Persuading an Open Learner Model in the Context of a University Course: An Exploratory Study

Blandine Ginon[1], Clelia Boscolo[2], Matthew D. Johnson[1], Susan Bull[3]

[1] School of Engineering, University of Birmingham, UK
[2] Department of Modern Languages, University of Birmingham, UK
[3] Institute of Education, University College London, UK

Abstract. The LEA's Box open learner model (OLM) allows learners to try to persuade the system to make changes to their learner model by challenging evidence or providing justifications. This aims to help make the OLM more accurate, and provides a means for learners to satisfy themselves that the model does indeed reflect their current state of learning. We report an exploratory study with 15 university students, with learner model data coming from quizzes in a Learning Management System. Students generally claimed to understand the approach of learner model persuasion, how it is useful, how it relates to their learning, and identified cases when they could use persuasion.

Keywords: Open Learner Model, Learner Model Persuasion

1 Introduction

Open learner models (OLMs) are learner models that can be accessed in a user-understandable form [3]. Some are interactively maintained by both system and student, helping increase the accuracy of the model, supporting reflection, facilitating planning and self-monitoring, and affording the learner a greater level of control over the learner model data [2;10]. Those that allow users to directly edit, and therefore fully control the contents of their OLM (e.g. [4;8;12]) may be particularly appropriate when learners are known to be accurate, and are also confident in self-assessment. It has been suggested that learners may feel more confident if the model changes are *validated* by another stakeholder [12] such as a teacher or the system. OLMs can also be updated through the student contribution of additional information (e.g. [6;10;17]), an evidence based approach [18], enabling the OLM to benefit from user-given data, but without handing full control to the learner as in editable models.

In contrast to the above, negotiated learner models allow learners to challenge learner model data, with separate representations retained if the learner and system cannot agree on a representation [1;9;11]. Persuadable OLMs also allow learners to request and justify changes to their model, e.g. by answering additional questions [7;12;14;15] or selecting from teacher-defined reasons [5]. If the system is convinced, the model will be updated. However, in this case the system retains control of the learner model if the student does not successfully justify their reasons for changing representations. Both negotiation and persuasion aim to help overcome possible learner reticence of not having validation for the model content in OLMs that they

can edit or add information to, without challenge (as suggested in [12]), whilst ensuring some responsibility for OLM content is retained by the learner – an important aspect that OLMs aim to support [3;10].

In our context, all OLM evidence originates from external data sources. Such approaches have also been investigated with other OLMs (e.g. [6;13;16]), since today's learners now use a range of learning applications. However, a potential limitation of such situations is that the data from other sources may be of different granularity, may not be equally representative of student learning, or may simply not be regarded by students as equally valid. Therefore, adding the facility to allow users to try to persuade the learner model to update any data that they believe does not adequately represent their skills, aims to help overcome these limitations. Students may offer information that can help increase the accuracy of their learner model in this context, while retaining the system control offered by persuasion approaches, and also the validation as considered important by some students [12]. Our initial findings with a persuadable OLM are likely to apply also in some negotiated learner modelling contexts.

2 The LEA's BOX Persuadable Learner Model

The LEA's Box OLM offers ten visualisations [5], both simple (e.g. skill meter, radar plot) and more complex (e.g. network), see Fig. 1, and the OLM can be constructed from a range of activities and multiple data sources (based on [6]). As in some other OLMs (e.g. 10]), the persuasion feature allows learners to view evidence underlying their learner model. In addition, it allows users the opportunity to try to persuade the system to make changes if disagreement occurs, e.g. by challenging evidence or providing justifications for their own assessment of their skills. Table 1 (extended from [5]) details the moves available to the system and learner.

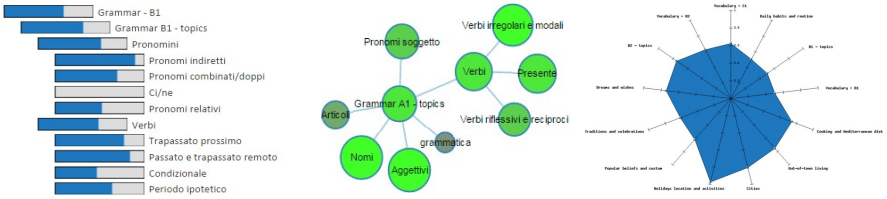

Fig. 1. Example LEA's BOX visualisations: skill meters; network; radar plot.

