Computer-based formative assessment to promote reflection and learner autonomy

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Abstract

This paper introduces a computer-based system primarily for formative assessment to help learners identify their knowledge, difficulties and misconceptions in a subject in order that they can focus their efforts where most required. The system constructs a dynamic model of students’ understanding as they answer questions which is continually updated as they interact further. Students can view this individual ‘learner model’ which offers simple representations of their knowledge state. They can also compare their knowledge level with that of their peer group and with instructor expectations for the current stage of the course. Instructors can set up their own questions to ensure that the environment is suitable for their specific courses. The aim is to help learners identify their knowledge, difficulties and misconceptions, engage in prompt reflection on their knowledge and learning and facilitate planning, thus encouraging learner autonomy. We present the results of use of the system in five university courses in Electronic, Electrical and Computer Engineering.

Introduction

In recent years, throughout the higher education sector, teaching and learning has become increasingly student-centred and mediated by technology (Laurillard, 2002). As part of this move, the University of Birmingham is engaged in the development of a managed learning environment with seamless interfaces between access to learning materials and support services delivered over the web. The University’s teaching and learning strategy identifies as important activities ‘the provision of opportunities and mechanisms for students to self-assess their progress through diagnostic tools, including web-based formative assessments’ and ‘the encouragement of research into the pedagogic opportunities offered by the wide range of learning settings now available - virtual and real, classroom and distance, web and paper-based.’

The Electronic, Electrical and Computer Engineering department at the University of Birmingham offers a range of full time bachelors and masters degrees in the areas of electronic and electrical engineering, computer systems engineering and interactive and multimedia systems. As part of its provision of web-based support materials, the department has recently deployed ‘open learner models’ (OLMs) developed by the department’s Educational Technology Research Group.

A learner model is a representation of a learner’s current understanding constructed by a computer-based educational environment according to the learner’s actions in that environment. Typically, this involves the system making inferences about the individual learner’s knowledge, difficulties and misconceptions, based on their answers to questions, with the learner model containing the currently relevant information about the learner’s understanding – i.e. it is a model of the learner’s present knowledge state. This differs from standard approaches to questioning students and returning a score (with or without additional comments), as in such approaches the result is usually based on all attempts at questions and so historical information is included in the feedback. In contrast, a learner model recognises that a learner is learning, therefore their knowledge state is constantly changing and thus their initial answers may no longer be representative of what they now know. Therefore the learner’s understanding is represented in the learner model, rather than a set of responses or a performance score, and this information is dynamically updated as the student learns. The focus is therefore on knowledge of concepts rather than the correctness or incorrectness of responses to questions. An open learner model is a learner model whose contents are externalised to the student it represents in an understandable format. This enables the focus on knowledge of concepts to be passed on to the learner, rather than having the learner seek feedback in terms of right or wrong answers.
The student body of the department is highly diverse in terms of interests, prior experience, prior qualifications, skill sets, learning culture and expectations of the process of education. Approximately 50% of the students are international. The formative assessment activities within courses are an extremely important mechanism for dealing with this diversity and the resulting feedback provides individually tailored information on what each student needs to do in order to improve. Unfortunately, however, it has been identified in a range of higher education contexts that some students do not give sufficient attention to aspects of their course that are not assessed. Wellington and Collier (2001) give examples for electrical and electronic engineering, Lynn and Taylor (1993) for business operation and control and Rees and Garrud (2001) for medicine. Accordingly, a significant proportion of our students tend not to engage in a satisfactory manner with the existing formative assessment mechanisms in the department, with the result that they lack adequate preparation for the final summative assessment. This is especially true of weaker students, who are the very people that have the greatest need. There are a number of reasons for this lack of student engagement. Many students exhibit strongly tactical behaviour in the allocation of their time, devoting very little time to activities that do not have a direct pay-off in terms of marks. Also, many students are in part-time employment during term-time which reduces the time available for study.

Given that the OLM approach focuses on knowledge, it provides students with an additional support mechanism in understanding their own strengths and weaknesses. It does not replace, but rather supplements, the existing formative assessment methods. The intention is that it should provide a flexible mechanism that can be used by students as and when they feel the need, and when they have the time - i.e. they can use it in a flexible, self-paced manner. They receive individually-tailored information about their own understanding, how this compares with their peer group and how it compares to the expectations of the department.

