



3. Tutorial Notes
On
Categorisation and Educational
Benefits of Open Learner Models
(OLM)

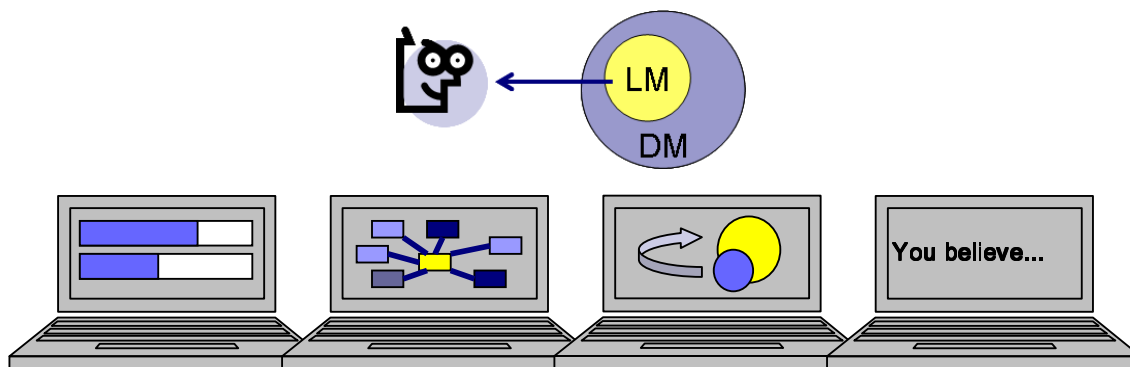
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What is an Open Learner Model (OLM)?

Usually learner models are hidden from the learner they represent, as the main purpose of a learner model is to provide information to enable an adaptive learning environment to adapt to a user's learning needs. Systems are now increasingly opening their learner models to the learner. Such *open learner models* allow the learner (and/or others) to view information about him/herself.

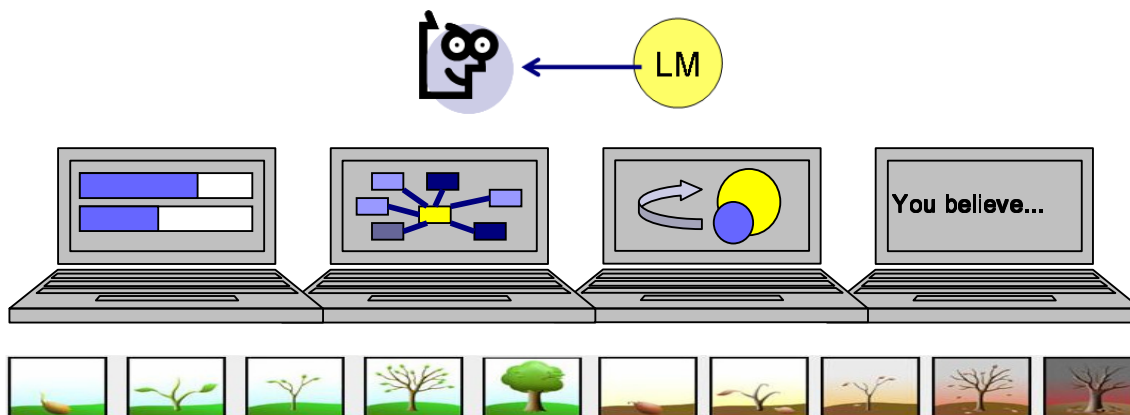


The aims for externalising the learner model are varied, and include:

- increasing the accuracy of the learner model
- promoting learner reflection
- facilitating navigation
- helping learners to plan or monitor their learning
- facilitating collaboration (or competition) in CSCL environments
- providing learners with greater control over their learning
- encouraging greater trust in the learner model (and hence the system as a whole)
- addressing the issue of the right of learners to view data about themselves
- allowing learners to compare their knowledge to the domain content
- allowing learners to compare their knowledge to instructor expectations
- allowing learners to compare their knowledge to that of their peers

What is an Independent Open Learner Model (IOLM)?

Independent open learner models are designed for use away from a full intelligent tutoring system. They contain no domain model: the focus is on supporting independent learning and the development of metacognitive activities. Thus, by viewing their learner model, the learner identifies their learning needs and appropriate actions to take to overcome any difficulties. IOLMs and OLMs may use similar externalisations of the learner model contents.



