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Global Implications of Emerging Technology Trends book preface

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This book, entitled Global Implications of Emerging Technology Trends, is focused on the Information Technology Research as a fully multicultural, multidisciplinary and interdisciplinary research filed, which has a broad scope of application areas, with the aim to face up the complex Knowledge Society problems and challenges we currently have to solve (García-Peñalvo, 2014, 2015b, 2015c, 2013).

The book comprises fourteen chapters that are organized in three main sections: information, media and coding literacy (Lee & So, 2014; National Research Council Committee on Information Technology Literacy, 1999; Vee, 2013), educational and learning technologies (Herold, 2016; Robinson, Molenda, & Rezabek, 2008; Spector, 2015) and data-driven intelligent ecosystems (Bogdanova & Ackovska, 2010; Cruz-Benito, Therón, & García-Peñalvo, 2016).

1. Information, media and coding literacy

Information literacy may be defined as the capacity of people to recognize their information needs; locate and evaluate que quality of information; store and retrieve information; make effective and ethical use of information; and apply information to create and communicate knowledge (Catts & Lau, 2008), or the ability to recognize the need for information and knowing how to access, evaluate, synthesize and communicate it (Moeller, Joseph, Lau, & Carbo, 2011).

The development of the knowledge society means social transformations in which citizens need new competences and skills to tackle with the new technological ecosystems (Rodríguez-de-Dios & Igartua, 2016). These competences are based on the combination of both information literacy and media literacy set of skills that are necessary for life and work nowadays.

This situation presents an increasing approach for introduce digital or information technology (IT) literacy from the early beginning of the individual development (Bers, Flannery, Kazakoff, & Sullivan, 2014; Kazakoff & Bers, 2012; Pinto-Llorente, Casillas-Martín, Cabezas-González, & García-Peñalvo, 2017). The most frequent approach to teaching digital literacy has been to gradually encourage the learning of programming, and the term code-literacy (diSessa, 2000; Prensky, 2008) has been coined to referrer the process of teaching children programming tasks, from the simplest and most entertaining to the most complex.

Consequently, at the same time that children learn human languages, both for speaking and writing, natural languages, encompassing all matters related with the experimental sciences (physics, chemistry, biology, etc.), and humanity languages, involving social sciences and humanities, it is also necessary they learn digital languages, in which ones of the competences to be success in the digital world are included, using coding as the way to solve problems and computational thinking as working paradigm (Llorens-Largo, 2015).

A code-literate person means that can read and write in programming languages (Román-González, 2014), computational thinking is referred to the underlying problem-solving cognitive process that allows it. Thus, coding is a key way to enable computational thinking (Lye & Koh, 2014) and computational thinking may be applied to various kinds of problems that do not directly involve coding tasks (García-Peñalvo, 2016c; García-Peñalvo & Cruz-Benito, 2016; García-Peñalvo, Reimann, Tuul, Rees, & Jormanainen, 2016; Wing, 2006). An example of this is TACCLE 3 – Coding European Project that is devoted to promote computational thinking and coding in pre-university studies, specially in primary schools, all around Europe (García-Peñalvo, 2016a; García-Peñalvo, Hughes, et al., 2016; TACCLE 3 Consortium, 2017).

The information and media literate part of the book is composed by four chapters.

Martínez-Abad et al. (2018) expose that large-scale assessments of student's performance present criterion variables such as language, mathematics, or science, but it is noticeable how these assessments leave aside contents from other key competences such as information literacy. Authors, extending a previous work (Martínez-Abad, Torrijos-Fincias, & Rodríguez-Conde, 2016), present a theoretical approach to the subject and an example of an empirical study that aims to shed some light to the topic of information literacy by analyzing the relationship between the level of information literacy shown by a student and their academic performance in subjects such as language and mathematics. The results suggest that it is possible to develop an instrument for the assessment of the complex information literacy competence, and which is also easy to administer in the classroom.