Another motivation for the use of an OLM is its ability to identify a student’s misconceptions. It is often the case that a student’s ability to progress is inhibited by an inappropriate or incorrect belief structure. At its simplest, this can consist of misunderstandings about basic definitions (e.g. that voltage is something that flows through a resistor). At a more complex level, it can arise in situations where students have learned a set of strategies that work well in one context and inappropriately carry them over to a new learning context. An example that commonly occurs in electronic engineering education is when students who have learnt to write computer programs in a procedural language, such as C, encounter a hardware description language, such as Verilog. The similarity of the languages’ syntax belies a vast difference in their semantics. Students will often waste large amounts of time, and be quite resistant to correction, attempting to write a hardware description using the strategies that are appropriate to procedural language programming. In this context, an important part of the learning experience is to ‘de-program’ the student in order to stop them from falling back on the strategies that had served them well previously.

The ‘OLMlets’ open learner model was developed to address the problems described above. OLMlets has an interface through which instructors may enter multiple-choice questions and responses for their courses (which can include images and limited special characters), structured according to the topics required; and define misconceptions related to specific responses. Instructors can also define which topics should be known at various stages of a course, including full or partial knowledge of each topic at each stage. Because OLMlets can be used in a range of course types it can become a consistent form of support throughout a degree, being used independently or alongside the learner’s current Managed Learning Environment.

Students self-register for OLMlets so no additional administrative support is required in order for them to be adopted by a course. As students answer the multiple-choice questions input by their instructor OLMlets constructs the model of the individual’s knowledge level and misconceptions related to each topic. The learner model is accessible to the student in graphical and textual formats as a source of information to encourage reflection on knowledge and to facilitate planning.

**The student’s environment**

Open learner models are usually part of an intelligent tutoring system. As described above,
intelligent tutoring systems model a learner’s understanding based on their behaviour in the system. These learner models are then used by the system to adapt the interaction to the individual’s learning needs. A growing trend is to open the learner model to the student it represents as a means to prompt reflection, helping learners to identify what they need to work on. Thus OLMlets aims to promote learner autonomy as students should undertake the necessary work themselves in order to learn the required material (i.e. OLMlets does not give them the answer).

Open learner models may be either simple or complex in format. Simple OLMs typically show a student’s knowledge level as a subset of expert knowledge, and complex representations include concept maps, hierarchical knowledge structures and detailed textual descriptions of knowledge and misconceptions. Our need was for an environment that could be easily deployed in a range of courses. Thus a simple representation was sought where instructors would not need to define specific relationships between the various concepts of their courses, as would be required for more detailed structured learner model views. Similarly, because of this need for a simple approach, the OLMlets learner models are not embedded in a full intelligent tutoring system as this would require the system to additionally model and understand the domain content of each course.

Most simple OLMs are presented in the form of a skill meter (Corbett and Anderson, 1995; Mitrovic and Martin, 2002; Papanikolau et al, 2003; Weber and Brusilovsky, 2001). OLMlets has five presentation formats: skill meter, graph, boxes, table and text (Figure 1) so that the learner is not restricted to a single representation. Previous work with OLMlets found that, although the skill meters were commonly used by students, other views were sometimes preferred and some learners were routinely using more than one learner model view (Bull and Mabbott, 2006). Therefore OLMlets has retained a choice of methods to access the learner model. An extension to the standard skill meter (which shows knowledge level only) is to include information on misconceptions (Bull and McEvoy, 2003). OLMlets follows this approach, allowing students to see whether they hold misconceptions (in contrast to problematic areas which are not misconception-based).

Inputting questions and instructor expectations for a course

The skill meter view in Figure 1 shows an example of a misconception description which appears when the learner clicks on the ‘misconceptions’ link that appears when they have a misconception of a topic.

Kay (1997) proposes that, through an open learner modelling approach, it may be useful for a learner to be able to compare their current level of understanding to that of their peers or to the instructor’s expectations. Clicking on the ‘compare’ link (shown in Figure 1) allows students to compare their level of understanding to that of others on their course for each topic, the star indicating the student’s own knowledge level of the topic (Figure 2). This is a useful way for learners to identify whether a topic is difficult in general, and it can be reassuring for a struggling student to see that other learners are also having trouble with a particular topic at that time. In contrast, those who believe that nobody else is working (as students are wont to tell each other) can see that their perception may not match the reality.