Primary purposes of independent open learner models are:

1. to promote metacognitive activities
 - self-assessment
 - self-monitoring
 - reflection
 - planning
2. to encourage independent learning *outside* the environment
 - identify knowledge and difficulties
 - plan where to invest effort
 - learner responsibility for choosing and undertaking activities

Issues in Open Learner Modelling

Key questions to consider in open learner modelling include the following:

- How much of the learner model is accessible to the user? Can they see an overview of knowledge level only? Can they see specific beliefs modelled? Can they see their difficulties and misconceptions? Can they view information about their learning preferences or other learning issues (e.g. affect)? Can they see other users' learner models? How does this compare to the actual contents of the underlying model?
- Is the externalisation of the learner model similar to the underlying representation?
- Does the learner have access to information in the learner model regarding the uncertainty of inferences?
- Can the user see previous model states or predicted future states in addition to their current knowledge state?
- Does the learner have access to information about the sources of data in the learner model?
- Does the learner have information about the model's effect on personalisation? When is this important?
- How is the model presented? Is it in text form? Is it simple (e.g. skill meters), or a complex/structured graphical representation (e.g. hierarchical tree structures or concept maps), or using animation?
- How is the learner model presented? Is it an overview of knowledge? Details of beliefs? Some details? All details?
- What type of access to their learner model does the learner have? Can they view it only? Can they edit it? Can they add information? Can they try to persuade/convince the system that its model of them is incorrect? Can they negotiate the contents of their learner model? Should different access types be available at different times?
- How flexible is the learner's access to their learner model? Can they access it whenever they wish?
- Does the access initiative come from the student or system or both? Or might peers, instructors, etc., initiate interaction with the learner model?
- Can the learner control who has access to their learner model? For example, when a system may use it, whether peers, instructors, etc., may view it?
- Is the user supported in the use of their open learner model? How?
- How are learners motivated to use their open learner model?
- How does a group model differ from an individual model?
- How is the open learner model evaluated? What is the evidence?



What Do Students Say About Open Learner Models?

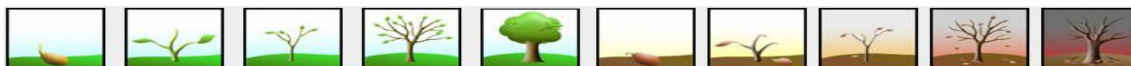
The following are typical excerpts from students' open-ended questionnaire comments.

UMPTEEN: a simple independent open learner model that can be optionally opened to peers and instructors in named or anonymous form (Bull, Mabbott & Abu Issa, 2007).

- Accessing the learner model provided me the chance to self assess my progress by constantly referring to it. It also clarified the areas that I'm strongest at in C programming, and pointed out my weaknesses, which could be considered as a recommendation of what should be studied further. I realized I had performed better than I expected in some areas. More than that, it clarified misconceptions. Now - according to my learner model - I have a fair and better understanding of the fundamental concepts.
- I opened the learner model straight away because I was interested to see how I'd done in the questions... When you normally begin to learn about a subject you don't really know how much of the content you understand. I like to know how I'm doing in my work (what level I'm at)... For me being able to view the OLM is a confidence booster.
- Comparing with others can let us know which level we are in. Is my performance much better than I supposed, or although I did well, I just reached the average level?
- I feel as a person that I'm quite competitive. So the opportunity to see how my peers had fared with the same test was something I really wanted to do. It was interesting to compare my worst subject areas with other people's to see if they had struggled with that area. My first feeling was not to try and get the highest mark but to get above average (this is the first figure that really meant anything to me), these figures helped to provide goals.
- When I click on the person's name xxx, I find he has similar knowledge in the concepts of pointers and addresses. Then we can help each to discuss this concept, which improve both of our knowledge. And when I open the person named yyy, he has better knowledge than me in the concept of bitwise and logical operators. I can learn more from him. ... When someone knows my strong parts, they can get some help from me.
- Viewing the group model let me know not only one out of three students have problems on concept of array size and index, it let me to realize that I am performing better than I thought, low mark on this concept is not all my fault, it is actually quite difficult for students, what I need to do is do not lose my courage and confidence, study hard.
- As I didn't get a good mark in the test, I opened my learner model to all the peers anonymously. Lots of my classmates did better than me. Definitely this will be a spur to encourage me to review C programming immediately. Maybe this will make someone who did as bad as me feel better. At least, he or she was accompanied.
- The peers who open their models with personal details to me are my close friends. They prefer to trust their friends. There is one student to whom I am not familiar, she showed me hers. In my thought, she trusts me, so I opened mine to her.
- The reason I anonymously opened my learner model is to ensure that the instructors and peers get the objective information of their students or peers. It is the content of the learner model rather than the names of students that really matters.

OLMlets: a simple independent open learner model that allows learners to compare their knowledge against the instructor's expectations for the current stage of a course, and allows students to optionally release their learner models to each other and the instructor, named or anonymously (Bull et al., 2008). The UMPTEEN approach was incorporated into OLMlets.

- I found the expected knowledge comparison useful, prompting me to read more of the course notes, and to try to meet or exceed the expectations each week.
- The comparison against the lecturer's expectations helped me identify if I was on target within the module.
- Comparing myself with peers was useful and helped me plan what to learn next within the course structure if I was behind. It was interesting to compare my weaker areas with other people's to see if they too had struggled with the same area. It also gave me a fairly good idea about what



progress my peers were in hence letting me know if I was doing enough work for the module to be at the same stage as the majority of the group.

