SRL Tasks and Activities as a Model of Cognitive Behaviour within ETTHOS

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***Abstract*—As computer supported learning fragments from monolithic platforms into a wide range of disparate learning experiences it is important to develop systems that provide generic services appropriate for a wide array of learning scenarios. The authors have previously developed a platform for deploying metacognitive scaffolding coupled to a web-based adaptive eLearning system, supported by a cognitive model of reading for learning tasks, developed with instructional experts. We have began investigating more generic cognitive task models in order to support a wider variety of learning experiences. Here we discuss models of SRL and their suitability.**

Keywords: self-regulated learning; metacognition; ETTHOS; cognitive model; activity model;

I. Introduction

A key facet of providing support for computer-based learning is understanding the processes that the learner undertakes as they progress in both their learning and their use of the system. In supporting metacognitive development utilizing the ETTHOS (Emulating Traits and Tasks in Higher Order Schemata) model [1–3], the authors previously used a model of reading for learning developed by Pressley & Afflerbach [4]. In ETTHOS, tasks the learner undertakes are divided into activities – for example, the task schema for 'Before you Begin' comprises of activities such as *constructing a goal* and *over viewing an activity*. This task model arose out of protocol analysis which traced and identified the activities that a successful learner undertakes while reading a piece of academic material – this can include things like text, tables, figure, etc. These activities would then be matched to the items of a metacognitive support model (currently Schraw & Dennison's MAI [5]). As the technology moves to support a wide variety of learning systems and experiences – simulated worlds, serious games, experiential simulators, as well as more 'traditional' web-based systems, a more generic model of learning tasks and activities is required, not just for that of reading. In the next section we will examine the suitability of models of SRL to fulfill this role.

II. SRL Tasks and Activities

In order to refactor the ETTHOS model for external service provision, a generic task model is a helpful adjunct. Much of computer-based learning is amenable to (or specifically targeted at) Self-Regulated Learning (SRL). The ROLE project (www.role-project.eu) is working to define the underlying processes involved in undertaking SRL-based studying. As part of this work they are defining activity models for SRL (*cf.* [6], [7]). They have identified 6 key high-level learning activities [6] (which would be Tasks within the ETTHOS nomenclature): Goal setting, Self-monitoring, Self-evaluation, Task strategies, Help-seeking, Time management. These are further broken down – for example Goal Setting includes: *to formulate goals*, *to order goals*, *to describe obstacles*. In ROLE, these are mapped to SRL competencies in order to define skills (*cf.* [6] Figure 4). However, taking these tasks and their component activities allows us to construct the learning model within ETTHOS, mapping the metacognitive factors and items across to allow salient scaffolding to be provided, supporting the SRL learning process.

III. Related Work

MetaTutor [8] is a hypermedia-based learning environment, which incorporates *pedagogical agents* who interact in natural language for tutoring biology. The process of SRL is represented in MetaTutor as both declarative and procedural knowledge and measures of the skill are assessed based on the learner's actions, decisions, ratings, and verbal inputs.

Conversely, Open Learner Models trigger self-reflection through representing the learner's progress. Intelligent Tutoring Systems track a learner's progress, learning gain, or cognitive competencies – OLMs take advantage of this without actually measuring or tracking the SRL activity itself. A notable example of a system that has reported the benefits of an OLM is SQL-Tutor [9].

IV. Illustrative scenarios

In our first service iteration, Goby [1], the models were developed to support constructive learning. A typical instructional process might work as follows:

1. The learning environment makes a call to Goby notifying a particular user is undertaking a particular constructive reading activity.
2. Goby examines its model, matching activity to metacognitive item according to its ruleset and produces an appropriate scaffolding prompt
3. The scaffolding is immediately displayed within the learning environment.
4. Goby updates its models

With a more generic service, supporting SRL, the following process is envisaged:

1. The computer-supported learning system (CSLS) determines that the learner is engaging with a particular SRL activity (it is assumed it has such a capability) and emits a notification
2. The metacognitive scaffolding service (MSS) receives this notification
3. The MSS looks up the activity and the learner
4. The MSS returns a packaged scaffolding intervention
5. The CSLS unpackages the intervention and delivers it in an appropriate manner, determining a balance of flow, saliency and timeliness.
6. Any interaction with the intervention is routed to the MSS to update its models

Note that in the second scenario, a much more complex interplay of control is necessary as the MSS and CSLS must negotiate to ensure that the intervention is timely without disrupting the learning.

V. Challenges

As with all disconnected or loosely coupled services, it is important that the service supports a range of cues in order to ensure properly tailored content. As currently implemented the service supports both a range of RESTful calls to the models contained at a range of granularities and a limited parsing of input to tailor the user model. Stereotypes to support / initialize user models across a range of learning activities are still to be developed. The service also instantiates infrastructure parsers to allow different learning environments to have their service calls translated into standard API functions.

In our new service the computer supported learning may not take place within a traditional learning management system, nor be entirely computer based. As well as ensuring appropriate content, there must be negotiation between the service and the learning platform about style and timing of delivery.

The move from the targeted model based on constructive reading to a more generic cognitive model requires careful validation to ensure that the support provided is both salient and constructive. To develop a system that can support the wide range of activities currently deployed by current teaching models requires a wide range of activities to be supported. Another approach would be to use something like the 8LEM model [10], where eight broad learning methodologies are defined (of which self-regulation is only one) after examination of over 100 online courses. Of course, online course and computer-supported learning are not a completely overlapping set so additional challenges in further defining and validating activities exist.

VI. Conclusions

The move from the integrated provision of metacognitive affordances within computer based learning/training to Support/Scaffolding as a Service necessitates the need for generic models of cognitive and metacognitive learning behavior, as well as contextual cues to drive those models and their provision. Models of SRL provide one promising route to allow generic Tasks to be coupled through service calls to all the provision of appropriate, timely and effective content.

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