The first step of the persuasion workflow (Fig. 2) displays the student's current level for a competency (statement). The student may then request evidence or self-assess, to try to change the value. Requesting evidence is available throughout persuasion, and details how the current competency is calculated, taking into account all evidence associated with the competency and its sub-competencies (Fig. 3). Evidence may, for example, be a score in a quiz, a teacher assessment, or the result of a past persuasion. The modelling process gives more recent evidence a higher weight. Following a student self-assessment, the system requires justifications to validate the increase or decrease to the value in the learner model. Using teacher defined parameters [5], the system accepts or declines the proposed change, or may propose a compromise. If the student accepts a compromise or the system accepts the student's proposition, the model is updated with an additional piece of evidence stating the new value.

In that case, older evidence no longer contributes to the modelling process, but remains available for reference. If a self-assessment or a compromise is declined, the model is not updated as the system, parameterised by teacher, ultimately retains the control, as in other persuadable learner models [7;14;1515].

Table 1. Persuasion moves for each stakeholder.

	Student	System
Accept/agree	Agree with the system's evidence; Accept a compromise	Agree with the student's justifications; Accept a compromise
Decline	Decline system proposed compromise	Decline (e.g. too recent)
Compromise	Propose a compromise between the system's the student's self-assessment	Propose a compromise between current level and self-assessment
Request evidence or justifications	Request evidence for current level	Request justifications for a self-assessment
Provide evidence or justifications	Provide justifications (e.g. homework, further study, external factors)	Provide evidence (e.g. learner model evidence)
Self-assess	Proposition of a new OLM state	×
Challenge evidence	Disagreement with item of evidence	×
Statement	×	Statement of fact about the OLM

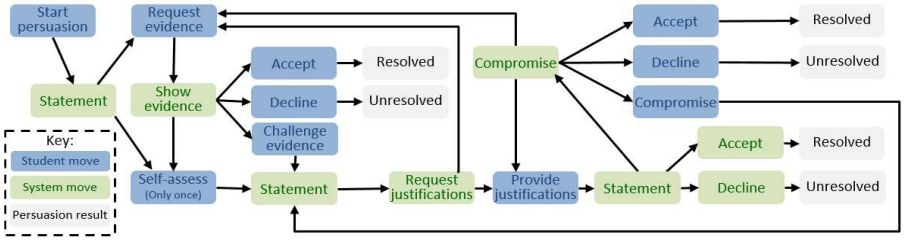

Fig. 2. Workflow for persuasion.

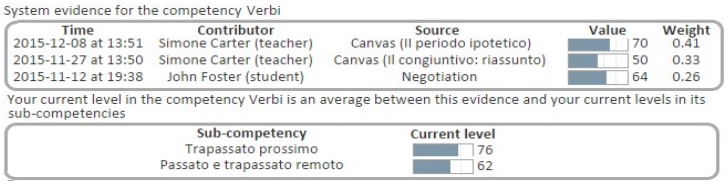

Fig. 3. Example display of system evidence.

3 User Perceptions of the LEA's Box Persuadable OLM

The LEA's Box OLM was used by 15 volunteers studying Italian at the University of Birmingham. The exploratory study investigated whether students claim to understand OLM persuasion and find it useful, and their motivations for why it might be used in their learning. OLM evidence came from short answer quizzes imported daily from the course Learning Management System (LMS). The quizzes take about 30 minutes to complete, can be repeated, and cover 133 teacher defined grammar and vocabulary topics.

At the start of the course, students were given a demonstration of the OLM and its persuasion facility using a test account with sample data. The OLM was available for two months (the first week and last two weeks of which were during term time). All OLM usage was logged. At the end of the period, participants completed a 5-point

Likert scale questionnaire, and individual semi-structured interviews took place with 5 volunteers during an optional lab session. The interviews lasted about 10 minutes, and were audio recorded and transcribed. They took place in front of the student's OLM, and focused on participants' perceptions/attitudes towards OLM persuasion, including whether it was used, why it might be used and why it might not be used.

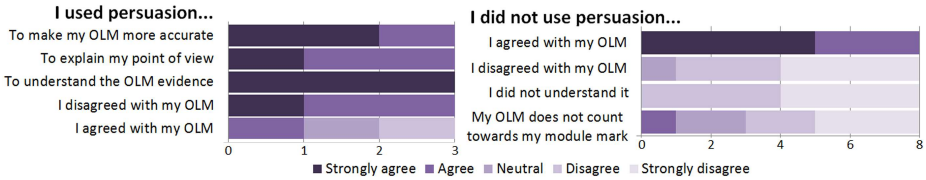

Fig. 4. Questionnaire responses: reasons to use/not use the persuasion feature.

