

# Special section on “emerging trends and challenges in digital learning”

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## 1 Introduction

There is a growing interest in the field of digital technologies in education and learning, and this special section aims to discuss recent academic research on all dimensions of emergent and universal technologies and information systems used to promote digital learning processes. It will provide a global forum for the investigation and reporting of diverse issues that affect the learning processes: human–computer interaction, intelligent systems, information systems innovations in learning and its impacts in people, organizations and society. It will also address all aspects of technological developments on educational issues toward ensuring universal access.

Digital learning is a complex phenomenon linked with many different interpretations in the existing literature. In order to create a consensus, we will need to base this on a common definition. Kyndt et al. [1] describe digital learning as an unplanned and implicit process with unpredictable results. This learning process has a self-evident character and takes place in the daily working situation [2]. It is seen as the development of the individual through interaction with others [3]. Digital learning often happens spontaneously and unconsciously without any a priori stated objectives in terms of learning outcomes [1].

In this context, it is possible to argue that digital learning technologies are powerful, transformative tools which are

improving on our knowledge and capacity to learn with more flexibility. They help to promote innovative pedagogical practices [4] and also support professionals and students on knowledge construction, becoming a tool that helps to access information, communicate information and collaborate with others [5].

According to [6], on the one hand, teachers can use technology to plan and prepare classes and collaborate with other teachers. On the other hand, students use technology to potentiate their knowledge, to study and to conduct research projects, analyses data, solve problems.

Cheon et al. [7] held that mobile learning can also play a significant role in education. These authors identified several potential benefits of mobile learning including cost savings, ubiquitous communications, study aids and location-based services.

Bocconi et al. [8] argue that the students' use of digital learning resources is related to the teachers' digital competences. Wastiau et al. [3] have also indicated that students have the highest frequency of digital learning technology use when taught by teachers who possess appropriate digital skills, who use the internet, including social media [9].

In this context, this special section aims to include scientific issues related to new technologies and information systems contributing to learning and new knowledge creation for universal access in the following topics:

- Technological developments in learning: mobile technology, virtual environments, augmented reality, automation and robotics, as well as other tools for universal learning, focusing on issues that are not addressed by existing research;
- Universal e-education: mobile learning, e-Learning, game-based learning, social media in education, new

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learning models and technologies and wearable technologies for education;

- Case studies: empirical studies and education digital technologies with access for all citizens, methodologies for digital learning, evaluation techniques and tools, perceptions of learning processes, efficiency for end user and digital learning best practices.

## 2 Development of the special section

In this special section, we showcase extended versions of a series of selected papers previously presented at the 2016 World Conference on Information Systems and Technologies (WorldCIST'16), held at Recife, Brazil, in April 2016. The special section is focused on research work to enhance data analysis in the context of universal access and accessibility and was also open to other authors who submitted thematically related contributions.

The event represents the fourth global conference for researchers and practitioners to present and discuss recent results and innovations, current trends, professional experiences and challenges of modern Information Systems and Technologies research, technological innovations, developments and applications. All WorldCIST'16 conference papers went through a “blind review” process by at least two members of the Program Committee. After further reviews, a set of ten high-quality papers were selected, copy-edited and finally released in the present special section.

However, the call for papers was open and original research contributions were solicited, with the focus on new technologies, trends and challenges for a digital learning society. Authors contributed with research papers, case studies and demonstrations that present original scientific results, methodological aspects, concepts and approaches to the digital learning society.

## 3 Papers in the special section

A summary of the aims of these papers is provided in the following.