García-Sánchez et al. (García-Sánchez, Gómez-Isla, Therón, Cruz-Benito, & Sánchez-Prieto, 2018) focus their work on visual literacy (Fransecky & Debes, 1972). They present a new approach of a quantitative analysis used to research about the understanding of visual literacy issues, with the aim of finding common patterns, opinions and behaviors between different people regarding the usage of visual communication and people's state of visual literacy, while also considering the possible cultural differences related. In order to conduct these cross-cultural analyses, authors propose a new kind of quantitative questionnaire-based instrument that includes a section to measure the cultural characteristics of the individual and their level of literacy. This instrument proposal is the main result of these chapter, since the research field of visual literacy lacks this kind of quantitative approaches.

Adrián R. Vila (2018) presents a study of the action performed by the publishing industry in the context of the transposition into digital format of printed books comprising a Latin American and Caribbean literary corpus. The designed corpus includes works and authors labelled as a Latin American segment of the Western Canon, in addition to those segments provided by feminist, queer, postcolonial, and/or decolonization critical theories. It is described/defined the digital ecosystem to which the corpus is transposed as well as some of the strategies implemented by the major e-book trade platforms and the main digital libraries to offer Latin American and Caribbean literature transposed into digital format are described/defined. Likewise, a reading extended to the influence of the postcolonial turn is proposed by considering cartonera publishing as a device of the postcolonial turn but, this time, widening the range of typographic forms as well as the postcolonial effect on the publishing field. This is the evolution of his previous work (Vila, 2016).

Klinge O. Villalba Condori (2018) defends that in order to introduce computational thinking in the classrooms, it is essential to modify the initial training of teachers restructuring the curricula of the Faculties or Professional Schools of Education, in any field or context it is going to be possible to identify areas of basic or general training and areas of specialized training, as well as reading or writing, computer thinking is currently essential because its application in any professional context is necessary. This research is very related to TACCLE 3 – Coding principles (García-Peñalvo, 2017; Reimann & Maday, 2017) and closed to experiences developed in different countries (Balanskat & Engelhardt, 2015; Brackmann, Couto Barone, Casali, & Hernández, 2016; García-Peñalvo, Llorens Largo, Molero Prieto, & Vendrell Vidal, 2017; Llorens Largo, García-Peñalvo, Molero Prieto, & Vendrell Vidal, 2017).

2. Educational and learning technologies

Educational technology is defined as the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources (Richey, 2008).

The Association for Educational Communications and Technology (AECT) denoted instructional technology as the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning (Januszewski & Molenda, 2008).

Educational technology and instructional technology are terms that are often used interchangeably, and there are a growing number of people who recommend adopting a label that includes the word "learning" (Lowenthal & Wilson, 2010).

Taking this into account, educational technology is an inclusive term for both the material tools and the theoretical foundations for supporting learning and teaching, thus it refers to all valid and reliable applied education sciences, such as equipment, as well as processes and procedures that are derived from scientific research, and in a given context may refer to theoretical, algorithmic or heuristic processes. This means that educational technology is not restricted to high technology and is anything that enhances learning in a blended or online context (García-Peñalvo, 2015a; Herold, 2016).

Nevertheless, a modern motion of technology education means electronic and plays and important role in current society (Selwyn, 2011). Education technology or EdTech, refers to an area of technology devoted to the development and application of tools (including software, hardware, and processes) intended to promote education (Lazaro, 2014).