- While comparing my open learner model with my friends, this was done equally at the computer and in discussion from time to time. This allowed me to check up on their individual progress against mine to see if I was doing better than them. At times I wasn't, therefore it motivated me to improve on my weaker areas and get to the same level or better than them. This also allowed us as a group to reflect on any difficulties and to overcome them through group discussions. It also helped talking to other students who had got further than me to overcome my misconceptions and problematic areas within the weaker topics.

UK-Special: a simple independent open learner model that helps learners to recognise their progress across the courses comprising their degree, and how these courses relate to their future career (Bull & Gardner, in press). UK-Special uses the OLMlets learner models.

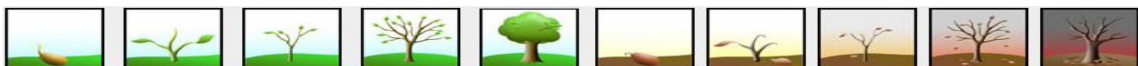
- The point I find particularly important is how UK-Special relates to each module and then allows a student to see how the different modules fit together to provide a broad knowledge spectrum. This helps to prevent students seeing each module as a completely separate entity and allows them to gain a better overall view.
- It is very important to know the uk-spec because it let me know many skills and required knowledge necessary to become a professional engineer. This allows students to know and set their goals easily with this in place. Tendency of students not knowing why they are studying their modules will be greatly reduced.
- It is exciting to find out how the learning outcomes from my course meet the requirements of employers which leads to a professional career in engineering.

For further details and issues in open learner modelling see:

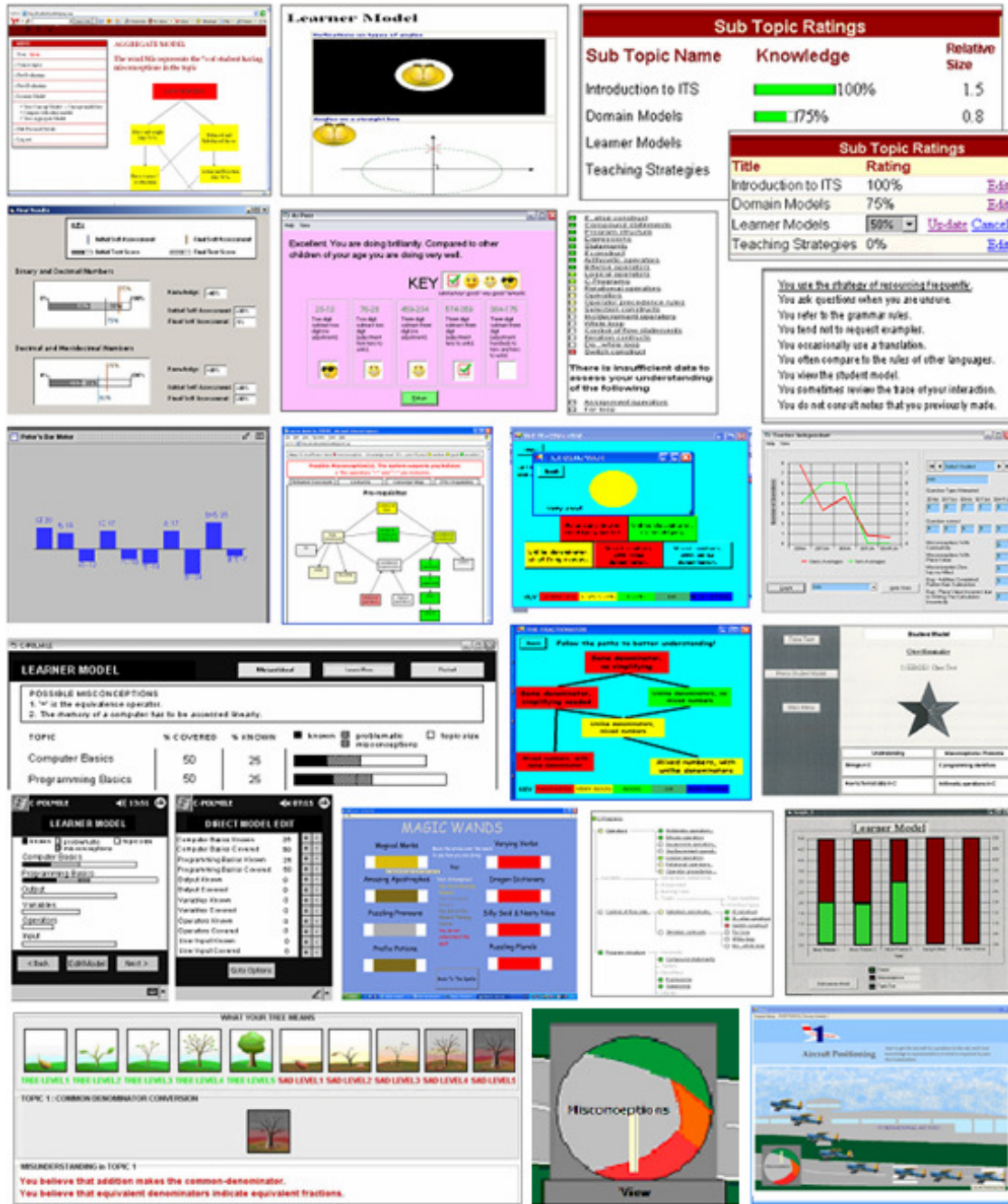
Bull, S. & Kay, J. (2007). Student Models that Invite the Learner In: The SMILI Open Learner Modelling Framework, International Journal of Artificial Intelligence in Education 17(2), 89-120.

