

Learner Trust in Learner Model Externalisations

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Abstract. This paper introduces t-OLM, an open learner model to investigate user trust in a range of learner model externalisations. It was found that, while sufficient levels of use were made to suggest user trust in an externalised learner model, the relationship between trust and perceived utility, perceived accuracy, and level of understanding of the model representations, is not straightforward.

Keywords. open learner model, user trust, learner model externalisation

Introduction

Open learner models (OLM) are learner models (LM) that are externalised to the user, and have been argued to help promote reflection and planning [1][2]. LMs can be externalised using simple or detailed views [1][3]. Initial work suggests students may trust an OLM, but simple views may be trusted even if a user does not fully understand them or have complete confidence in their accuracy; and structured views, although understood better and considered more accurate, were trusted less by some learners [4].

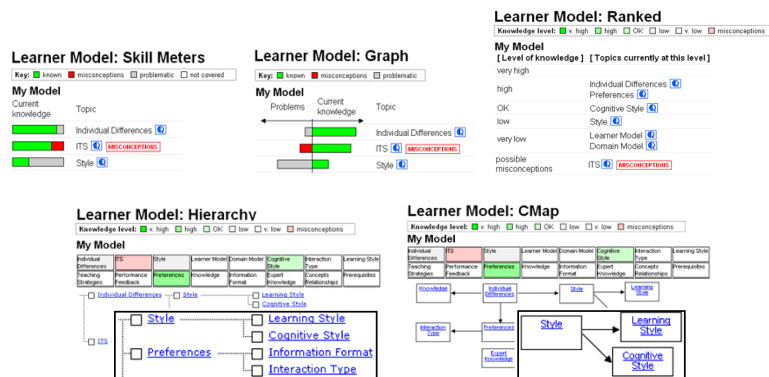


Figure 1. Simple LM overviews (upper) and structured LM views (lower).

The above results were with two OLMs: the simple LM views of OLMlets [1]; and detailed views of Flexi-OLM [3]. We here investigate trust when simple and structured views are available in a single system. t-OLM (based on [1][3]) allows users to view their understanding as suits their preferences (Figure 1). Colour shows knowledge,

areas of difficulty and misconceptions. We investigate use of the model views, and user trust in each. Our definition of trust relates to user acceptance of system inferences, and their belief that they can act appropriately according to those inferences [4].

1. Learner Trust in Learner Model Externalisations

Participants were 12 students from Electronic, Electrical & Computer Engineering, University of Birmingham, UK. Users interacted with t-OLM for 1.5 hours, including a post-use questionnaire (with a 5 point Likert scale). Students were also asked for their own definition of trust in interactive learning environments. As shown in Table 1, most users (3/4) found at least one LM view useful for each of 4 purposes of inspecting the LM (to determine knowledge, misconceptions, general difficulties, what to learn next).

Table 1. Preferred LM views for four purposes of inspecting the LM (*X = Agree, x = Neutral, blank = Disagree*)

Students	Knowledge					Misconceptions					Areas of difficulty					What to learn next					Total (/4) Purposes (/4) with at least 1 view useful
	S Meter	Graph	Ranked	Hierarchy	C Map	S Meter	Graph	Ranked	Hierarchy	C Map	S Meter	Graph	Ranked	Hierarchy	C Map	S Meter	Graph	Ranked	Hierarchy	C Map	
S1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	4
S2	X	X	X	X	X	x	x	X	x	x	x	x	x	x	x	x	x	x	x	x	2
S3	X	X	X	X	X	X	X	X	X	x	X	X	X	X	x	X	X	X	X	x	4
S4	x	x	X	X	X	x	x	X	X	X	x	x	X	X	X	x	x	X	X	X	4
S5	X	X	x	X	X	X	x	x	X	X	x	X	X	X	x	X	x	X	X	X	4
S6	X	X		X	X	X	X		X	X	X	X		X	X	x	x		x	X	4
S7	X	X	x	X	X	X	X	x	x	x	X	X	X	X	X	X	X	X	X	X	4
S8	X	X	x	X	X	X	X		X	X	X	X		x	X	X	X	X	x	x	4
S9	X	X	X	X	X	X	X	x	x	x	X	X	X	X	X				X	x	4
S10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	4
S11	x	x	x	x	x	x	x		x				x					x	x	x	0
S12	X	X	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	1
T	10	10	6	10	10	8	7	5	7	6	7	8	7	8	8	4	5	5	7	6	

