Doubtless to

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state, we went through a great change from industrial society to the information and communication based society today which made the integration of technology in to the teaching and learning processes fundamental.

The emergence of the integration of the technology to the Physical Education (PE) thus can be interpreted as a logical and irreversible change. During recent years we have seen a rapid development and cultural integration of ICT in classroom settings, sport halls and in other sport and exercise environments in various countries across the world (Kretschmann, 2015). Yet, integrating the technology in teaching and learning is a complex issue. It is important to grasp how individuals learn and what exactly works for the integration process. According to Fromme (2003), formal attempts to equip students with smart technological competences are usually anticipated by informal and non-formal learning processes of children within their digital culture. It would be necessary to define the phenomena of technology integration here. Integration technology can be defined basically as a set of teaching activities in which teachers develop and train mental and physical abilities of the students in the use of ICT. The International Society for Technology in Education (ISTE), a prominent society in providing support and leadership in the effective use of technology in Higher Education provides a definition of the integration technology in education: *"Curriculum integration with the use of technology involves the infusion of technology as a tool to enhance the learning in a content area or multidisciplinary setting. Effective integration of technology is achieved when students are able to select technology tools to help them obtain information in a timely manner, analyze and synthesize the information, and present it professionally. The technology should become an integral part of how the classroom functions - as accessible as all other classroom tools. The focus in each lesson or unit is the curriculum outcome, not the technology"* (Haris, 2005: 116; as cited NETS for Administrators, 2009).

Technology integrated pedagogy is a vital competence for teachers in order to enable them to activate today's digital students. Thus, in order to investigate effective technology integration, it is fundamental to understand the theories, practices and claims and reports in the area. Therefore, the main aim of this paper is to foster an academic discussion on the use of ICT in PE. It will present a short review of the theories, tools, technological devices currently used by PE teachers, factors that promote or hamper the technology use in PE.

Current Situation in Europe with a Scope of ICT in Education

The society we are living in is such a place that, more and more people of all ages use digital technologies in their everyday lives. Nonetheless, most of the schools that those

children go, do not have a system that fits this everyday reality. The virtual world is changing how education is resourced, delivered and enjoyed (Report/Study, 2013). We will need to keep up with changes happening in the job market and equip students with the skills that future employers expect. This is simply because, the future estimates show that the e-Learning market is expected to grow fifteen-fold, accounting for 30% of the whole education market for the next 10 years (European Commission Press Release, 2013: 2). All individuals should be able to get benefit of these developments since the technological age of today constantly changes in itself and only the individuals who adapt themselves to these changes will be able get educational benefits of the technology. Educators and policy-makers have the responsibility to shape this transformation.

European Commission released a report (2013) on ICT use in education at schools. The report "Survey of schools" is a collection and benchmark of information from 31 European countries (27 EU Member States, Croatia, Iceland, Norway and Turkey) on the access, use, competence and attitudes of students and teachers relating ICT in schools. It has been the last in-depth analysis on the understanding of technology in classrooms across Europe, with data collected in 2011-2012. Students, teachers and head teachers from 31 European countries (EU Member States plus Iceland, Norway and Turkey) responded to over 190,000 questionnaires. A detailed and comparative report on the use of ICT in school education across Europe, from infrastructure provision to use, confidence and attitudes was provided by the study. According to the results of the survey; only one fourth of 9 year olds study at a 'highly digitally-equipped school' – with recent equipment, fast broadband (10mbps plus) and high 'connectivity' (website, email for students and teachers, local area network, virtual learning environment). Furthermore, the proportion 'highly digitally-equipped schools' is less than half of the total numbers and a reasonable number of students have nearly never used a computer in their school lessons (European Commission Press Release, 2013: 2).

Again, according to the highlights of the EU survey, more than 50% of students in EU countries never use digital tools such as textbooks, exercise software, broadcasts/podcasts, simulations or learning games. Most primary and secondary level teachers across the world do not consider themselves as 'digitally confident' or able to teach digital skills effectively, and most of them require more training in using ICTs (Baert, 2011; European Commission Press Release, 2013: 2).

The implications of this digital challenge in Higher Education (HE) are similar. HE also faces a challenge: a significant rise in the number of EU students is foreseen in the next ten years, universities need to integrate traditional teaching methods and offer a mix of face-to-face and virtual and online learning possibilities, such as MOOCs (Massive Open

SPORT TK: Revista Euroamericana de Ciencias del Deporte   A theoretical approach to the use of information and communication technologies in...