Clicking on the series of numbers at the top of the screen in Figure 1 allows students to compare their knowledge with instructor expectations, using the skill meter view as an illustration (Figure 2). Although in this example the student has misconceptions, it can be seen that they do have adequate knowledge when considering the instructor’s expectations for this stage of learning. The learner can also compare their current understanding with expectations for previous or future stages of the course. This can be helpful in situations where the learner is behind, as viewing expectations at different times during a course may help a student to set more realistic goals. Furthermore, students who have other work commitments can plan their time according to what the instructor considers achievable at different stages of learning.

The Electronic, Electrical and Computer Engineering department has a wide range of course types, ranging from more traditional electronic engineering courses to human-centred computing. OLMlets is necessarily straightforward in order to firstly enable its use in a range of subject areas for which multiple choice questions are appropriate and secondly to encourage instructors to input questions and then easily deploy the system in their courses.
Figure 1. The individual learner model views

Figure 2. The comparison learner model views
OLMlets has an interface through which instructors input their multiple choice questions and corresponding responses, as shown in Figure 3. Instructors can indicate which responses are correct, which are incorrect, define misconceptions and assign specific misconceptions to incorrect answers (misconception descriptions are automatically prefixed by ‘you may believe that’ in the OLM). Images, superscript and subscript and limited special characters can be used (e.g. $\Omega$, $\lambda$, $\Pi$).

Instructors can define the knowledge level that they would expect a student to have reached at certain points for each topic in a course. This is illustrated in Figure 4 for a course that builds up knowledge sequentially and for a course where students are learning different topics at the same time but at different rates. The breakdown can be configured by week number, day number (for intensive courses) or by lecture number, as appropriate for the course, and the number of stages can be defined by the instructor. The student can then view this comparison of expectations against their current knowledge through any of the individual OLM views (illustrated in Figure 2 with the skill meter view).

**Results from diverse courses in Electronic, Electrical and Computer Engineering**

This section presents an overview of results of OLMlets in use at different levels in five quite varied course types.

**Participants, materials and methods**

Participants were students in the department of Electronic, Electrical and Computer Engineering at the University of Birmingham using OLMlets in five courses in the autumn term of the 2005/06 academic year, as listed in Table 1. The data was collected in January 2006. There were a total of 223 learner models. For the purpose of this paper, where the focus is on usage in different courses, these are analysed as separate users, although there was some overlap of students in the first year courses with 19 individuals having learner models in both.

![Figure 3. Entering multiple choice questions](image-url)
that use of OLMlets was optional, the level of uptake (40% and 44% for Circuit Analysis and Communication, IT and Laboratory Skills respectively) is not especially low. The 89% uptake in Project Management and Professional Practice was high. There was

The first year Communication, IT and Laboratory Skills and second year Project Management and Professional Practice courses had students from the full range of degree types as they are compulsory for all students. The first year Circuit Analysis course had students from the more traditional engineering degrees. The third year Interactive Learning Environments course comprised mainly students from the Computer Interactive Systems degree, but also some from the Computer Systems Engineering degree. Students taking fourth year/MSc/MRes User Modelling were from the full range of degrees in the department.

The second year Project Management and Professional Practice course informed the students about OLMlets by email and with a notice on the student noticeboard. The two first year courses gave the OLMlets URL in a lecture. There was no additional support available in any of these first and second year courses following the announcement. Given this lack of additional support, and the fact

Table 1. Courses in which OLMlets were used

<table>
<thead>
<tr>
<th>Year</th>
<th>Course</th>
<th>Taking Course</th>
<th>Used OLM-lets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Circuit Analysis</td>
<td>70</td>
<td>28 (40%)</td>
</tr>
<tr>
<td>1</td>
<td>Communication, IT &amp; Lab Skills</td>
<td>108</td>
<td>47 (44%)</td>
</tr>
<tr>
<td>2</td>
<td>Project Management and Professional Practice</td>
<td>122</td>
<td>109 (89%)</td>
</tr>
<tr>
<td>3</td>
<td>Interactive Learning Environments</td>
<td>29</td>
<td>29 (100%)</td>
</tr>
<tr>
<td>4/MSc/MRes</td>
<td>User Modelling</td>
<td>10</td>
<td>10 (100%)</td>
</tr>
</tbody>
</table>
no upcoming assessment for Circuit Analysis at the time of deployment, thus students had no immediate assessment goal. The Communication, IT and Laboratory Skills course introduced OLMlets a short while before a multiple choice test was administered and Project Management and Professional Practice deployed OLMlets about a month before a multiple choice test. The question types in OLMlets and the tests themselves were similar in each case. The test for Communication, IT and Laboratory Skills was worth 25% of the final course mark and for Project Management and Professional Practice it comprised 40%. There may have been students who did not know about OLMlets in the Communication, IT and Laboratory Skills course as on the day that the URL was provided there were only about 60 students present. Therefore the percentage given above is probably underestimating uptake from amongst those who had actually been made aware of the system.

