

Editors' introduction to the special issue on cognition & learning technology

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The International Association for the Development of the Information Society (IADIS; see <http://www.iadis.org/>) 2008 International Conference on Cognition and Exploratory Learning in the Digital Age (CELDA) was hosted by the University of Freiburg, Germany, in October 2008 (see <http://www.celda-conf.org/2008/>). CELDA aims to address the main issues concerned with evolving learning processes, supporting pedagogies and technology applications. There have been advances in both cognitive psychology and computing that have affected the educational arena. The convergence of these disciplines is increasing at a fast pace and affecting academia and professional practice in many ways. Paradigms such as just-in-time learning, constructivism, student-centered learning and collaborative approaches have emerged and are being supported by technological advancements such as simulations, virtual reality and multi-agents systems. These developments have created both opportunities and areas of serious concerns.

Three of the themes of CELDA 2008—assessing learning in complex domains, cognition in education, and technology and mental models—produced seven papers that were very highly rated by reviewers, well received at the conference, and nicely complementary in terms of research, theory, and implications for learning and instruction. These papers have been edited and revised based on feedback from reviewers, conference participants and the editors of this special issue. The organizing committee of CELDA 2008 proposed a

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special issue of ETR&D based on selected papers from CELDA 2008. The result is this special issue comprised of the seven papers selected on the basis of a common focus on mental models, cognition and assessment.

The first paper in this special issue by Roy Clariana (Pennsylvania State University, USA), Patricia E. Wallace (The College of New Jersey, USA), and Veronica M. Godshalk (University of South Carolina, USA), entitled “Deriving and measuring group knowledge structure from essays: The effects of anaphoric reference,” used a technology called *ALA-Reader* and Pathfinder network analysis (see <http://interlinkinc.net/>) to explore an automated procedure to capture and represent knowledge structures in student essays.

The second paper by Pablo Pirnay-Dummer (University of Freiburg, Germany), Dirk Ifenthaler (University of Freiburg, Germany), and J. Michael Spector (University of Georgia, USA), entitled “Highly integrated model assessment technology and tools,” involves three integrated tools to assess the development of skill and knowledge in challenging problem-solving domains. This suite of tools, called *HIMATT*, elicits text and annotated concept maps, and then provides a set of automated analysis techniques to compare representations to a reference model (e.g., an expert model), to a prior representation by the problem solver, or to representations of other problem solvers. Taken together, *ALA-Reader* and *HIMATT*, represent state of the art techniques to elicit and analyze knowledge structures. The creators of these tools are now engaged in an effort to cross-validate their methods to determine areas of convergence and divergence.

The third paper by Carlos Capelo (Universidade Lusófona, Portugal) and João Ferreira Dias (EBAP-Fundação Getúlio Vargas, Brazil), “A feedback learning and mental models perspective on strategic decision making,” made use of causal influence diagrams to elicit mental models and determine the relationship of mental model structures and decision making behaviors. The methodology used by Capelo and Dias is similar to one of the methods used in *HIMATT* and further demonstrates how mental model representations might be used to predict and assess the quality of decision making in complex situations.

The fourth paper by Kinshuk (Athabasca University), Tzu-Chien Liu (National Central University, Taiwan), and Sabine Graf (National Central University, Taiwan), entitled “coping with mismatched courses: Students’ behavior and performance in courses,” demonstrates the efficacy of a technique to help students identify their own cognitive learning styles and make appropriate adjustments for courses that are not especially well suited for their learning styles.

The fifth paper by Nadine Schlomske (University of Jena, Germany) and Pablo Pirnay-Dummer (University of Freiburg, Germany), entitled “Model based assessment of learning dependent change within a two semester class,” used one of the tools now integrated in *HIMATT* called *MITOCAR* to elicit and analyze students response to challenging problem solving scenarios over a period of two semesters to determine how well *MITOCAR* predicts the development of expertise. The results are nicely compatible with the first two papers in this special issue and demonstrate the value of automated tools to elicit and analyze mental model representations.

The sixth paper by Michael J. Hannafin (University of Georgia, USA), Kathleen Hannafin (University of Georgia, USA), and Bruce Gabbitas (University of Georgia, USA), entitled “Re-examining cognition during student-centered, Web-based learning,” examine the challenges that student-centered and Web-facilitated learning place on individual learners to take responsibility for their learning goals, to monitor their progress, and to assess their learning agendas. Recognized cognitive principles for the design of student-centered, Web-based learning are critically reviewed, and the need for further in-depth study of both design and student performance in these environments is discussed.

The seventh paper by Manoli Pifarré (Universitat de Lleida, Spain) and Ruth Cobos (Universidad Autónoma de Madrid, Spain), entitled “Evaluation of the development of metacognitive knowledge supported by the KnowCat System,” explores the impact of a computer-supported collaborative learning environment called *KnowCat* on the development of metacognitive knowledge.

These seven papers demonstrate the many complex interactions between technology and cognition and, further, they nicely exemplify the interdisciplinarity required to understand how knowledge and skill are developed in the digital age. The theoretical foundations, innovative technologies, and insightful findings in these papers will surely prove useful in advanced educational technology research and practice.