ISSN edición web: 2340-8812 / vol. 8, n.º 2 / Murcia / Julio 2019 / Págs. 81-88   SPORT TK, 8(2), 81-88

Online Courses), which allow individuals to access education anywhere, anytime and through any device. But many universities are not ready for this change. The European Commission revealed 'Opening up Education' action plan to tackle this and other digital problems which are hampering schools and universities from distributing high quality education and the digital skills which the job market will require by 2020. A new website was launched to help kick-off the action by the Commission (European Commission Press Release, 2013). "Open Education Europa" will allow students, practitioners and educational institutions to access a free-to-use to share open educational resources.

Theories in Technology Integration in PE

Developments in today's technology, increasing competition and changes in the service expectations bring about changes in the data collection types and services presented to the clients. This is why the educational institutions provides their cliemts with new communication technologies. The prominent expectation of this process is approving and adaption to the innovations. Roger's (**1962**) Difussion Theory, is approved as the most important and widely accepted theory of information technologies studies. Rogers (1995) defines the innovation as "any idea, object or application which is perceived as innovation by individuals or organization" in his theory. **Rogers (2003)** conceptualizes five distinct stages within the process of diffusion as a relatively linear process from; knowledge, persuasion, decision, implementation, to confirmation. When a new innovation exists, the individual will first learn how it knowledge. In the decision phase, the individual will decide to either adopt or reject the innovation.

Ely (1990) did not develop a model but, explained eight conditions that facilitate the implementation about technology diffusion; distress with the existing conditions, knowledge and skills, resources, time, rewards, participation, commitment, and leadership. Concerns-Based Adoption Model (CBAM), developed by Hall & Hord (1987) is a model that applies to anyone who experiences change. Within the model we observe seven stages of a process where perceptions and feelings of individuals about the innovation are explained. These stages expanse from nonuse, orientation, preparation, mechanical use, routine, to refinement, integration, and renewal.

Sprague, Kopfman, and Dorsey's (1998) description of technology learning cycle consists of five phases: (a) awareness of and exposure to new technologies, (b) exploration and filtration to consider the usefulness of the technology in the field, (c) learning of the new technology, (d) personal and professional application of the technology, and (e) sharing and reflecting on teaching with the technology. Similarly, Marra, Howland, Wedman and Diggs (2003) developed the

Technology Learning Cycle of TLC as a conceptual framework which promotes teaching and learning using emerging technologies (Figure 1).
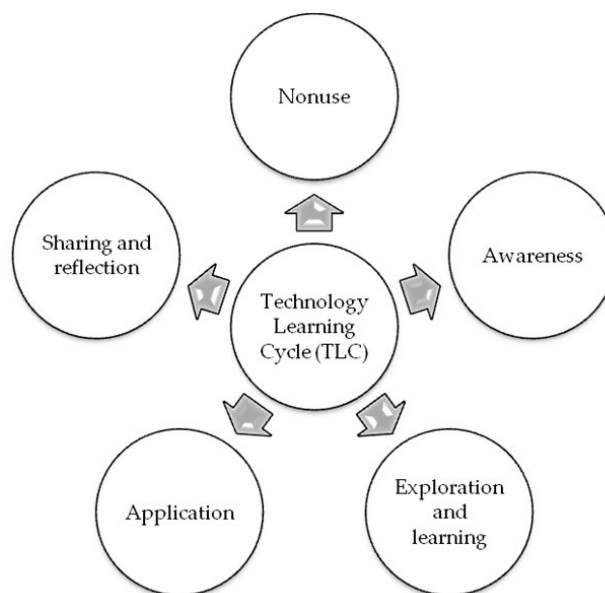

Figure 1. Technology Learning Cycle (TLC).

As seen, theories on technology integration have common elements. Most models start with an unawareness of the individual/teacher about a tool. Upon being aware of it they will either refuse it or will practice to learn more about it. Once they have captured how to use the tool, they may choose again to either reject it or use it within the classroom (Baert, 2011) Teachers must first familiarize with the organization of the use of the technology before constituting a routine within their teaching. When they complete this phase, other changes will occur in order to increase the outcomes and finally cooperation and interaction with "digital natives" will start.