The fourth year/MSc/MRes User Modelling course introduced OLMlets in a lab session a month before assessed reports were due. This is a coursework-only course, the reports comprising 100% of the assessment. The form of assessment therefore differed from the OLMlets questions, though the questions were designed to address issues relating to the requirements for completing a good report. The third year Interactive Learning Environments course also introduced OLMlets in a lab session. As a comparison to the other courses where use of OLMlets did not contribute directly to the final course mark, the learner model of each student on the third year course was assessed, comprising 10% of the course mark. The introductory lab session was held several weeks in advance of the date on which the learner models were assessed. Of course, it is difficult to compare this course directly with the more junior courses in order to determine the effect of using the learner model for summative assessment as opposed to formative assessment because the students had a specific interest in educational technology. However, the fourth year/MSc/MRes course on User Modelling also had students with a clear interest in learner modelling, thus a more valid comparison can be made against that course. Because these two courses introduced OLMlets during a lab at which all students were present, all of them used the system.

In all groups, the students were able to access the five formats of individual learner model views, as well as the peer comparison which is automatically generated based on all models contained in the system for a course. Expected knowledge was set by the instructor in each of the courses and so was also available to all students. Misconceptions were defined for first year Circuit Analysis, second year Project Management and Professional Practice and third year Interactive Learning Environments.

Results
The system logs show that, across the five courses and 223 users, a total of 29,993 questions were attempted. (NB: Once all questions for a topic have been answered a new random sequence is generated and the questions can be attempted again). 1,241 questions were answered in first year Circuit Analysis (mean 44 per student); 2,051 in first year Communication, IT and Laboratory Skills (mean 44 per student); 16,880 in second year Project Management and Professional Practice (mean 155 per student); 9,340 in third year Interactive Learning Environments (mean 322 per student) and 481 in fourth year/MSc/MRes User Modelling (mean 48 per student).

37,021 learner model inspections were made. Table 2 gives the figures for viewing the individual model (for all five formats) which comprised 30,566 of the model inspections, including the mean, median and range of inspections of individual views. Seven students did not access their individual learner model.

In three of the courses in which the learner models were not assessed the mean model viewings were quite similar (31, 33 and 37 per student) but the ranges varied. The median number of model inspections was 16 to 28. In Project Management and Professional Practice the viewings were much higher, with the mean viewing being 124, median being 84 and the range being three to 610 viewings per student. In Interactive Learning Environments, the course in which the learner models were assessed, the mean number of model inspections was even higher at 491. The range was varied (16 to 1,112) but the median was high at 517. This was the only course where more viewings were made of the learner model than questions answered.

Misconception descriptions can be accessed in each of the individual model views. Once opened, these descriptions remain visible until the user chooses to hide them, thus the
logs may underestimate the attention given to misconceptions. Table 3 shows how many times students opened a misconception description in the three courses in which misconceptions were modelled and gives the mean, median and range values. This data includes only those students who had misconceptions. The viewing of misconceptions was most frequent in the third year course where the learner model was assessed. Only one of the 29 students had no misconceptions at any point during their learning. There was no clustering of misconception viewing, with a range of three to 54 viewings, but with fewer at the higher end of this range. In the first year Circuit Analysis course 12 of the 28 users had no misconceptions. Of the remainder, half viewed misconception descriptions once or twice. Most of the others viewed the descriptions fewer than eight times. In the second year Project Management and Professional Practice course only two of the 109 students had no misconceptions. There was no clear pattern to the viewing of misconception descriptions - 12 learners looked at the descriptions only once or twice, while 39 students looked at them more than ten times. This figure includes eight users who viewed their misconceptions more than 20 times (with a maximum of 45).

