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## **Editorial: technological support for new educational perspectives**

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This Special Issue of the *International Journal for Continuing Engineering Education and Lifelong Learning* combines research and opinion from a diverse range of practitioners working within the instructional context of electronic learning environments, commonly referred to as e-learning. The reader is presented with a richness of view on the technological support for new educational perspectives that surround human-computer interaction (HCI), brought about by the mix of disciplines that involve: the primary, secondary and higher education sectors, cognitive psychology, computer science, educational technology, multimedia and virtual reality, mathematic teachings, instructional design, software engineering, and humane education. Initial invitations for this Special Issue were sent to a well defined research community selected from authors who presented papers involving interactive approaches to HCI instructional technologies at the IEEE International Conference on Advanced Technologies (ICALT 2002): Issues, Achievements, and Challenges, held at Madison, Wisconsin, USA August, 2001. This conference forum presents high quality work from international researchers, academics and industry practitioners who make a contribution to the design and development of advanced and emerging learning technologies. Invitations were then extended by the Editors to include other interested academics working within the field of online courseware development, providing the opportunity to publish an eclectic melting pot of HCI research from many parts of the world. Papers were prioritised for publication, based on their strong focus on the interactive aspects of HCI, in preference to authors taking a more unilateral approach, concentrating on technology or pedagogy alone.

There are a number of definable categories into which these papers fall, namely: interactive collaboration contexts, innovative approaches towards instructional design, and accommodating strategies for learner differences.

#### *Interactive collaboration*

It would appear that while most authors have agreed that creating collaborative instructional environments will be an important trend for future web-enabled courseware design; in the main, it is more difficult to see how interactive knowledge-sharing systems

will proceed. Vladan Devedzic's *'Next-generation web-based education'* answers some important questions on how search engines can enhance the pursuit of selective information through a web-intelligence towards a new type of content-oriented intelligence and adaptivity. Roger Hartley provides a convincing argument for online interactive collaborative systems to enable the safe facilitation of instructional/training programs in potentially dangerous situations. In his paper entitled, *'An interactive computer based simulation environment for supporting and developing complex decision making skills'*, it is possible to create difficult scenarios that involve public safety without putting people at risk. Professor Hartley's CACTUS system represents a dynamic medium to deal with the differences between the external representation of what happens in real life, to the internal translation that is necessary for cognitive understanding to occur amongst trainers and trainees. George Lepoura, Costas Vassilakis, and George R.S. Weir, however, draw on an industry based system prototype that allows users to easily search for information, interact with colleagues and share experiences in their paper entitled, *'A system to support dissemination of knowledge and sharing of experiences in the working environment'*. They maintain that this type of system will encourage corporate knowledge development to improve productivity and efficiency.

Still within the overt context of collaborative knowledge production, the next set of papers concentrate on the school sector. In the first instance, Chiung-Hui Chiu, describes a research project that investigated networked shared learning in an elementary school setting. In the paper entitled, *'Exploring how primary school students function in computer supported collaborative learning'*, Chui effectively demonstrates how important it is for educational researchers to conduct robust experimental methodologies that can be extrapolated to other events. This work is one of the few papers on networked collaborative learning research, currently available. The second paper in this conceptual vein, *'Developing applications with a framework for the analysis of the learning process and collaborative tutoring'*, deals with the ontological complexities of synchronous and asynchronous instructional events. For this, Miguel Mora, Roberto Moriyon, and Francisco Saiz describe the FACT system, which represents a guided approach to tutoring that includes a comprehensive review of interactivity amongst the students and facilitators, while at the same time providing an overall capacity for extending a rich history of the instructional event as a whole.

While collaboration is a common theme running through many of the submitted papers; the Editors have selected authors offering novel approaches to this emerging paradigm.

### *Innovative approaches*

In preparing students for the future, it has been suggested by Tomaz Amon that educators should be providing opportunities for them to acquire knowledge through electronic media. Tomaz points out that as the amount of information available through search engine technology is enormous, navigation and selection of appropriate instructional material is central to the success of eBook technologies. He discusses the advantages and disadvantages of eBooks in *'Usefulness of the electronic textbook: implementation difficulties'*, offering primary and secondary students the opportunity to explore biology through a web-based virtual reality world.

Moreover, the opportunity for courseware developers to utilise electronic media to offer virtual reality (VR) to engage students/learners has been identified by Anne

O'Brien's paper '*Rose coloured glasses: VR and the opportunities for humane education*', to enable an understanding of the relationships of human beings with other species. This paper provides the first stage of a novel research project that aims to investigate humane educational experiences. This paper describes an innovative methodology to enhance the use of the 3D technologies to ignite imagination and creativity through VR and virtual reality modelling language (VRML).

In another creative view taken for this Special Edition, course providers can integrate media across a number of higher-education courses to enrich the knowledge acquisition of mathematics by involving a variety of connected disciplines. Nicoletta Sala describes an undergraduate program in '*The role of new technologies to support the teaching and the learning of mathematics*'. This paper describes ways in which new media assists the teaching and learning process by incorporating normally disparate knowledge domains of philosophy, arts, and architecture.