Resources and Current Technological Devices used in PE, specific focus on Higher Education

There are many resources and discussions available in the area of how technology can be integrated in PE education. These studies state that use of ICT's expands the scope of physical education applications (Adamakis & Zounhia, 2013; Ambros, Foguet & Rodriguez, 2013). "Digital Technologies and Learning in Physical Education: Pedagogical Cases" is a good resource that provides practical solutions for teachers in which digital technologies are explained briefly that can be used by teachers to support and enhance young peoples' learning. The revolutionary changes in education imposed by the evolving technologies such as modern computing systems, digital and social media tools force the users of this

SPORT TK: Revista Euroamericana de Ciencias del Deporte

ISSN edición web: 2340-8812 / vol. 8, n.º 2 / Murcia / Julio 2019 / Págs. 81-88

A theoretical approach to the use of information and communication technologies in...

SPORT TK, 8(2), 81-88

technology to acquire new digital competences to better perform in teaching and learning processes (Collins & Halverson, 2010). The benefits of ICT in education are great both in terms of educational resources, as well as for the student's own learning process (Karsenti & Lira, 2011). "Digital Technologies and Learning in Physical Education: Pedagogical Cases" provides help for teachers to see the modern teaching practices and cases of transition .

Another good resource is about "*Advances in Technology Enhanced Learning*" which offers a series of research projects which aim to explore how to make engagement in learning and teaching more enthusiastic (Wild, Lefrere & Scott, 2013). This interactive and experimental resource presents a discussion about innovations which lead up to the collaboration in an order. The book brings out methodological and technological breakthroughs through a dozen chapters to learners, instructors, and decision-makers in schools, universities, and workplaces. The Open University's Knowledge Media Institute and the EU TELMap project is another additional example that have brought together the good examples from the European research area to showcase their vision of the future of learning with technology via their recent research project work. A wide range of Technology Enhanced Learning area from: environments for responsive open learning, work-based reflection, work-based social creativity, serious games and many more were discussed in the book for a good investigation into the use and integration of technology. It is imperative to examine the technologies currently used in Higher Education physical education classrooms and PE programs (Wild, Lefrere & Scott, 2013).

Any research regarding the integration of the technology in education includes modern computing as a main component of the process. These approaches include the use of word processing, content-based software programs, desktop publishing, databases, web pages, multi-media systems and visual presentations. Email, the Internet and Web pages and electronic portfolios are beneficial examples of technology implementation in physical education. Wikis in PE programs

extend the learning environment of teachers enabling to realize collaborative projects. Software programs such as the FITNESSGram is also listed in beneficial tools to measure the fitness levels of youth. It record fitness data and generate report cards and provides the users with feedback. Desktop programs such as Microsoft Excel, and Web and CD-ROM software allow data collection, transfer results to desktop systems quickly and thus assist physical educators with class management, fitness testing, and assessment and are favored for their quick and easy access to input data and calculate formulas (Baert, 2011).

Measurement of the physical activity and exercise requires some specific tools. Pedometers and heart rate monitors are the most prominent types in use. Exergaming, an enjoyable tool that complements PE activities increases the motivation to exercise and promoting physical activity. Telemetric machines are reported as useful in field experiments to measure the level of functional and motion and cardiac frequency in aerobics (Badau & Badau, 2018). Researchers may use a mix of different software components for a measurement at the same time. An example of a study where reaction time capacity in relation to the sportsmen's motric prevalence was measured through with a specific software test, a was used requiring the following materials: a computer, a software with the help of which the test were drawn by using for the left and right hands (Badau, Baydil & Badau, 2018). Moreover, swimming is a growing sport for its great importance new technologies have also managed to offer new avenues for understanding and control of the training process and training (Moran-Navarro, 2016). It can be stated that we face information and communication technologies in the whole process of physical education either in teaching or learning facilities. Using technology tools for multiple reasons and aims imposes a need to classify the technological tools according to the reason to use them. To sum up and categorize the Technologies used in PE field, the following table was prepared (Table 1) (Baert, 2011).

Table 1. Technologies Used in PETE Programs.

Technology	Category
Office Tools	Computer Technologies
Presentation Tools	Computer Technologies
Projector	Teaching Technologies
Email	Communication Technologies
Course Management Tools	Web-Based Technologies
Electronic Distribution of Grades	Web-Based Technologies
Digital Camera	Teaching Technologies
Online Research Databases	Web-Based Technologies
Pedometers	Physical Activity Technologies