Table 4 shows use of the peer comparison view, where there were a total of 2,980 inspections. Some students were not interested in comparing their knowledge to that of others - 22 of the 223 users (10%) did not access this view at any time. However, most students accessed it several times, with means of seven and eight and medians of four and five for three of the courses in which the learner model was not assessed; and a mean of 12 and median of nine viewings in the other course for which the learner model was not assessed. In the course that assessed the learner model, students compared their knowledge to the knowledge of others more frequently, with a mean of 35 and a median of 25.

Table 5 shows usage of the instructor expectations comparison view. As with the misconceptions, the expectations comparison remains on screen until the learner chooses to close it. The logs may therefore underestimate the consideration that users gave to this information. 1,833 inspections of this view were made. The highest number of viewings was in the third year course where the learner model was assessed, even though it was only the final model that contributed to the course mark. The second year Project Management and Professional Practice course also had a high level of inspections from some students but the mean and median viewings were lower. Inspections of the comparison with instructor expectations were made occasionally by those in the first year courses, however 38 students were not interested in this information. In the Communication, IT and Laboratory Skills course, OLMlets was introduced only a short time before the end of the teaching period and therefore students had little need for this view. In the fourth year/MSc/MRes course interest in this view was higher, with six students making at least 12 inspections but with four making five or fewer viewings.

Discussion

Nearly 30,000 questions were answered (mean being 135 per student) and over 37,000 learner model inspections were made (mean being 166 per student). It is perhaps not surprising that students chose to access their learner model frequently in OLMlets as this was the only feedback the system gave on their progress. However, it was not expected that learners would make such extensive use of the system in terms of both answering questions and viewing the learner model in the courses for which it was optional and where no additional support was available. This level of use suggests that OLMlets was considered by students to be a helpful support alongside a lecture course. This therefore goes some way to overcoming the problem of lack of participation by many in formative assessment. The provision of what is perceived as directly-related practice for a forthcoming test seems sufficient to motivate students to take part. Furthermore, there was also a reasonable level of usage in the Circuit Analysis course which had no upcoming assessment at the time of deployment.

For the three courses in which misconceptions were defined many students viewed the misconception descriptions, although in the third year course (where the learner model was assessed) the misconception inspections were higher as students had extrinsic motivation to ensure that their learner model was as good as they could possibly achieve. However, students on the other courses were also consulting their misconception descriptions. As mentioned previously, once opened, misconceptions
Table 2. Use of the individual model views

<table>
<thead>
<tr>
<th>Course</th>
<th>Individual Views</th>
<th>Mean</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Circuit Analysis</td>
<td>911</td>
<td>33</td>
<td>16</td>
<td>0-273</td>
</tr>
<tr>
<td>1 Communication/IT/Lab</td>
<td>1477</td>
<td>31</td>
<td>24</td>
<td>0-143</td>
</tr>
<tr>
<td>2 Project Management</td>
<td>13566</td>
<td>124</td>
<td>84</td>
<td>3-610</td>
</tr>
<tr>
<td>3 ILE</td>
<td>14236</td>
<td>491</td>
<td>517</td>
<td>16-1112</td>
</tr>
<tr>
<td>4 User Modelling</td>
<td>376</td>
<td>37</td>
<td>28</td>
<td>14-82</td>
</tr>
</tbody>
</table>

Table 3. Inspection of misconception descriptions

<table>
<thead>
<tr>
<th>Course</th>
<th>Misconceptions</th>
<th>Mean</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Circuit Analysis</td>
<td>79</td>
<td>5</td>
<td>8.5</td>
<td>1-27</td>
</tr>
<tr>
<td>2 Project Management</td>
<td>1052</td>
<td>10</td>
<td>8</td>
<td>0-45</td>
</tr>
<tr>
<td>3 ILE</td>
<td>441</td>
<td>16</td>
<td>12.5</td>
<td>3-54</td>
</tr>
</tbody>
</table>

Table 4. Use of the peer comparison view

<table>
<thead>
<tr>
<th>Course</th>
<th>Peer View</th>
<th>Mean</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Circuit Analysis</td>
<td>217</td>
<td>8</td>
<td>5</td>
<td>0-68</td>
</tr>
<tr>
<td>1 Communication/IT/Lab</td>
<td>326</td>
<td>7</td>
<td>5</td>
<td>0-34</td>
</tr>
<tr>
<td>2 Project Management</td>
<td>1343</td>
<td>12</td>
<td>9</td>
<td>0-70</td>
</tr>
<tr>
<td>3 ILE</td>
<td>1011</td>
<td>35</td>
<td>25</td>
<td>2-144</td>
</tr>
<tr>
<td>4 User Modelling</td>
<td>83</td>
<td>8</td>
<td>4</td>
<td>2-40</td>
</tr>
</tbody>
</table>

