

Guest Editorial

INSTRUCTIONAL TECHNOLOGIES IN ENGINEERING EDUCATION

E-learning has penetrated almost every area of education, and it is hard to find any institution that does not offer some e-learning options to its students. With the adoption of e-learning in mainstream education, use of emerging and innovative instructional technologies is gaining importance in academia. This is particularly true for engineering education where the learning process lends itself to variety of multi-sensory approaches. However, the applied nature of the discipline poses as many challenges as it provides opportunities to enhance the learning process, particularly over the classroom-based learning that has generally been devoid of contextual and authentic scenarios.

This special issue is aimed at the emerging and innovative design, development and implementation of instructional technologies in engineering education. With the advent of Web 2.0 and 3.0 technologies and changing educational paradigms due to changing needs of the society, both technological advancements and instructional pedagogies have influenced the way instruction takes place. New ways of learning has resulted as a consequence, giving rise to mobile learning technologies, collaborative learning technologies, social networking technologies, to name a few.

The call for papers attracted interest from rather large number of research groups and 86 submissions were received as a result. This shows strong research interest in engineering discipline for innovations in instructional technologies. After two stage double-blind review process, 14 papers are included in this special issue, representing research in both theoretical and experiential aspects.

The issue starts with the description of an innovative method for domain independent curriculum sequencing using particle swarms optimization. Paper by de Marcos, Barchino, Martínez and Gutiérrez presents an implementation for the learning object sequencing problem and discusses its performance in a real scenario. Laabidi and Jemni next focus on accessibility issues in e-learning in their paper and apply model driven architecture in the development process of accessible e-learning systems. They present a new formalism based on UML profiles called Profile Based Accessible E-learning in order to specify all accessibility requirements to define models of accessible e-learning systems.

Alvarez, Nussbaum, Recabarren, Gomez and Radovic discuss an innovative mix of face-to-face communication through a social network with the use of interconnected handhelds supporting the practical work. The approach aims to provide an effective constructivist, technology-supported collaborative strategy in engineering courses for supporting the teaching of regular subject matter as well as fostering the development of students' communication and social skills. Sancho, Fuentes, Gomez-Martin and Fernandez-Manjon also focus on similar students' attributes through the application of a collaborative 3D fantasy virtual learning scenario that aims to increase students' motivation and bring learning in a real-life professional context, focusing on developing basic teamwork abilities and important soft and social skills. Paper by Kim, Cha and Hong also focuses on social technology and identify factors, such as user needs, readiness, and personal epistemology, for successful implementation of the 2.0 platform. For this purpose, they detail an investigation of how faculty and students perceived a new user interactive Web 2.0 system deployed at a tertiary education institution.

Shyr discusses a somewhat unique problem related to distance education approaches for applied domains, where laboratories are an essential part of the learning process. Shyr's paper focuses on helping students understand concepts and master basic technologies for developing Internet-based mechatronics monitoring and control systems. It then describes preliminary assessment of the effectiveness of an implementation of Internet-based mechatronics laboratory platform. Kim and Wang focus on visual reasoning skills, another somewhat unique aspect of disciplines like engineering, architecture, and design. They describe an intelligent tutoring system for visual reasoning that adaptively supports different learners' needs, tracks learners' progress, and provides active critiquing. Yueh and Sheen also focus on laboratory training but discuss it from the perspective of blended cohort scenario. They describe an implementation of Nano-bio Technology Laboratory Corridor that blends real and virtual laboratories to provide experiential learning in Nano-bio Engineering Education.

Next paper in this special issue focuses on problem solving skills. Chen describes a pedagogical model for constructing expert system knowledge base that includes identification of a suitable problem, definition of the problem domain, specification of goals or solutions, specification of problem attributes and values, generation of rules and examples, and selection of the right tool. The overall aim of the model is to facilitate students' critical thinking and problem solving skills. Rippel, Schaefer, Mistree and Panchal provide

another innovative pedagogical model, fostering collective learning and to apply mass customization in education, by aiming at enabling students to experience mass collaboration and to improve their understanding of emerging trends in product development. They describe their experience in implementing the model in a graduate engineering design course.

Baloian and Luther describe an implementation of algorithm visualization in the form of concept keyboards which stand apart from traditional visualization approaches by allowing the learners to control the execution of an algorithm by deciding which function should be performed when. Their paper describes the application of concept keyboards in the learning of cryptographic protocols. Tappan discusses another innovative visualization approach in the form of pedagogy-oriented simulation systems that expose students interactively to the design, simulation, and analysis of a broad range of manageable, real-world engineering applications.

Kosec, Debevc and Holzinger tackle the issue of equal opportunity in engineering education and describe a lecture web cast system that includes extensive functionality to support students with special needs. Their system aims at broadening of knowledge and a deeper understanding of the material by all students – with or without any disabilities. Finally, the special issue concludes with the paper by Ashoori, Shen, Miao and Peyton that discusses personalization in adaptive virtual learning environments. They describe the application of agents technology in multi-user virtual environments to develop various personalized services such as personalized content management, user-models, and adaptive instant interaction, with aim to engage and motivate learners.

While the papers in this special issue are selected as to provide a balanced overview of where theoretical research is heading and what the state-of-the-art in implementation is, the overall aim has been to expose the readers to a collection that would serve as a stepping stone in a rapidly growing area. The focus therefore has been first and foremost to maintain the highest quality standards as expected in a journal such as *International Journal of Engineering Education*. In this context, the success of this special issue directly relates to the quality of the accepted papers, and we would like to thank our colleagues who contributed their expertise and time to evaluate the submissions and provide valuable feedback.

These colleagues are: Ahmed Rafi, Amel Bouzeghoub, Andreas Holzinger, Ben Chang, Bruno Defude, ChanMin Kim, Chih-Yueh Chou, Chiu-Pin Lin, Davinia Hernández-Leo, Dominique Burger, Donna Russell, Dunwei Wen, Eric Zhi-Feng Liu, Fathi Essalmi, Gi-Zen Liu, Guangbing Yang, Henda Chorfi, Hongxing Geng, Hsue-Yie Wang, Huei-Tse Hou, Jarkko Suhonen, Jon Dron, Liesbeth Kester, Luca Spalazzi, Luigi Lella, M.O. Thirunarayanan, Maiga Chang, Mohamed Koutheaïr Khribi, Mohsen Laabidi, Monica Landoni, Nian-Shing Chen, Peter Sloep, Ramzi Farhat, Richard Huntrods, Robert Luke, Sabine Graf, Shadi Abou-Zahra, Sten Ludvigsen, Steve Leung, Tommaso Leo, William Sugar, Wu-Yuin Hwang, Yasuhisa Tamura, Yen-Hung Kuo, Yih-Ruey Juang, Yu-Ju Lan, and Yu-Lin Jeng.

Kinshuk, Tzu-Chien Liu and Mohamed Jemni
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