Educational technology encompasses different approaches in the literature: eLearning (García-Peñalvo & Seoane-Pardo, 2015; Gros & García-Peñalvo, 2016), instructional technology (Molenda, 1997), information and communication technology (ICT) in education (García-Peñalvo, 2008a), EdTech (Lazaro, 2014), learning technology (Berlanga & García-Peñalvo, 2005a, 2005b), multimedia learning (García-Peñalvo & García Carrasco, 2005), technology-enhanced learning (TEL) (Kirkwood & Price, 2014), computer-based instruction (CBI) (Kulik & Kulik, 1991), computer managed instruction (Day & Payne, 1987), computer-based training (CBT) (Williams & Zahed, 1996), computer-assisted instruction or computer-aided instruction (CAI) (Suppes & Morningstar, 1969), Internet-based training (IBT) or Web-based training (WBT) (Driscoll, 1997), flexible learning (Hill, 2006), virtual education, online education or digital education (García-Peñalvo, 2008b; Seoane Pardo & García-Peñalvo, 2014), collaborative learning (Dillenbourg, 1999a, 1999b), distributed learning (Oblinger & Maruyama, 1996), computer-mediated communication (Walther, 1996), cyberlearning (Frechette, 2006), multi-modal instruction (Steil, Röthling, Haschke, & Ritter, 2004), personal learning environments (Wilson et al., 2007), networked learning (Goodyear, 2005), virtual learning environments (VLE) or learning platforms (García-Peñalvo & García Carrasco, 2002), m-learning (Casany et al., 2012; Ramírez-Montoya & García-Peñalvo, 2017; Sánchez-Prieto, Olmos-Migueláñez, & García-Peñalvo, 2014), ubiquitous learning (Conde González, Muñoz Martín, & García-Peñalvo, 2008; Joo-Nagata, Martínez Abad, García-Bermejo Giner, & García-Peñalvo, 2017; Yang, 2006) and Massive Open On-line Courses (MOOC) (García-Peñalvo, 2015d; García-Peñalvo, Fidalgo-Blanco, & Sein-Echaluce, 2018; López Meneses, Vázquez-Cano, & Román Graván, 2015; Martínez Abad, Rodríguez Conde, & García-Peñalvo, 2014; Martínez-Núñez, Borrás-Gene, & Fidalgo-Blanco, 2016).

This book comprises four chapters related to the educational and learning technologies.

Martín-Fernández et al. (2018) analyze several editions of a MOOC and the opportunity offered by the use of different types of learning (formal, non-formal and informal) that occur in them, thus characterizing patterns to train the open content and knowledge generation through gamification (Minović, García-Peñalvo, & Kearney, 2016; Sánchez i Peris, 2015). From results, indicators for managing successful and sustainable knowledge communities are proposed along with indicator for persistence and interaction between participants.

Fonseca et al. (2018) discuss about key concepts of the Technology Enhanced Learning phases as well as some different approaches that can be defined as “Good Technological Practices“ and their main results in order to implement technologies in the formative process.

Briz-Ponce et al. (2018) describe the current situation of mobile devices and apps to make an approach of the future tendencies of these tools. To achieve this goal, it was necessary to conduct a survey and involve different undergraduate students of the University and different professionals. Results reveal that students are using more and more apps and mobile devices but there is an important gap between students and professionals so it is still necessary to boost their relevance to improve their potential use. This is study is an evolution of a previous one (Briz-Ponce & Juanes-Méndez, 2015).

A. García-Valcárcel and J. J. Mena Marcos (2018) aim at determining what in-service teachers think (teachers’ opinion), know (technical knowledge) and do (tactual use) about ICT to promote professional collaborative learning. This is an updated version of a previous work (García-Valcárcel Muñoz-Repiso & Mena Marcos, 2016).

3. Data-driven intelligent ecosystems

A technological ecosystem is a metaphor to express a needed evolution of the traditional information systems (García-Peñalvo, 2016b, 2018). These are solutions based on the composition of different software components and services that share a set of semantically defined data flows. The result is a complex ecosystem that provides a set of services that each component separately does not offer and is able to evolve as a whole in a better way when its components does or when some components are dropped out or when new components are included. Moreover, the technological ecosystem is thought to offer a better user experience in the way that users are also part or components of the ecosystem.

The internal structure of the technological ecosystems is more complex than a traditional information system (García-Holgado & García-Peñalvo, 2017a, 2017b), this implies that these solutions should be taken into account in those cases in which the knowledge management (Fidalgo-Blanco, Sein-Echaluce, & García-Peñalvo, 2014, 2015) and solution-making processes are based on heterogeneous and complex data-driven architectures (García-Peñalvo et al., 2015).

The technological ecosystem metaphor comes from the Biology field and it has been transferred into software development because it reflects so well the evolutionary nature of software. There are several authors that use the definition of natural ecosystem to support their own technological ecosystem definition systems (Chen & Chang, 2007; Dhungana, Groher, Schludermann, & Biffl, 2010; Mens, Claes, Grosjean, & Serebrenik, 2014; Yu & Deng, 2011). This way, a technological ecosystem may be defined through a mapping with the main elements that appear in every natural ecosystem (García-Holgado & García-Peñalvo, 2014, 2016), i.e., the organisms or biotic factors, the physical environment in which they inhabit or abiotic factors and the relationships between organisms and organisms with the environment. Specifically, within a technological ecosystem there are a set of persons and software components that represent the role of the biotic factors; a set of elements that allow that ecosystem runs (hardware, communications, etc.), these are the abiotic factors; and a set of data flows that mean the relationships among the software components and among these components and the involved users.