For some of the distinctions between OLMs and IOLMs see:

Bull, S. & Kay, J. (2008). Metacognition and Open Learner Models, in I. Roll & V. Aleven (eds), Proceedings of Workshop on Metacognition and Self-Regulated Learning in Educational Technologies, International Conference on Intelligent Tutoring Systems, 7-20.



Examples of (I)OLM Screens



Thanks to: Inderdip Gakhal, Mohammed Ghani, Piyush Kathuria, Lisa Ko, Stella Lee, Luke Lim, Andrew Mabbott, Manveer Mangat, Tom Marianczak, Josie Marsh, Adam McEvoy, Mark McKay, Theson Nghiem and Harpreet Pabla.

Trees are from Stella Lee. See Lee & Bull (2008), for details.



Motivation for SMILI☺ OLM Framework

From Bull and Kay (2007):

Abstract. In recent years, the learner models of some adaptive learning environments have been opened to the learners they represent. However, as yet there is no standard way of describing and analysing these 'open learner models'. This is, in part, due to the variety of issues that can be important or relevant in any particular learner model. The lack of a framework to discuss open learner models poses several difficulties: there is no systematic way to analyse and describe the open learner models of any one system; there is no systematic way to compare the features of open learner models in different systems; and the designers of each new adaptive learning system must repeatedly tread the same path of studying the many diverse uses and approaches of open learner modelling so that they might determine how to make use of open learner modelling in their system. We believe this is a serious barrier to the effective use of open learner models. This paper presents such a framework, and gives examples of its use to describe and compare adaptive educational systems.

SMILI☺ Framework Description: *Examples*

The table below shows five (I)OLMs: Mr Collins, Sam-coach, SASY-unix, OLMlets and MusicaLM, defined according to the SMILI☺ Open Learner Modelling Framework. The table shows the goals of openness of the learner model: XX for central goals; X for lesser goals and x for minor concerns. Further breakdown and references are provided on the following pages.

Purpose of (I)OLM	<i>Accuracy</i>	<i>Reflection</i>	<i>Plan / Monitor</i>	<i>Collaboration / Competition</i>	<i>Navigation</i>	<i>Right of access, control, trust</i>	<i>Assessment</i>
(I)OLM systems							
Mr Collins	XX	XX	XX			x	
Sam-coach	X	XX	X		X	X	
SASY-unix	X	X	x		X	XX	
OLMlets		XX	XX	XX	XX	XX	XX
MusicaLM		XX	X				



SMILI© Open Learner Modelling Framework (Bull & Kay, 2007): **Mr Collins**

Elements	Properties	Description	Notes
1. Extent of model accessible	Complete	O	
	Partial	O	
	Knowledge level	O	
	Knowledge	O	
	Difficulties	O	
2. Match underlying representation	Misconceptions	O	
	Learning issues	O	learning strategies, transfer
	Preferences	O	
Other users' LM	^		
3. Access to uncertainty	Similar	^	underlying rep. is in prolog statements
4. Role of time	Complete	O	
	Previous	O	
	Current	O	
5. Access to sources of input	Future	O	
	Complete	O	
6. Access to model effect on personalisation	System, Self	O	
	Complete/Partial	O	
7. Presentation	Textual	O	
	Graphical	^	
	Overview	O	
	Targeted Details	O	
	All Details	O	
8. Access method	Support to use	^	
	Inspectable	O	
	Editable	^	
	Addition	^	
	Student persuade	^	
9. Flexibility of access	Negotiated	O	
	Complete	O	access to overview and details chosen
	Partial	O	
10. Access initiative comes from	System	O	
	User	O	
	Peer, Instructor, etc...	^	
11. Control over accessibility (to others)	Complete	^	
	System	^	
	Peer, Other	^	
	Instructor	^	

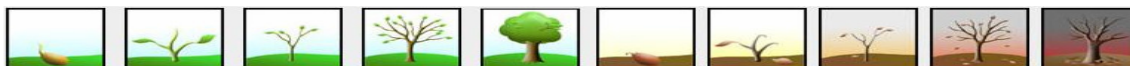
Key:

- O Open
- ^ Closed
- Not applicable / not relevant in system

References

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.