Technology	Category
YouTube/TeacherTube	Web-Based Technologies
Web-based assignments	Web-Based Technologies
Fitness Assessment Tools	Computer Technologies
Heart Rate Monitor	Physical Activity Technologies
Electronic Portfolios	Web-Based Technologies
Online Discussion Forum	Communication Technologies
Handheld	Teaching Technologies
Smart Board	Teaching Technologies
Educational Games	Computer Technologies
Cell phone applications	Teaching Technologies
PE Software Programs	Computer Technologies
Social Networks	Communication Technologies
Web 2.0 Tools	Web-Based Technologies
Sport Based Simulators	Physical Activity Technologies
Exergames	Physical Activity Technologies
Chat Rooms	Communication Technologies
Accelerometer	Physical Activity Technologies
Webquests	Web-Based Technologies
GPS Systems	Physical Activity Technologies
Podcasting/Vodcasting	Web-Based Technologies
Bookmarking Tools	Web-Based Technologies
Virtual Networks	Communication Technologies

Factors affecting technology integration

When considering the integration of the new technologies in education it is vital to understand the barriers that hamper the facilitation of technology together with the enabling factors that ease the process. Teachers are the key component of this process. Neverthless, pertaining to the distinctive characters and the unique nature of the classroom environment, promotion of the integration still remains as a great challenge for teachers (Villalba & Gozalez-Riviera, 2016; Pyle & Esslinger, 2014). Thus, identification of factors that promote or inhibit teachers from possessing a positive attitude towards the integration of technology is useful information to obtain. Baert (2011) states that there are many factors influencing the applicability of the process of technology integration in the educational environments. The easiness of the hardware to use, how well it is supported in schools, the organization of the circumstances on which technology is distributed, the design of the software, preparedness and confidence of the instructor to work using technology in technologically rich environments, the proper evaluation of the student performance and readiness of the community and parents to accept new models of learning and assessment (Baert, 2011; Bur-

bules, 2018; Petko, Prasse & Cantienei, 2018; Report/Study, 2013; Yücel & Devecioğlu, 2012). Emergent and instant changes in technologies and the resistance to change have also been factors that limit the level of integration of technology (Johnson, 2018; Sargent, 2018). The factors influencing the process of integration to technology are listed as follows;

- Time restrictions to learn,
- Poor access to hardware, software, and support,
- Insufficient leadership,
- Lack of common vision or rationale for technology use,
- Inadequate training and support for educational staff,
- Incompetencies of the education providers, institutions,
- Funding,
- Level of fear from digitally equipped target groups (students),
- Poor understanding of technology
- Lack of institutional expertise
- Lack of a institution wide technology plan.

By using the information and communication technologies in educational institutions, it is expected to go beyond the walls and time limits of the classroom settings and thus

realization of the systematical changes occur in the school and thus the barriers are overcomed. However, the most important component of this process is the application of the new competences in teaching and learning activities (Loveless, 2001; Loveless, 2003). While specifying the effects of the ICT's Tearle ve Golder (2008) propose that the tools as the products of the technological developments can be applied in various course curriculum. ICT's are expressed to foster success, self-esteem and motivation of the students when the access barriers and inadequacies are solved (Collins, 2011; Condie & Munro, 2006; Karsenti, Savoie-Zajc & Larose, 2001; Taylor, 2009). The implications of the process regarding the students' experiences occur as peer learning and exchanging learning experiences with each other, with the aim of expressing themselves and reflecting on their learning (Fu, 2013; Ramesh, 2016; Selwyn, 2014; Quijada, 2014). Because of these reasons, we need to go a bit ahead and provide more practical solutions for the digitally equipped educational environments.

Conclusion

Most smart technologies over the past 30 years have been associated with indications of widening participation in education, increased motivation and engagement, better levels of attainment', enhanced convenience of use and more 'efficient' and 'effective' provision of educational opportunities (Gümüşdağ, 2017). When Information technologies combined with activities in actual environments, they can motivate students and increase their level of physical activity (Araújo, Batista, & Luz Moura, 2015). Thus, it is not wrong to state that, good practices may provide a promising introduction for planning the technologically equipped educational environments.

This review was intended to provide a brief summary of the debates about the use of ICT in the field of physical education. Through it is intended to provide information to different professionals in the education sector so that they get a scope of the latest claims, discussions and reports in the related field. Considering the future of this area, some questions should be posed about 'how the infrastructure of education can be changed to do things that were previously thought impossible and impractical. New information to help conceptualize technology use in education, ways to overcome the challenge of pedagogues to 'be brave' should be discussed further.

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A theoretical approach to the use of information and communication technologies in...

SPORT TK, 8(2), 81-88

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A theoretical approach to the use of information and communication technologies in...

SPORT TK, 8(2), 81-88