

A Role for Open Learner Models in Formative Assessment: Support from Studies with Editable Learner Models

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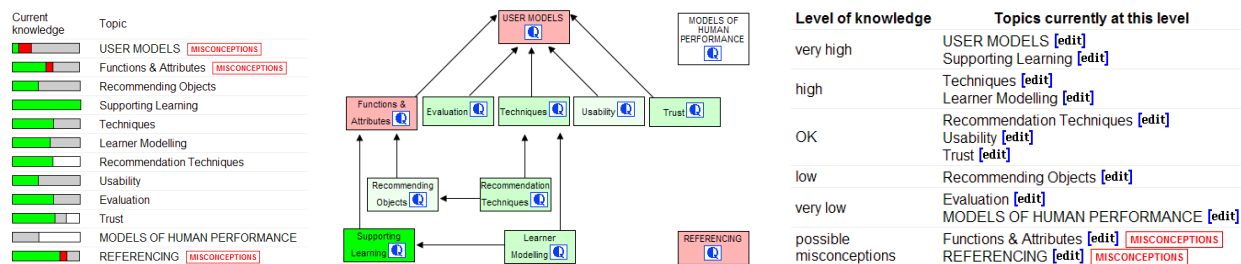
Position Statement: Summary

This position statement builds on arguments for developing open learner models to provide formative assessment opportunities and promote learner reflection. We suggest that students do use open learner models for such metacognitive activities, illustrated by their behaviour when using learner models that they can directly edit. We conclude that, in addition to theoretical justifications for open learner models to support formative assessment, there is initial evidence showing students will not simply change their model to reveal what they want it to show – even if this could gain them additional or ‘easy’ marks. Instead, students will use an open learner model to help them plan and monitor their learning.

Open Learner Models

Adaptive learning environments individualise the interaction to suit the learner’s educational needs. This personalisation is achieved by dynamically modelling the learner’s understanding as revealed (or inferred) from their actions in the environment. In most adaptive systems, the learner model is used only or primarily for this purpose, and so is not available for user viewing. ‘Open learner models’ are learner models that are accessible for user inspection in an understandable form, to help the learner identify their current knowledge or understanding of a subject, sub-topic or specific concept. They may then use this information to help them reflect on their knowledge, identify gaps in their understanding and plan their learning (Bull & Kay, 2007). The open learner model thus provides the user with additional information about their learning progress that is not usually available to them.

Learner models can be displayed to users in a variety of ways. We here illustrate open learner model interfaces using two ‘learner model views’: skill meters (left) and a structured learner model presentation which shows relationships between topics (centre). Colour is used to indicate strength of understanding (green), misconceptions (red), general difficulties that are not identified as specific misconceptions (grey), and areas that have yet to be attempted (white). Clicking on ‘misconceptions’ links in these (and the other) learner model views leads to simple statements of the learner’s misconception, as a starting point for them to work out their difficulties. (For example, in a course about user modelling: “You may believe that adaptive systems do not have any drawbacks”).



Editable Learner Models

Editing the learner model (e.g. above right) may be helpful in situations where a learner has additional information about their knowledge, for example: in cases where understanding has not yet been demonstrated during an interaction (such as existing background knowledge, understanding gained as a result of attending a lecture or reading course notes/other information); or where the student is aware of having forgotten information that they had previously known. This accords with the notion that learners should have control over, and responsibility for their learning, and hence their learner model (Bull & Kay, 2007). We here briefly present the results of three studies undertaken with university students:

- (i) A lab-based study with 20 participants, where some of the contents of the learner model were automatically changed before the learner model was presented to the learner. The purpose was to identify whether students would edit the inaccuracies introduced into the representations in their model, while not editing the model data that accurately reflected their understanding.
- (ii) A study of a deployed open learner model with 135 students over two terms, where the model inferences were not altered by the system in this way (i.e. the representations were assumed to accurately reflect the user's knowledge), but where the user could edit their model if they wished.
- (iii) A study of a deployed open learner model with 18 students during one term, again where the model was not changed by the system before presentation, but where the user could edit their model up until the point that it was summatively assessed (the model contributed 5% to the final course mark).

In study 1 students generally edited their learner model when a misconception they did not actually hold, was inserted before the model was displayed. However, they did not do so when additional correct beliefs were inserted into their model. They tended not to edit the accurate (i.e. unchanged) representations. Study 2 showed very little model editing activity at any point during the deployment. Study 3 showed that, while some students edited their learner model at some points during the term, only one edited their model to show knowledge that was not verified, before the summative assessment deadline.

Discussion

Given the potential for open learner models to prompt reflection by showing users inferences about their knowledge, we believe this to be a useful approach to encourage metacognitive activities related to self-regulation and planning, and to support formative assessment (see Bull & Kay, 2007). We have provided examples of cases in which open learner models are *editable* by the user. Although the lab-based study showed a tendency for students to remove erroneously represented misconceptions from their learner model, they did not notice, or chose not to remove knowledge that was automatically added – i.e. knowledge they did not actually have. Nevertheless, the accuracy of the edits that they did make, seems confirmed. In situations of deployed open learner models, students generally made few edits. This was found both in a study with a large number of students who were optionally using the system for formative assessment only; and in a smaller scale study where the learner model was also summatively assessed. It is this latter case that is particularly interesting: it suggests that the perceived benefits of formative assessment supported by an open learner model outweighed the temptation to simply edit the learner model to gain course credit. Therefore, in addition to theoretical reasons for providing open learner models to support formative assessment, we believe that students themselves see them as beneficial, and will use an open learner model appropriately to support their independent learning.

Reference

Bull, S. & Kay, J. (2007). Student Models that Invite the Learner In: The SMILI Open Learner Modelling Framework, *International Journal of Artificial Intelligence in Education* 17(2), 89-120.