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), *Artificial Intelligence in Education*, AACE, Charlottesville VA, 501-508.

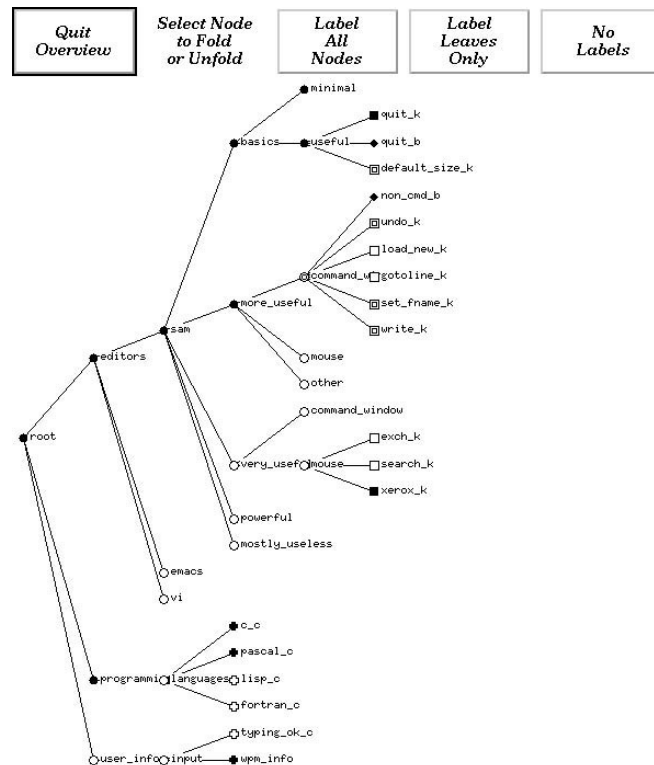


SMILI☺ Framework Description: SAM

Early Example

Primary goals of the sam-coach are reflection, monitoring and planning, and to give learners the power to scrutinise and control their model, enhancing its accuracy. The model used the accretion-resolution representation for scrutable long-term modelling: the user can scrutinise their model to see what the system believes about them, the evidence for those beliefs, the meaning of the model components and, if they wish, to use the interface to tell the system their own assessment of their knowledge, preferences or other aspects. This is added to the model without removing any existing evidence. Learners can also use the learner model as a starting point for navigation within the environment. Learners worked with the sam text editor as part of their university computing course work. The sam-coach sent weekly advice on how to make better use of the text editor. For example, a user who had not learnt the undo command might be emailed advice about it. For students in the experimental group, the email included details of how to view and interact with their learner model.

There are several parts to the interface to the learner model (Cook & Kay, 1994). The screen below shows qv (quick overview). Black nodes indicate the learner knows this aspect, as in the case of 'quit_k', the quit command, near the top of the screen. White node symbols indicate lack of knowledge. The default presentation collapses parts of the model tree as here, where the node labelled 'powerful' is shown as unknown and represents a collection of concepts. Left-clicking on such a node expands it. Right-clicking on it gives access to full details of the model and allows the learner to indicate the value of a component and this causes evidence to be added to the model. In addition, as the model is stored as a set of text files within the user's file space, the user can edit it. It also provides a personalised explanation of the concept. The scrutiny support presents the full set of evidence for a component and an explanation of how this was interpreted.



SAM Coach: Open Learner Model



SMILI[©] Open Learner Modelling Framework (Bull & Kay, 2007): **SAM**

Elements	Properties	Description	Notes
1. Extent of model accessible	Complete	○	
	Partial	○	
	Knowledge level	^	
	Knowledge	○	
	Difficulties	○	
	Misconceptions	○	
	Learning issues	-	
2. Match underlying representation	Preferences	-	
	Other users' LM	^	
3. Access to uncertainty	Similar	○	
4. Role of time	Complete	○	
	Previous	○	
	Current	○	
5. Access to sources of input	Future	○	
	Complete	○	
6. Access to model effect on personalisation	System, Self	○	
	Complete/Partial	^	
7. Presentation	Textual	○	
	Graphical	○	
	Overview	○	
	Targeted Details	○	
	All Details	○	
8. Access method	Support to use	○	
	Inspectable	○	
	Editable	○	
	Addition	○	
	Student persuade	^	
9. Flexibility of access	Negotiated	^	
	Complete	○	access to overview and details chosen
10. Access initiative comes from	Partial	○	
	System	^	
11. Control over accessibility (to others)	User	○	
	Peer, Instructor, etc...	^	
	Complete	○	
11. Control over accessibility (to others)	System	○	
	Peer, Other	○	
	Instructor	○	
		○	

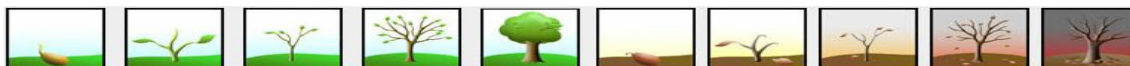
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References

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Cook, R. & Kay, J. (1994). The Justified User Model: A Viewable, Explained User Model, in A. Kobsa & D. Litman (eds), *Proceedings of 4th International Conference on User Modeling, MITRE, UM Inc*, 145 - 150.