This part of the book presents six chapters.

Murteira Mendes et al. (2018) present a Question Answering system to help clinical practitioners in a cardiovascular healthcare environment to interface Clinical Decision Support systems. This can be built by using an extended discourse representation structure, CIDERS and an ontology framework, Ontology for General Clinical Practice. CIDERS is an extension of the well-known DRT (Discourse Representation Theory) structures, intending to go beyond single text representation to embrace the general clinical history of a given patient represented in an ontology. The Ontology for General Clinical Practice improves the currently available state-of-the-art ontologies for medical science and for the cardiovascular specialty. It is shown the scientific and philosophical reasons of its present dual structure with a deeply expressive (SHOIN) terminological base (TBox) and a highly computable (EL++) assertions knowledge base (ABox). To be able to use the current reasoning techniques and methodologies authors made a thorough inventory of biomedical ontologies currently available in OWL2 format. This work is based on a previous work (Murteira Mendes, Pimenta Rodrigues, Rodríguez-Solano, & Fernandes Baeta, 2014).

Benaouda Rashid and García-Peñalvo (2018) present a study that concerns the conceptualization of an intelligent ecosystem(García-Peñalvo & García-Holgado, 2017) for the territorial planning, taking as an example the agriculture case, as a tool for decision making.

Bouarara (2018) deals on the unveiling of fresh bio-inspired techniques, such as, artificial social cockroaches (ASC), artificial haemostasis system (AHS) and artificial heart lungs system (AHLS) and their application for SPAM detection. For the experimentation, the author has used the benchmark SMS Spam corpus V.0.1 and the validation measures (recall, precision, f-measure, entropy, accuracy and error). He has optimizing the sensitive parameters of each algorithm (text representation technique, distance measure, weightings, and threshold). The results are positive compared to the result of artificial social bees and machine learning algorithms (decision tree C4.5 and K-means). This chapter is based on previous works of the author (Bouarara, Hamou, & Amine, 2016a, 2016b).

Poggi and Tomaiuolo (2018) review some typical social attacks that are conducted on social networking systems, describing real-world examples of such violations and analyzing in particular the weakness of password mechanisms. They also present some solutions that could improve the overall security of the systems. This is an updated version of this work (Franchi, Poggi, & Tomaiuolo, 2015).

Vázquez-Ingelmo et al. (2018) outline the technological evolution experimented by the Observatory for University Employability and Employment information system (Michavila, Martín-González, Martínez, García-Peñalvo, & Cruz-Benito, 2015) to become a data-driven technological ecosystem. This Observatory collects data from more than 50 Spanish universities and their graduate students (bachelor's degree, master's degree) with the goal of measuring the factors that lead to students' employability and employment (Michavila, Martínez, Martín-González, García-Peñalvo, & Cruz-Benito, 2016). The goals pursued by the Observatory need a strong technological support to gather, process and disseminate the related data. The system that support these tasks, has evolved from a standard (traditional) information system to a data-driven ecosystem, which provide remarkable benefits covering the Observatory requirements (Vázquez-Ingelmo, Cruz-Benito, & García-Peñalvo, 2017).

Yaokumah and Kumah (2018) propose a theoretical model that integrates security policy, monitoring, security operations, and security roles to examine employees' security compliance. Data were collected from two hundred and thirty-three IT security and management professionals. Using Partial Least Square Structural Equation Modelling and testing hypotheses, the study finds that information security policy has significant indirect influence on information security compliance. The effect of security policy is fully mediated by security roles, operations security activities, and security monitoring activities. Security policy strongly influences operations security activities and has the greatest effect on security roles and responsibilities. Among the three mediating variables, monitoring has the most significant influence on security compliance. This work is an extension of this previous research (Winfred Yaokumah, Brown, & Dawson, 2016).

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