EDITORIAL

Learning processes, especially when linked to "conceptually rich domains" (Azevedo, 2009) (Lin, 2001), require strategic environments, where learning experiences are the result of a design phase that looks at a metacognitive perspective (Tsai, 2009) as a vehicle to stimulate reflexive processes on knowledge and self-knowledge (Schunk 2008). The self-regulated approach has especially been adopted in the field of technology-enhanced learning and is based on the premise that learners adaptively regulate their cognitive and metacognitive behaviours during learning.

In this issue we host two invited papers by Prof. Roger Azevedo (Mc Gill University, Montreal, CA) and Prof. Gautam Biswas (Vanderbilt University, TN, USA), which are two outstanding persons in the field of self-regulated learning, and metacognition applied to artificial learning environments.

In particular, Prof. Azevedo wrote about "Dysregulated Learning with Advanced Learning Technologies" that is the empirical evidence that some students put in action strategies that lead to minimal learning instead of modifying their behavior adaptively according to a self-regulated learning paradigm. The paper is focused on studying dysregulated behavior to avoid it in learning environments aimed to foster self-regulation.

Prof. Biswas wrote about "Modeling and Measuring Self-Regulated Learning in Teachable Agent Environments". This research relies on the agent-based learning environment named "Betty, the virtual student" where a learning-by-teaching paradigm is exploited. A comparative study is discussed where Betty provides two different metacognitive feedbacks to two groups of 8th-grade science students. A data mining technique has been used to explore in detail the learning behavior of each student during the interaction with Betty.

These two papers are extended versions of the contributions presented to the "Cognitive and Meta-cognitive Educational Systems" AAAI symposium (MCES 2010) that was held in Arlington Virginia on November 11-13, 2010. MCES 2010 was the second edition of the successful AAAI Fall 2009 Symposium with the same name.

This year the third symposium will be co-located with the 12th International Conference of the Italian Association for Artificial Intelligence - A*IA 2011 (http://chilab.dinfo.unipa.it/aixia2011/workshop_06.php).

The idea for MCES 2009 stemmed from several theoretical, conceptual, empirical, and applied considerations about the role of metacognition and self-regulation when

learning with Computer Based Learning Environments (CBLEs). A related goal was the design and implementation issues associated with metacognitive educational systems. MCES implemented as CBLEs are designed to interact with users, and support their learning and decision-making processes. A critical component of good decision-making is self-regulation.

The main aim of MCES 2010 was to continue the discussion started in 2009 on some of the previous considerations and to enhance the discussions with some new ones:

- What are the theoretical foundations and how are they articulated in CBLEs?
- Is it possible to develop a unified framework for all metacognitive educational systems?
- What are the necessary characteristics of these systems to support "metacognition"?
- To what extent does the educational system itself have to exhibit metacognitive behavior(s), and how are these behaviors organized and enacted to support learning?
- What are the main aspects of metacognition, self-regulation skills, emotions, and motivations that influence the learning process?
- What does it mean to be metacognitive, and how can one learn to be metacognitive? Can MCES actually foster learners to be self-regulating agents? How can a MCES be autonomous and increase its knowledge to match the learners' evolving skills and knowledge?
- What is the role of artificial agents in supporting metacognition and self-regulated learning? MCES may not be embodied, but does it help if they act as intentional agents?

The symposium hosted many contributions from researchers in heterogeneous disciplines: AI, cognitive and learning sciences, education psychology, education science, HCI, computational linguistics, web technologies, social network analysis, visualization techniques, software architectures, and multi-agent systems.

Discussion focused mainly on the need to have quantitative measures of the learner's metacognitive abilities. The debate was between Education Psychologists and AI and HCI people. The formers need to have measures of metacognition in support of the evidence of particular behaviors in the learner when she is engaged in studying a topic. The latters want to have computable models of metacognitive abilities to build a new generation of truly metacognitive agents that are able to support the learning process. Both kinds of people argued that suitable computable models are needed to represent metacognitive process despite the particular research goal.

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