In the paper *Integrating Affective Learning into Intelligent Tutoring Systems*, Jiménez et al. (2017) discuss the promotion of independent study through computational tools, such as Intelligent Tutoring Systems. This work introduces a novel affective learning ontology that examines student, tutor and dialogue issues. The paper also presents an assessment of which elements of an ontology are taken into account in education systems. The authors believe that the findings from their research will serve as a useful reference

for the design of educational systems such as Intelligent Tutoring Systems. In the paper *Learning Analytics Tasks as Services in Smart Classrooms*, Aguilar et al. (2017) explore the implementation of a Smart Classroom, called SaCI, using the concept of communities of agents. With this concept, the authors carry out the definition and implementation of sets of agents according to their roles, functionalities, characteristics, among others, in SaCI. In the paper *Higher Education in Brazil: An Exploratory Study Based On Supply and Demand Conditions*, de Campos et al. (2017) study the context of Private Brazilian Higher Education Institutions comparing their supply and demand conditions. Their work adopts an inductive and exploratory methodological approach through the longitudinal analysis of data provided by the Census of Higher Education, between the years of 2008 and 2013, and the Demographic Census of 2010, in order to map its scenario. It aims to contribute for higher education institutions (HEI) to identify new target groups as potential entrants, enhance the discussion of forms and mechanisms of governance models and deliver strategic information. In the paper *Evaluation of the Fanpages of Spanish Universities: Public vs. Private Institutions*, Teijeiro-Álvarez et al. (2017) analyze the importance of social media in improving knowledge exchange, which may be reflected in improving the quality of higher education institutions. For this purpose, the authors studied the relevance of three Spanish universities in Facebook to provide concrete evidence on its use as a means of communication. Their findings reveal that Facebook has an important role in terms of Social Capital by identifying communication strategies in order to achieve a higher efficiency, brand image and reputation. In the paper *MoocCast: Evaluating Mobile-Screencast for Online Courses*, Tabuenca et al. (2017) argue that the progressive adoption of smartphones and interconnected devices is inspiring students to redesign their physical spaces toward a seamless shift between daily life and learning activities. This work presents a study evaluating mobile-screencast technology as a means to facilitate learning processes in online courses. The contribution from this manuscript is the identification of preferred learning spaces for students; the mobile-screencast evaluation as a solution for improved accessibility in online courses and an open tool for mobile-screencast and initial results from a formative evaluation are presented. In the paper *Bridging the Accessibility Gap in Open Educational Resources*, Navarrete et al. (2017) present a proposal for the design of Open Educational Resources (OER) websites that would enable equitable access for all users. The contribution of this research arises from the explicit recognition of the particular needs associated with the disability profiles to establish the response of the entire OER system, which enables a truly inclusive experience by exempting the user from performing configuration tasks. In the paper *Research challenges in accessible MOOCs: A systematic literature*

review 2008–2016, Sanchez-Gordon and Lujan-Mora (2017) present the results of a systematic literature review on the combined field of accessible MOOCs that covers from the years 2008 to 2016. In total, 40 relevant studies were identified and mapped to eight research dimensions that form a lifecycle encompassing problem characterization, needs identification, use of industry guidelines, specifications and standards, accessibility requirements specification, architectures, design strategies, verification of accessibility requirements compliance, and validation of user needs satisfaction. In the paper *Digital Assessment in Higher Education. Promoting Universal Usability through Requirements Specification and Universal Design Quality Reviews (UD-Q)*, Eileen et al. (2017) highlight the potential for improvement of current practices related to universal design, both for providers of digital assessment solutions and for higher education institutions. Based on a case study of practices in Norwegian higher education sector, the paper reviews existing requirements for ensuring universal design in digital assessment solutions, prototypes an approach to evaluating universal design quality (UD-Q) of two major Norwegian digital assessment solutions and investigates the compliance between providers' self-assessments from interviews and UD-Q evaluation scores.

As the special section editors, we would like to take this opportunity to thank the various authors for their papers and the reviewers for their comments and suggestions. We are also grateful to Prof. Constantine Stephanidis, UAIS Editor-in-Chief, for his support and encouragement throughout the editorial process. Finally, we would also like to thank The Iberian Association for Information Systems and Technologies (AISTI) for their support for this special section to be a reality.

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