Another author identifies role-play as a new technological context to support collaborative learning within a computer mediated communication (CMC). Rachael Pilkington's paper entitled, '*Reflecting on roles: using synchronous CMC to develop a knowledge-building community amongst post-graduates*' identifies three different kinds of roles that are involved during a collaborative learning event. The overall findings reveal the importance of belonging to a community as critical to the success of an e-learning program.

In dealing with new ways to implement interactive HCI solutions for education settings, the next group of scholarship provides examples of courseware designed to adapt to the differences in learners.

### *Accommodating differences*

Raymund Sison raises the importance of tools to support online learning systems, in his paper, '*A conversational model of online learning*'. Professor Sison describes a model whereby there are three ways of viewing the conversations that surround the learning process in terms of: learner-learner, learner-teacher, and learner-peer.

While responding to individual differences within a web-mediated instructional program presents a number of difficulties for the courseware designer; Victoria Tsiriga and Maria Virvou describe an adaptive learning support system called an 'intelligent computer assisted language learning' (ICALL) in their paper, '*Modelling the student to individualise tutoring in a web-based ICALL*'. They describe an adaptable stereotyping technique that is multi-dimensional and has the capability to interact with individual learners to tailor the system's response according to the user's knowledge acquisition levels. The model proposed by Tsiriga and Virvou is a web-based student-modelling component that teaches the domain of the passive voice of the English language called 'Web passive voice tutor' (Web-PVT). This is a dynamic system that operates in three different ways: to provide course material navigation support, to adapt exercises according to current knowledge/misconceptions, and to feedback to the learner in the form of error diagnosis.

Another example of learning systems' design that accommodates learner differences is made possible through 'learner centred design' (LCD). This approach recognises unique groups of learners. In their paper, '*Designed for learners: applying software engineering to the development of scaffolded educational software*', Kathleen Luchini, Chris Quintana, Joseph Krajcik, and Elliot Soloway, describe a software engineering

methodology that supports novice learners through new learning content and unfamiliar work practices. This paper describes the software engineering process they have developed called 'scaffolded work environments' (SWEets). The authors of this paper identify that further development work will see the SWEets technique extended to include supporting learners in diverse settings and engaged in a variety of complex activities.

There is a plethora of possible differences involved in any given instructional/learning session. For instance: individual learner capabilities, method of content delivery techniques, and anticipated instructional outcomes. Managing cooperative learning is therefore complex. H. Huai, A. Hunger, S. Werner and F. Schwarz have approached this dilemma in their paper, '*Integrating internet-based multimedia technology into technical education*'. They describe two models (MODULO and PASSENGER), which are essentially novel tools that integrate multi-media into instructional/learning systems. Essentially these researchers are involved in researching new methods to initiate flexible learning support systems that will cater for learner cognitive style differences engaged in the technical education sector.

Maria Virvou; initiates research into perspectives of human plausible reasoning (HPR) that draws on cognitive theory. In her paper, '*Modelling the knowledge and reasoning of users in a knowledge-based authoring tool*', Maria describes an intelligent tutoring system (ITS) that has the capacity to provide learners the opportunity to work in two modes; either as a tutor, or a co-learner, thereby promoting elevated knowledge sharing.

Finally, this Special Edition includes the paper on ICALT-2002 by Piet Kommers; it may convince you of the longitudinal themes that survive the short-term interest.

As this is a most dynamic process of epitomising the up-to-date vision and prototypes of authors, we would like to make a plea for further integrated views where both technology and pedagogy are interconnected. The unification between technological and pedagogical perspectives is in 'designing media for education'. One of the major paradigmatic shifts in the last decade has been to accept the learner as a major partner in the design of learning processes. In contrast to the instructional metaphor, now the constructionistic era has begun; its central thesis is that anticipation to a nomothetic [1] learner has its limitations and may overlook the essential learning needs of any of the targeted persons. The state of the art of new-media-integration shows how complex theories and real media applications are interrelated. As an added complication it is the learner who has momentary interests, fears and passions. Considering these factors, it is virtually impossible to predict how media will be used in the real settings.. The key question for the coming years seems to be, to what extent media-based learning environments should elicit a higher level of process control from the learner, versus the more traditional paradigm that we as architects should, without delay, anticipate a certain ideal learning process and make the procedural steps clear to the user. More specifically regarding the adult-learner and the 'lifelong' learner, the balance between these two orientations seems to shift to the first one, whereas for primary and secondary schools, the prescriptive procedural guidance is likely to be the more favourable. Here a dilemma seems to appear, as it is unlikely that learners will alter their learning style from receptive to productive only at a later age. Is this a preamble to a forthcoming special issue addressing the question of how to migrate from one learning style to another during the critical stages of adolescence and job-oriented learning?

**Notes**

- 1 Achieving nomothetic – in contrast to ideographic theories; so far instructional theories have aimed at finding the first principles rather than finding the more specific learning patterns for individual students. The underlying pedagogical traditions had a stronger need for finding the ideal conditions for the unique person of the learner.