Table 5. Use of the instructor expectations comparison view

<table>
<thead>
<tr>
<th>Course</th>
<th>Expect. View</th>
<th>Mean</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Circuit Analysis</td>
<td>169</td>
<td>6</td>
<td>2</td>
<td>0-22</td>
</tr>
<tr>
<td>1 Communication/IT/Lab</td>
<td>178</td>
<td>4</td>
<td>0</td>
<td>0-24</td>
</tr>
<tr>
<td>2 Project Management</td>
<td>537</td>
<td>5</td>
<td>3</td>
<td>0-29</td>
</tr>
<tr>
<td>3 ILE</td>
<td>841</td>
<td>29</td>
<td>24</td>
<td>1-63</td>
</tr>
<tr>
<td>4 User Modelling</td>
<td>108</td>
<td>11</td>
<td>13</td>
<td>1-23</td>
</tr>
</tbody>
</table>
remain visible on screen until the learner hides them. Therefore it is important to consider that the level of attention paid to misconception descriptions may be higher than suggested by the logs. Furthermore, unless a student holds many misconceptions, the misconception description links will not always be present. Therefore the level of use of this feature suggests that there are sufficient students who will consult this information if it is offered. This is particularly interesting given that this kind of information is not often available to learners.

While some learners chose not to use the peer comparison view, most made several comparisons. The highest level of use was in the course that assessed the learner model. This may have been higher simply because students used OLMlets more frequently and so made the comparison correspondingly. Alternatively, students may have been concerned about achieving an equal or higher mark than others. Questionnaire comments for that course indicate that some students were clearly motivated by being able to see their relative position in the class for the range of topics, while there was only one student who stated that they found it demotivating to see that their knowledge was lower than that of other people (Bull and Mabbott, 2006).

Although the level of usage was lower in the other courses it should be remembered that, during a session, students are unlikely to need to make many comparisons to other students. Their focus appears to be mainly on their own knowledge, with reference to other learners at intervals in their learning.

Many students used the lecturer expectations view. Again, heaviest usage was in the course that assessed the learner model. Nevertheless, there were also students on the other courses who used it. This may be because students find it helpful to make continued reference to their developing knowledge relating to a target, such as a forthcoming assessment, as this provides more objective external evaluation rather than their own (possibly inaccurate) self-assessment.

In the course in which the learner model was assessed there was higher use of the system and higher viewing of the model since students could determine when their learner model was sufficiently strong. More interesting is that students in other courses used OLMlets despite the fact that its use did not contribute directly to the course mark. Of course, the similarity of questions to the upcoming assessment in two of the courses probably increased students’ motivation to use it. Nevertheless, it is unlikely that they would have continued their use had they not found the system beneficial. The difference in usage levels in the two courses that had multiple choice tests might be accounted for by the fact that the Project Management and Professional Practice course released the OLMlets questions about a month before the test, thus students had more time to use it, whereas the Communication, IT and Laboratory Skills course deployed OLMlets only shortly before the test.

Based on an examination of utilisation in different kinds of engineering course with different assessment types, it appears that a simple OLM can be a useful resource alongside lectures as a means of stimulating students to take part in formative assessment. If the OLMlets learner models also contribute to the final course mark then use may increase further, also involving additional formative diagnostic feedback to students.

Summary

This paper has described OLMlets, an open learner model with multiple individual and comparison views for use in a range of course types. The primary aim of OLMlets is to prompt reflection by showing students simple representations of their knowledge level and difficulties in order to facilitate their planning of future learning episodes. Use of OLMlets in five university courses in Electronic, Electrical and Computer Engineering was described. It was found that, in general, students answered questions and accessed the individual learner model views quite frequently, viewing comparisons of their own knowledge level with that of their peers and with instructor expectations at different stages of the course. Thus the first deployment of OLMlets has provided students with increased support through individualised formative assessment, thereby fulfilling its aim. The next stage is to deploy the system into a broader range of courses and to see whether the level of usage is maintained when students are using it in several of their courses at the same time.
References

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