SMILI☺ Framework Description: *SASY-unix*

Recent Example

The driving motivation for SASY is to enable users to see how an adaptive hypertext is personalised to them. The goals are to encourage reflection and provide a foundation for user access to the whole of the personalisation process: this includes access to the learner model, but also enables the user to see what has been presented to them, or omitted, in the personalisation. The tutorial in the example below is for computing students, but can be adapted for different courses as well as preferences such as the number of quiz questions.

Openness is central to SASY. A small-scale qualitative evaluation showed the utility of making the details of personalisation more obvious, as in the version of SASY below (Czarkowski et al., 2005). Some important features of a SASY page are the list of the components from the user model at the right of the screen. The list includes just those components that played a role in the personalisation. Each of these has a link labelled 'why?', which takes the user to details of the user model. The model shows the components of the model, explanations of what they mean and details of how they are interpreted and used. The user can edit their user model to increase its accuracy. Users can also navigate to relevant topics or questions from the main part of the screen.

The screenshot displays a web interface for the SASY-unix system. At the top, a navigation bar includes links for Home, Contents, Your Profile, Make Notes, Change Topic, and Help. The main content area is titled "UNIX File System overview" and contains a dialogue between Costello and Abbott about UNIX, followed by explanatory text and a "Did U know" section. A sidebar on the right, titled "Personalisation", shows "2 items removed" and "5 items added", and lists several items with "why?" links. At the bottom, a footer indicates the page is "Courses/UNIX3/FS_1.xml".

Home Contents Your Profile Make Notes Change Topic Help

UNIX File System overview

UNIX Joke:
Costello calls Abbott with some questions about UNIX:
Costello: What is the command that will tell me the revision code of a program?
Abbott: Yes, that's correct.
Costello: No, what is it?
Abbott: Yes.
Costello: So, which is the one?
Abbott: No, 'which' is used to find the program.
Costello: Stop this. Who are you?
Abbott: Use 'who am i' not 'who r yoo'. You can also 'finger yoo' to get information about 'yoo'.
Costello: All I want to know is what finds the revision code?
Abbott: Use 'what'.

The File System is responsible for the management of data and files within your computer. It is responsible for storing your files on a permanent storage device (e.g. a hard-disk), allowing you to retrieve, view, modify and return them to storage.

In UNIX, all your data is stored in files and directories, in a hierarchical structure. A directory is a logical container of files and more directories. This is the same as the concept of folders in a Windows operating system. A UNIX file stores data, for example, text or an image.

Did U know ?
In actual fact, in UNIX directories are just special files that contain the names of the files they contain. However, the system knows to interpret these files differently to regular files. In UNIX, all data in the file system is stored as files and inodes. Inodes store system information about files that tell the file system where the data physically is stored on disk (i.e. the disk address of the data chunks).

A UNIX File System holds system files/directories user's private files/directories. Typically, the system administrator will restrict access to the system area and provide users with their own private areas.

Henrik's Hint : *This topic is here because you need to know these things:*

- How to navigate around the file system
- How to use relative and absolute paths
- How to view the security permissions on a file or directory

According to your profile, you know about the UNIX File System but haven't passed the quiz:

You can either [review these topics](#) or [attempt the UNIX File System Quiz](#)

Page: Courses/UNIX3/FS_1.xml

Personalisation

2 items removed
5 items added

because your profile has:

- You want to get more than a pass grade [why?](#)
- You know the UNIX File System but haven't passed the quiz [why?](#)
- You want Henrik's hints [why?](#)
- You want UNIX jokes [why?](#)
- You want lots of practice quizzes [why?](#)

SASy-unix: Open Learner Model



SMILI[©] Open Learner Modelling Framework (Bull & Kay, 2007): **SASY-unix**

Elements	Properties	Description	Notes
1. Extent of model accessible	Complete	O	
	Partial	O	
	Knowledge level	^	
	Knowledge	O	
	Difficulties	-	
	Misconceptions	-	
2. Match underlying representation	Learning issues	O	
	Preferences	O	
	Other users' LM	^	
3. Access to uncertainty	Similar	O	
4. Role of time	Complete	O	
	Previous	O	
	Current	O	
5. Access to sources of input	Future	-	
	Complete	O	
6. Access to model effect on personalisation	System, Self	O	
	Complete/Partial	O	
7. Presentation	Textual	O	
	Graphical	^	
	Overview	^	
	Targeted Details	O	
	All Details	O	
	Support to use	O	model is explained
8. Access method	Inspectable	O	
	Editable	O	
	Addition	^	
	Student persuade	^	
	Negotiated	^	
9. Flexibility of access	Complete	O	full model and current focus
	Partial	O	
10. Access initiative comes from	System	^	
	User	O	
	Peer, Instructor, etc...	^	
11. Control over accessibility (to others)	Complete	^	
	System	^	
	Peer, Other	^	
	Instructor	^	