Table 2. Themes from interviews about expected use of persuasion feature.

Persuasion	Would Use	Would Not Use
Informational	**[5]** Course is large. Not all competencies have info **[3]** Only completed most relevant part of quiz **[2]** Wish to restore the model to a previous state **[2]** Quiz content broad. Only part completed quiz	**[2]** More evidence is required first. **[2]** Difficult to add self-assessment values.
Temporal	**[3]** Quizzes take a long time to complete. **[3]** Student ran out of time, quiz submitted early **[1]** Wanted immediate feedback, quiz not complete	**[2]** Takes time to complete persuasion. **[2]** Not exam period
Inference Precision and Level of Interaction	**[3]** Answer incorrectly marked e.g. part of sentence not typed, but still correct **[3]** No half marks. e.g. case sensitive responses **[2]** Setup error causes incorrect marking **[2]** Quiz platform interaction problems **[1]** Right answers placed in wrong boxes	**[4]** Do not feel have done enough quizzes yet to use persuasion effectively **[3]** Already accurate
Attitudes / Strategies	**[1]** Learning strategy leads to lower level showing in the OLM, e.g. use of trial and error	**[2]** Not technology confident **[1]** No summative mark

Most interaction occurred during the term (start and end of the period). 7 participants used persuasion, in 12 OLM discussions: 3 were resolved (i.e. with system-student agreement and a model update); one was discontinued as it was too soon after a previously resolved persuasion; 8 terminated after viewing evidence. All persuasion attempts were self-assessments higher than the value in the OLM. 11 participants returned questionnaires (Fig. 5): 3 used persuasion, 8 did not. Those who attempted persuasion indicated that they disagreed with their OLM, whilst those who did not try to persuade, indicated agreement. None of the latter claimed not to understand persuasion. One indicated that they refrained from persuasion because it was not summatively assessed. All who used persuasion wished to make the OLM more accurate, and wished to explain their viewpoint and understand the evidence behind the model. The 5 interview transcripts showed reasons for using/not using persuasion as relating to information, time, precision and attitudes (Table 2 states the [number of participants] who mentioned each theme). For OLM accuracy, participants indicated persuasion might be needed where they have short term goals (e.g. part completion of quizzes), because of limitations with the LMS (e.g. incorrect marking, multiple right answers) or because of more transient constraints (e.g. out of time to interact with the LMS, early quiz submission). Participants also indicated OLM persuasion may not be a priority because the model was already perceived as accurate, not enough course content had been covered, or it was not at the point of the course where it was of most

use ("during the summer exam period"). Two participants added that they wished use persuasion after they had completed more quizzes.

4 Discussion and Conclusions

OLMs are designed to represent learners' current skills, knowledge, competencies, etc. Usually they are assumed to be as accurate as is necessary for the purpose of personalising teaching. In this study, as also described in other research (e.g. [16]), the activities providing data were from a LMS. In our case, the data was transferred to the OLM each day. This meant that there was more scope for the OLM to be outdated, and perhaps, more reason for students to try to persuade the system to change values. Against this, however, is the fact that OLMs are typically updated dynamically as students interact with a learning system, and so students may have regarded the delay as too cumbersome to engage fully. Our aim, therefore, was to explore students' reasons to choose to use or not use an OLM persuasion feature in this context.

Interaction logs, questionnaires and interviews indicated that learners could see how persuasion related to their learning, and many participants said that they agreed with their model, so there was no reason to try to update it. Some stated that it was perhaps the wrong time in their learning to use persuasion, potentially because of the size of the course, time taken to complete (or partially complete) quizzes, or because they may wish to wait until upcoming summative assessment before more intense engagement. Of those who claimed to have started model persuasion, each had an interest in seeing evidence behind their OLM. This may suggest that a core foundation to OLM persuasion is understanding the evidence's origin and context, in order for the learner to think about the differences and similarities between this and their perceptions of OLM accuracy, in line with other calls to show learner model evidence [10]. Participants showed awareness of some limitations of the LMS quiz engine, such as stringent scoring, human error, or using it with their own learning strategies (e.g. working on only small parts of course content), leading to the OLM underestimating competency. This presents an interesting case for keeping the model accurate, and for OLM persuasion, away from the more usual use of OLMs in intelligent tutoring systems where dynamic modelling is at the core of the system.

