Next Generation e-Learning Systems: Intelligent Applications and Smart Design (Guest Editorial)

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This special issue of Educational Technology & Society presents a selection of papers from the 5th IEEE International Conference on Advanced Learning Technologies (ICALT2005) that was held in Kaohsiung, Taiwan in July 2005. There were 409 submissions to that conference. The acceptance rate for full papers was 23% and for short papers 30%. There were 205 papers published in the proceedings, along with descriptions of 55 posters and 32 workshop papers. We had the great honour of being co-chairs of the Programme Committee for that conference and it has been a difficult but rewarding task to decide from the great number of good papers presented at that conference.

The conference theme represents a confluence of two combinations of technology and intelligence and their application to the design of (web-based) educational systems. On the one hand, we have the increasingly sophisticated embedding of intelligent technologies in educational computing applications. On the other, we see a need for more ‘savvy’ approaches to learning technology design: so that emerging technology can better serve the real needs of its users, rather than their “anticipated” needs.

Advanced Learning Technologies (ALT) or Technology-enhanced Learning (TeL), at its best, is a field propelled by a creative tension – coupling an open-minded exploration of the educational affordances of each new technology with a rigorous demand for evidence to back up claims about potential benefit. Sometimes technological innovation seems to be in the driving seat, and some sceptics complain about “technological solutions in search of educational problems”. At other times, demands for evidence and the tight constraints of established evaluation methods can make the field appear as if it is moving nowhere. In the short term, this can be frustrating and partly demotivating. But one thing we have learned is that ALT progresses in the longer-term. While it may appear to meander back and forth, on a long view it generally seems to flow in the right direction.

Thus, each of the papers selected here needs to be seen as contributing to this general flow. As in any healthy field, the papers differ in their central concerns and may even seem to be heading in different directions – but these are eddies making up the stream, rather than signs of a field in disarray. We present them to you as worthwhile contributions in their own right, but also for what they say about the general flow of ideas.

The first paper in the collection, entitled “A Particle Swarm Optimization Approach to Composing Serial Test Sheets for Multiple Assessment Criteria” is by Yin, Hwang, Chang, Hwang and Chan. Their topic is central to education and forms a dominant theme within this special issue, being concerned with assessment of student learning. Assessment is a technically challenging area, hugely important for the student and potentially very time consuming for the teacher. Consequently there is a strong interest in automating or partially automating aspects of assessment work. Problems arise in computer-based test construction if very large item banks are in use and there are multiple constraints to be satisfied (such as length of test, restrictions on multiple use of items, gauging item difficulty to suit the level of the learner being assessed, etc.) This paper explores the use of particle swarm optimisation approach in test sheet construction. The authors draw on recent modelling techniques from statistical biology, in particular, swarm modelling algorithms, and demonstrate aspects of the efficacy and the usability of a test-construction methodology that builds on such algorithms.

Lai & Lan, in their paper entitled “Modelling Peer Assessment as Agent Negotiation in a Computer Supported Collaborative Learning Environment” are also interested in assessment and the use of technology to assist in the assessment process, but their context is radically different. They are concerned with facilitating peer assessment, rather than automating assessment per se. Peer assessment has some demonstrable value, especially as a way of getting students to engage more closely with ideas about how we make judgements about what is known and worth knowing. But it can also be fraught with difficulty. Lai & Lan describe a novel approach to helping
students negotiate in the peer-assessment process, through the use of mediating agents. Their paper is exemplary in combining technical innovation with demonstration of both learning benefits and user acceptance of the approach.

The context for the work reported by Kiu and Lee in their paper entitled “Ontology Mapping and Merging through OntoDNA for Learning Object Reusability” is the rapid evolution of interest in repositories of reusable learning objects. This is an area of great technical, economic and pedagogical interest, though one would have to remark that much more attention is being paid to supply-side than to demand-side issues. That said, the potential of learning object repositories is such that serious progress is needed in methods for enhancing the interoperability of repositories. Kiu and Lee’s work on ontologies is an impressive case in point. They present a framework for automated ontology mapping (the OntoDNA framework) and demonstrate its significance for interoperability questions.

Suohon & Sutinen, in their paper entitled “FODEM: developing digital learning environments in sparse learning communities” shift our attention to distance learning provision and in particular are concerned with the needs of people in sparsely populated areas. Their focus is firmly on ‘smart design’ and they introduce and illustrate a methodology for designing digital learning environments that takes into account the needs of widely distributed learner groups. Their approach – the Formative Development Method, FODEM – focuses attention on needs analysis, implementation through rapid prototyping and formative evaluation; it is capable of providing timely and usable information about learner needs and about how well those needs are being understood and addressed.

Sierra, Fernández-Valmayor, Guinea & Hernanz, in their paper entitled “From Research Resources to Learning Objects: Process Model and Virtualization Experiences” once more address the issue of reusable learning objects. In this case, their concern is with enabling wider educational access to materials that exist in museum collections. An important part of the problem is virtualization – in a sense, shifting the artefacts from the material to the digital world. The paper describes a process model for virtualization, building on the practical experience of the authors in working with domain experts in museums. An interesting aspect of this approach is that it is realistically conservative in its assumptions about how much effort, domain experts can contribute to such work. By this way, the authors attempt to avoid the fact that quite a lot of activity in the field of virtualization and/or re-purposing has made unrealistic assumptions about the skills and time available to domain experts – e.g. for producing metadata – and has consequently failed.

Chen, Hong, Chen & Liu, in their paper entitled “Mining Formative Evaluation Rules Using Web-based Learning Portfolios for Web-based Learning Systems” bring us to assessment once more. This time the focus is on formative rather than summative assessment. They take a data mining approach to extracting evidence about learning from students’ online portfolios. Their method involves a combination of neuro-fuzzy network and K-means algorithm for logically determining membership functions, and a feature reduction scheme to discover a manageably small set of simplified fuzzy rules for evaluating learning performance based on the material gathered in student learning portfolios. Their goal is to allow teachers to redistribute their time, concentrating on tasks where they can uniquely add value to the educational process.

Morimoto, Ueno, Kikukawa, Yokoyama and Miyadera, in their paper entitled “Formal Method of Description Supporting Portfolio Assessment” stay with the topic of portfolio assessment. This time, the point is to provide appropriate support to teachers and learners who can have problems understanding how best to engage with the portfolio assessment process. In particular, teachers need support in designing for portfolio assessment – e.g. determining the type of assessment portfolios that are needed. The contribution of this paper is to provide a way of formally mapping between lesson forms and portfolios.

Finally, von Brevern & Synytsya, in their paper entitled “A Systemic Activity based Approach for holistic Learning & Training Systems” look at the connections between work activity and learning activity in corporate settings. Their contribution is rooted in a Systemic-Structural Theory of Activity, which supports a more holistic conceptualisation of learning and working, such that (among other things) technical systems can be designed to support these in an integrated rather than a fragmenting way.

This Special Issue of Educational Technology & Society collected eight papers from the 5th IEEE International Conference on Advanced Learning Technologies (ICALT2005) in a single volume. Technology-enhanced Assessment on one hand and Reusable Learning Resources from the other, have been two different areas of focus, following a current international trend towards deeper investigations in these topics. With our capacity, as Guest Editors of this volume, we hope that the readers of ET&S shall appreciate the contributions of this collection towards the research of the Next Generation e-Learning Systems.