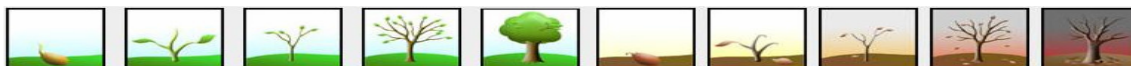
Key:

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References

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Czarkowski, M., Kay, J. & Potts, S. (2005). Web Framework for Scrutable Adaptation, *Proceedings of Workshop on Learner Modelling for Reflection, AIED 2005*, 11-18.



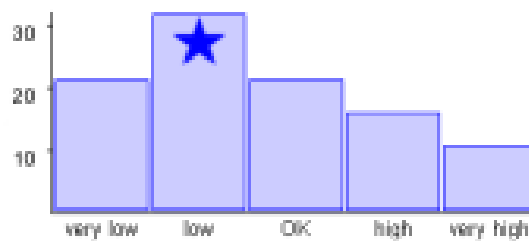
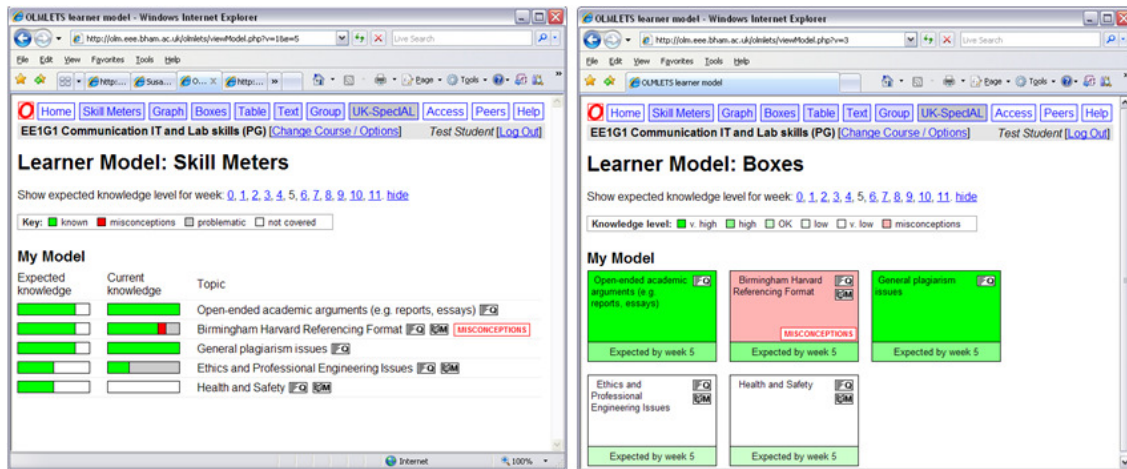
SMILI☺ Framework Description: *OLMlets*

Current Example

OLMlets is an independent open learner model (IOLM) that allows learners to view their model in five formats. Two of these are shown below as an illustration. The 'skill meters' give current knowledge levels (green) for each topic; any misconceptions held (red); and generally problematic areas, i.e. not related to specific misconceptions (grey). White indicates insufficient data to model the learner on the corresponding topic. The 'boxes' use shades of green to indicate strength of knowledge in each topic. (The 'Q' icons lead to questions on the topic; the 'M' icons to learning materials, e.g. course notes, slides, web links; the misconceptions links lead to brief statements of likely misconceptions.)

OLMlets is domain-independent, an IOLM designed to support users in any course for which appropriate multiple choice questions can be created. It is currently in widespread use in degree courses in electronic, electrical and computer engineering subjects (Bull et al., 2008) as a means to promote reflection, formative assessment and learner independence. Because it is domain-independent, the learner model views are necessarily simple.

In addition to the learner's own knowledge, the screens below show the comparison of the user's current knowledge in relation to the expectations for the current stage of the course, as defined by the instructor. In addition, students can access a graphical overview of the group's level of understanding of each topic which also shows their own level for comparison; and they can view the individual learner models of other users alongside their own, if these users give their permission (models can be released named or anonymously). In this case each of the peer models selected for viewing appear below the user's own model.