Some of our findings may generalise to other contexts: university students appear to understand how OLM persuasion applies to their learning, when it may be useful, and are willing to challenge evidence if they disagree, explaining their point of view. Such persuasion allows them opportunities to try to influence the model data, and could give them more control over their learning in, for example, an ITS where teaching is personalised according to the learner model. This control may be further increased in contexts learner model negotiation techniques are used.

Acknowledgments

This project is supported by the European Commission (EC) under the Information Society Technology priority FP7 for R&D, contract 619762 LEA's Box. This document does not represent the opinion of the EC and the EC is not responsible for any use that might be made of its contents.

References

1. Bull, S. & Pain, H. (1995). 'Did I Say What I Think I Said, And Do You Agree With Me?': Inspecting and Questioning the Student Model, in J. Greer (ed), Proceedings of World Conference on Artificial Intelligence and Education, AACE, Charlottesville VA, 501-508.
2. Bull, S. (in press). Negotiated Learner Modelling to Maintain Today's Learner Models. RPTEL.
3. Bull, S., & Kay, J. (2013). Open Learner Models as Drivers for Metacognitive Processes, in R. Azevedo & V. Aleven (eds), International Handbook of Metacognition and Learning Technologies, Springer, 349-365.
4. Bull, S., Dong, X, Britland, M. & Guo, Y. (2008). Can Students Edit their Learner Model Appropriately? in B.P. Woolf, E. Aimeur, R. Nkambou & S. Lajoie (eds), ITS08, Springer-Verlag, Berlin Heidelberg, 674-676.
5. Bull, S., Ginon, B., Boscolo, C., Johnson, M. (in press). Introduction of Learning Visualisations and Metacognitive Support in a Persuadable Open Learner Model, LAK16.
6. Bull, S., Johnson, M.D., Alotaibi, M., Byrne, W. & Cierniak, G. (2013). Visualising Multiple Data Sources in an Independent Open Learner Model, in H.C. Lane, K. Yacef, J. Mostow & P. Pavlik (eds), AIED13, Springer-Verlag, Berlin Heidelberg, 199-208.
7. Bull, S., Mabbott, A. & Abu-Issa, A. (2007). UMPTEEN: Named and Anonymous Learner Model Access for Instructors and Peers, IJAIED 17(3), 227-253.
8. Czarkowski, M., Kay, J. & Potts, S. (2005). Web Framework for Scrutable Adaptation, in J. Kay, A. Lum & D. Zapata-Rivera (eds), Learner Modelling for Reflection to Support Learner Control, Metacognition and Improved Communication, AIED Workshop, 11-18.
9. Dimitrova, V. (2003). StyLE-OLM: Interactive Open Learner Modelling. IJAIED 13(1), 35-78.
10. Kay, J. (1997). Learner Know Thyself: Student Models to Give Learner Control and Responsibility, in Z.Halim, T. Ottomann, & Z. Razak (eds), ICCE97, AACE, 17-24.
11. Kerly, A. & Bull, S. (2008). Children's Interactions with Inspectable and Negotiated Learner Models, in B.P. Woolf, E. Aimeur, R. Nkambou & S. Lajoie (eds), ITS08, Springer-Verlag, Berlin Heidelberg, 132-141.
12. Mabbott, A. & Bull, S. (2006). Student Preferences for Editing, Persuading and Negotiating the Open Learner Model, in M. Ikeda, K. Ashley & TW. Chan (eds), ITS06, Springer-Verlag, Berlin Heidelberg, 481-490.
13. Morales, R., Van Labeke, N., Brna, P. & Chan, M.E. (2009). Open Learner Modelling as the Keystone of the Next generation of Adaptive Learning Environments. In C. Mourlas & P. Germanakos (eds), Intelligent User Interfaces, ICI Global, London.
14. Tchetagni, J., Nkambou, R. & Bourdeau, J. (2007). Explicit Reflection in Prolog Tutor, IJAIED 17(2), 169-215.
15. Thomson, D. & Mitrovic, A. (2010). Preliminary Evaluation of a Negotiable Student Model in a Constraint-Based ITS, RPTEL 5(1), 19-33.
16. Tongchai, N. (in press). Impact of Self-Regulation and Open Learner Model on Learning Achievement in Blended Learning Environment, IJIET 6(5).
17. Van Labeke, N., Brna, P. & Morales, R. (2007). Opening Up the Interpretation Process in an Open Learner Model, IJAIED 17(3), 305-338.
18. Zapata-Rivera, D., Hansen, E., Shute, V.J. Underwood, J.S. & Bauer, M. (2007). Evidence-Based Approach to Interacting with Open Student Models, IJAIED 17(3).