

AIED 2013 Workshops Proceedings  
Volume 10

Self-Regulated Learning in Educational  
Technologies: Supporting, modeling,  
evaluating, and fostering metacognition  
with computer-based learning  
environments (SRL@ET)

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## Preface

It is important that the educational system helps learners develop a general ability to get up to speed quickly in new domains. In order to do that students need to be able to manage their learning, for example, by setting goals, planning their learning, monitoring their progress, and responding appropriately to difficulties and errors. These general learning skills are often referred to as metacognition, or self-regulated learning (SRL). Bransford et al. [3] suggest focusing on metacognition as one of three principles that should be applied to educational research and design, as stated in the influential volume “How People Learn.” A similar recommendation is given also in Clark and Mayer’s [4] book about e-learning design principles. Azevedo and colleagues have found that students who regulate their learning in a hypermedia environment are more likely to acquire deep understanding of the target domain [2]. A key question is whether instructional technology can be as effective in fostering metacognitive skills as it is in teaching domain-specific skills and knowledge. Numerous learning environments include metacognitive support in order to improve domain-level learning (e.g., [5] and [1] support self-explanation in order to promote learning of Physics and Geometry, respectively.) However, only a few systems actually attempt to help students to acquire or improve the metacognitive skills themselves (and not only the domain-level knowledge). Some work suggests that improving metacognitive and SRL skills can be done using educational technologies. Examples include the Help Tutor [6], Betty’s Brain [7] and MetaTutor [2]. However, a lot remains to be known about the fashion in which educational technologies can support the acquisition of metacognitive and SRL skills. The modeling, tutoring, and evaluation of metacognitive skills and knowledge poses a number of challenges:

**Modeling metacognitive and SRL knowledge:** Metacognitive knowledge is ill-defined by nature. While the correct answer to a problem at the domain level is usually independent of the learner or the context, this is not the case for metacognitive dilemmas, in which the appropriate metacognitive actions depend on the student, her capabilities, motivation, preferred learning style, the learning context, and her relevant domain knowledge. Traditional modeling may not be suitable to capture and adapt to the specific characteristics of the learner, task, and context. This difficulty influences the design of the systems as well as the methods for assessing students’ knowledge and actions.

**Tutoring:** Metacognitive tutoring is usually done within a context in which students are learning domain-specific skills. This setup requires that the two levels of instruction are integrated in a meaningful way. For example, the design of metacognitive tutors should add metacognitive content without overloading the students’ cognitive capacity, and relevant metacognitive learning goals should be set.

**Evaluation:** While students’ domain knowledge can be assessed using conventional tests, assessing students’ ability to plan, execute, and monitor their learning is much more challenging. First, this assessment should be independent of students’ domain knowledge. Second, the outcomes of productive metacognitive

behavior are often not immediate. They contribute to the quality of the overall learning, but cannot be observed immediately in the solution to a specific problem.

Educational technologies have the potential to tackle these challenges successfully. They offer individual coaching, have the ability to monitor students' progress and learning parameters over extended time periods, and can adapt to individual students' needs. However, it remains largely unknown exactly how educational technologies can help students acquire better metacognitive skills and thereby become better learners with respect to domain-specific skills and knowledge.

This workshop follows earlier workshops on metacognition and SRL (at AIED 2003, AIED 2007, ITS 2008 and ITS2012). In this workshop we discuss the above and other related issues concerning the tutoring of metacognitive and SRL skills using Intelligent Tutoring Systems, focusing on the following: Social self-regulation skills, Scaffolding self-regulation skills and Domain focused self-regulation.

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June, 2013

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