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Computers in Education: Advances in Software Technology

J.UCS Special Issue

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We live in the information society. Consequently, computers are nowadays ubiquitous in every aspect of our lives. Computer applications are used in many central sectors of our society: health, bank, security, etc. Of course, education is not an exception, and it introduces unique technical, managerial and most importantly pedagogical issues. These unique features make computers and education a field of study on its own.

This special issue features nine extended papers selected from the Proceedings of the X Symposium on Computers in Education (SIIE 2008) [Velázquez-Iturbide, 08]. SIIE already exhibits a long tradition and acknowledged prestige in Latin America. It also has a tradition of publishing selected papers [Bravo, 05; Fernández-Manjón, 07; Llamas-Nistal, 03; Mendes, 08; Ortega, 01]. In the last edition, 69 papers were accepted, resulting in an acceptance rate of 42%.

The variety of educational software is very rich, as illustrated in this special issue. The nine articles included can be classified into three groups, namely e-learning and web-based educational software, user-centered educational software, and visualization tools.

A first group of articles deal with e-learning and web-based educational software. e-Learning and its different blended-learning variants are nowadays ubiquitous, at least at the university level. These articles illustrate some of the most relevant issues in e-Learning.

The first article, "Innovation and Quality in e-Learning: a European Perspective", is authored by Dondi and is a general, comprehensive discussion on quality in e-learning. It is a common trend to think of e-learning as a monolithic technological and social model of learning. The author calls the attention to the diversity of sectors, roles and visions where e-learning takes place. Each of these dimensions has unique characteristics and values that influence expectations and ultimately quality criteria. The article elaborates this framework and gives recommendations to organizations involved in e-learning.

The article by Díaz *et al.* is titled "A Meta-modeling based Approach for the Multidisciplinary Design of Web-based Educational Systems". The article addresses

the multidisciplinary nature of web educational systems. Experts in different disciplines have different perspectives and therefore use different specification languages and tools. The authors propose an approach based on allowing each expert to use the tools she is proficient in and then integrate the different designs by using meta-modeling techniques. They exemplify their approach by combining two modeling issues: educational design and web design. The meta-model uses model-driven development (MDD) techniques and applies model transformations, and validation and verification rules. As a consequence, completeness, consistency and integrity are guaranteed.

The second group of articles is concerned with user issues. There are many different issues in and forms of user-centered educational software. The articles here included are good representatives of them: user motivation, automatic assessment and correctors, interactive tutors, accessibility, and support to learning styles.

The first article in this group is "Application Scenarios for the Learning Objects Pool", by Dinis and Rodrigues da Silva. The authors are concerned with motivating users to produce and rank high-quality learning objects. The Learning Objects Pool is a system designed to increase user motivation. It is based on the "stock exchange" metaphor, which poses a healthy competition by assigning credits to users and setting a value cost for each learning object. Details of the credit-based system are given, in particular the configuration mechanism. Finally, three different scenarios are elaborated of different contexts of use.

The article titled "Learning to Program with COALA, a Distributed Computer Assisted Environment" is authored by Jurado *et al*. Learning to program is a challenging activity and many efforts are devoted to improve it. COALA is an effort that intends to give to students and instructors distributed support for programming assignments. The main features of COALA follow. First, it is an extension of a professional tool, the Eclipse IDE. Second, it supports delivery, reception, testing, assessment, notification and annotation of programming assignments. Third, it assesses correctness (by means of test cases) and code style (by means of software metrics represented as fuzzy sets). Finally, it provides an annotation tool to the instructor for free handwriting of comments on the student's code.

The article by Mikic-Fonte, Burguillo-Rial and Llamas-Nistal is titled "TQ-Bot: An AIML-based Tutor and Evaluator Bot". The authors introduce TQ-Bot, a tutoring system that is at the cross of e-learning platforms, intelligent tutoring systems, and conversational robots (also called bots). TQ-Bot orients students in e-learning courses, through conversations in natural language, to the right contents. Students can ask general and course-specific questions, and the bot gives her advice and guides her through the learning path. Students can also use the bot for self-assessment. TQ-Bot provides the instructors with several facilities aimed at developing course-specific contents. In addition, the system delivers different statistics about the students' opinion and about students' performance.

The article "Eduquito: Virtual Environment for Digital Inclusion of People with Special Educational Needs" is authored by Santarosa and Basso. It addresses access of people with disabilities to educational software. Being accessibility an important issue of human-computer interaction, it neither can be forgiven to assure digital inclusion into education. The article describes the challenges of digital inclusion and the

solutions given in a web-based educational system, called Eduquito. In particular, the central element of the system is individual and collaborative work by means of projects.

Silva and Andrade present the article "Development of a Web Application for Management of Learning Styles". Learning styles are often used in pedagogy and in adaptive hypermedia. The authors here present a web system called Management of Learning Styles, intended to gather and process data about individuals from learning styles questionnaires. The main design decisions and design steps of the application are described. The main contribution of the article is the evaluation of the application with respect to usability and user acceptance (both teachers and students). The article clearly describes the procedure and results of this evaluation. In particular, the results were positive, which encourages the authors to spread the application for more extensive use.

The third group of articles also focuses on a particular class of software technology, namely visualization. The aim of visualization can be stated as making visible what is hidden, by using graphical representations. The two articles here featured represent two kinds of visualization, namely information visualization and software visualization. Although the latter can be considered a particular case of the former, their research interests and communities are currently different.

The article "Semantic Spiral Timelines used as Support for e-Learning" is authored by Gómez-Aguilar, Therón-Sánchez and García-Peñalvo. They introduce a visualization tool for e-learning activity called Semantic Spiral Timelines (SST), which integrated into Moodle. The particular use of information visualization sought here is visual analytics, where the user can see at a glance visual relations and patterns of student activity. The article describes the user interface of SST, the format and semantics of the graphical elements, and its interaction functions. All of them were tuned to provide elaborated, meaningful views from the huge amount of raw data of student access. It is also described in detail an extensive example of visual exploration, showing different interactions and the conclusions derived from the resulting visualizations.

The last article, by Almeida-Martínez, Urquiza-Fuentes and Velázquez-Iturbide, is titled "Visualization of Syntax Trees for Language Processing Courses". Language processors are complex systems that can benefit from visualization techniques to better understand their internal workings. VAST is a system aimed at visualizing and animating syntax trees. A unique feature of VAST is that it was designed to provide independence between the parser generator and the tree visualizer. The authors describe the specification of tree generation and manipulation in a parser generator, and the visualization and animation of syntax trees (currently, for bottom-up parsers). They also describe visualization features to cope with large syntax trees, and to show the relation of the visualization to the input stream. Finally, they report on the procedure and results of a pedagogical evaluation and two usability evaluations.

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