Table 2 shows learner inspections of each LM view, and their responses regarding their perception of the accuracy of the views, whether they understood them, and whether they trusted them. Users generally understood the views (especially skill meters, graph, concept map). They considered the skill meters accurate, but had less confidence in the accuracy of the other views, despite these representing the same underlying LM. Half trusted all 5 views, 3 were neutral on all, and 3 had different levels of trust in the various views. Higher levels of inspection did not necessarily indicate a student had greater trust in a view. The more extensive use of skill meters may reflect choices already in place in regular use of OLMlets in other courses [1]. (Further work will explore use and trust of views over time.) Students' typical definitions of trust match our own, often referring to accuracy of the model.

- *Trust would be knowing the content, questions and answers are accurate and the model generated is created using the correct relevant information gathered about the student/user.*
- *Trust means that the system correctly measures my learner model and has a correct domain model, accurate representation of knowledge and ability to see learner model.*

As there was no generally clear relationship between trust in a view and its perceived accuracy, or beliefs about the extent to which a user understood a representation, at this stage we recommend against making assumptions about how

users might use an OLM with reference to their trust in a representation. Further research is needed to identify features of an OLM that may be important in fostering trust in an OLM, and in a system as a whole, when designing future environments that aim to encourage reflection and other metacognitive skills with OLMs.

Nevertheless, we suggest that OLMs may foster sufficient levels of trust for users to accept them. However, as stated above, consideration should be given to providing alternative representations when encouraging user trust is important (e.g. to motivate students to use an OLM for formative assessment). It has already been found that learners have different preferences and are able to select between representations with little difficulty [1][3]; so our suggestion for use of a multiple-view OLM now extends to the development of user trust in a system.

Table 2. Inspection levels and trust of the learner model views (*X = Agree, x = Neutral, Blank = Disagree*)

Students	Inspection levels of the LM views						Belief in the accuracy of the LM views					Understanding of the information in the LM views					Trust in the LM views				
	S Meter	Graph	Ranked	Hierarchy	C Map	Total Inspections	S Meter	Graph	Ranked	Hierarchy	C Map	S Meter	Graph	Ranked	Hierarchy	C Map	S Meter	Graph	Ranked	Hierarchy	C Map
S1	71	3	4	5	6	89	X	X	x	x	x	X	X	X	X	X	X	X	X	X	X
S2	19	3	1	5	2	30	X	x	x	x	x	x	x	x	X	x	X	X	x	x	x
S3	85	2	1	5	4	97	X	X	x	X	x	X	X	X	X	x	X	X	X	X	X
S4	22	10	11	13	12	68	X	x	X	x	X	X	X	X	x	X	x	x	X	X	X
S5	7	6	9	12	12	46	x	x	x	X	X	X	X	X	X	X	x	x	x	x	x
S6	17	1	2	3	2	25	X	X	X	X		X	X	x	X	x	x	x	x	x	x
S7	48	10	7	16	18	99	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
S8	14	4	6	6	7	37	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
S9	36	4	4	8	8	60	X	X		X	x	X	X	X	X	X	X	X		x	x
S10	57	8	5	6	4	80	x	x	x	x	x	X	X	X	X	X	X	X	X	X	X
S11	18	7	5	7	5	42	X	x		x	X	X	X		x	x	x	x	x	x	x
S12	44	3	2	2	2	53	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
T	438	61	57	88	82	726	10	7	5	7	6	11	11	9	10	8	8	8	7	7	7

2. Summary

This paper has presented an investigation into user trust in a range of OLM presentations. The trust relationship does not appear to be as straightforward as a learner understanding a LM externalisation, finding it useful, believing it to be accurate, and trusting it. Additional research is needed to investigate these issues further.

References

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