OLMlets: Open Learner Model



SMILI[©] Open Learner Modelling Framework (Bull & Kay, 2007): **OLMlets**

Elements	Properties	Description	Notes
1. Extent of model accessible	Complete	○	
	Partial	○	
	Knowledge level	○	
	Knowledge	-	
	Difficulties	○	
	Misconceptions	○	
2. Match underlying representation	Learning issues	-	peer models available if peers allow
	Preferences	-	
	Other users' LM	○	
3. Access to uncertainty	Similar	-	
4. Role of time	Complete	^	
	Previous	-	
	Current	○	
5. Access to sources of input	Future	-	
	Complete	○	
6. Access to model effect on personalisation	System, Self	○	
	Complete/Partial	○	
7. Presentation	Textual	○	
	Graphical	○	
	Overview	○	domain-independent, so simple model
	Targeted Details	-	
	All Details	-	
Support to use	^		
8. Access method	Inspectable	○	
	Editable	^	
	Addition	^	
	Student persuade	^	
	Negotiated	^	
9. Flexibility of access	Complete	○	
	Partial	^	
10. Access initiative comes from	System	^	
	User	○	
	Peer, Instructor, etc...	^	
11. Control over accessibility (to others)	Complete	^	
	System	^	may release model named of anon.
	Peer, Other	○	
	Instructor	○	

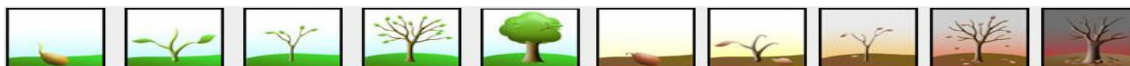
Key:

- Open
- ^ Closed
- Not applicable / not relevant in system

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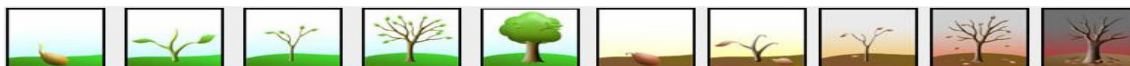
SMILI☺ Framework Description: *MusicaLM*

New Example

MusicaLM is an Independent Open Learner Model (IOLM) to support learners of basic music theory. Through responses to musical tasks involving harmony, MusicaLM builds a model of current beliefs held by the learner. For each concept the three most recent pieces of evidence are taken into account and weighted according to age of the data. The learner model is externalised in multiple forms. Initially a topic overview is given (left of screen) which may be broken down into a list of concepts. Through mouse-based interaction the learner is able to gain more detailed information (centre of screen). Beliefs held are available as text, music notation and audio (the notes). For each concept the learner may also view a skill meter, misconceptions and expert knowledge. Any of the information may be placed on a 'pinboard' (right of screen), where beliefs remain until removed, to allow comparison.

Using an earlier version of MusicaLM, an exploratory study involving 12 learners of basic music theory showed users were able to make use of the IOLM and inspect their beliefs in multiple formats, particularly when information was identified as incorrect (Johnson & Bull, 2009). An overall preference for textual descriptions was observed, with an increased use of domain-specific features (music notation and audio) when exploring problematic knowledge and misconceptions. Future studies are planned to further elaborate on the utility of this IOLM approach, exploring in greater depth the use of domain-specific features in the context of maintaining the learner model; the exploration of an expert's knowledge in conjunction with the learner's own beliefs; and the potential educational benefits of the provision of an IOLM in the domain of basic music theory.

MusicaLM v3.1: Open Learner Model



SMILI[©] Open Learner Modelling Framework (Bull & Kay, 2007): **MusicalM**

Elements	Properties	Description	Notes
1. Extent of model accessible	Complete	O	
	Partial	O	
	Knowledge level	O	
	Knowledge	O	
	Difficulties	O	
	Misconceptions	O	
	Learning issues	-	
	Preferences	-	
	Other users' LM	^	
2. Match underlying representation	Similar	^	underlying representation is numerical
3. Access to uncertainty	Complete	O	
4. Role of time	Previous	O	user can save previous states if they wish
	Current	O	
	Future	-	
5. Access to sources of input	Complete	O	
	System, Self	O	
6. Access to model effect on personalisation	Complete/Partial	O	
7. Presentation	Textual	O	also audio, music notation
	Graphical	O	
	Overview	O	
	Targeted Details	^	
	All Details	O	
	Support to use	^	
8. Access method	Inspectable	O	
	Editable	^	
	Addition	^	
	Student persuade	^	
	Negotiated	^	
9. Flexibility of access	Complete	O	access to overview and details chosen
	Partial	O	
10. Access initiative comes from	System	^	
	User	O	
	Peer, Instructor, etc...	^	
11. Control over accessibility (to others)	Complete	^	
	System	^	
	Peer, Other	^	
	Instructor	^	

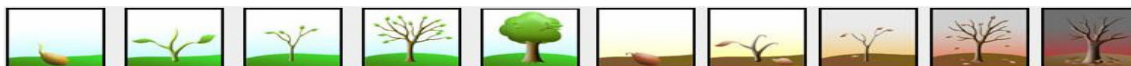
Key:

- O Open
- ^ Closed
- Not applicable / not relevant in system

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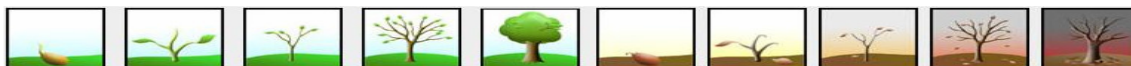
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