



PhD candidate

Mihaela Cocea

mihaela@dcs.bbk.ac.uk

www.dcs.bbk.ac.uk/~mihaela

PhD supervisor

George Magoulas

gmagoulas@dcs.bbk.ac.uk

Project Details

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Learner Modelling in Exploratory Learning for Mathematical Generalisation

Project Aims

The main aim of the project is to investigate what and how to model in the context of exploratory learning for mathematical generalisation. Other aims include feedback generation, usage of the learner models for personalised feedback and for providing teacher support.

Challenges and Research questions

The main challenge of Exploratory Learning Environments (ELEs) is to balance freedom with control: learners should be given enough freedom so that they can actively engage in constructing models and they should be offered enough guidance in order to assure that their constructions lead to useful knowledge. Other challenges are: (a) What to model? (b) Value of correct vs. incorrect actions; (c) Relation between abstract knowledge and forms of (re)presentation in the system; (d) Identification of underlying strategies from actions or sequences of actions.

In contrast to previous attempts, here we advocate an approach that extends user modelling in ELEs by reflecting and supporting the constructionist learning process. The research questions addressed in our research are:

- (a) What interactions are relevant and how can they be extracted from the flow of raw data and transformed into indicators?
- (b) What should be stored in the learner model in order to represent the evolution of the learner's constructionist models and their corresponding cognitive processes?
- (c) How should the learner model be updated in order to reflect both the current knowledge and the evolution of knowledge?

- (d) Using the learner model, how can personalised feedback be provided to support the constructionist process and inform the teacher?

Proposed framework for learner modelling

The structure of the proposed learner model and the updating process follow the model of human memory and includes two components: a short-term model (STM) and a long-term model (LTM) (see Figure 1). The STM includes recent actions of the learner. The LTM contains information about the domain and the task and thus has two parts: the Task LTM that has the same structure as the task model, and the Domain LTM, which is an overlay model of the domain and maintains the knowledge of the learning outcomes associated with the learning process as inferred from the learner's constructions.

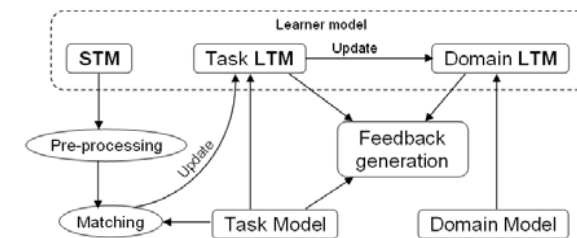


Figure 1. Learner modelling process

The learner modelling process supports two types of feedback: during the exploration process and at the end of certain processing stages. The first one aims to guide the learner in gradually constructing the knowledge, while the second one is more related to outcomes of the exploration and specific solutions.