

Towards a Sustainable Learner Model

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Abstract. Many students over-emphasise the product of a project to the detriment of learning, and this is something that continues into the workplace. This shows the need for a sustainable learner model that can be used on a day-to-day basis. The overall goal of the work is to investigate how learners can take a record their learning *with* them, over from each undergraduate course to the next and beyond into the workplace and informal learning. A prototype has been built that leverages cloud services, and a promising trial in an undergraduate course has taken place, pointing to the potential for scalability and sustainability of this learning model.

Keywords: visualising learning growth, multi-domain open learner, Project Based Learning, cloud services, mastery learning

1 Background (Pedagogy)

The main pedagogical frameworks on which this work is based are Project Based Learning (PBL), in which learners produce a series of artefacts culminating in a final product, usually organised around a driving question [1], mastery learning [2] and Dweck's work on "mastery-oriented" patterns [3].

In several iterations of an undergrad PBL course, the same observation was made: most students overemphasise the product to the detriment of learning, and this is something that continues into the workplace. Large studies such as [4] in which companies have splendid learning plans but then almost invariably defer learning to the end of projects and find there is no time for it, shows the need for a learner model such as this that can be used on a day-to-day basis. The aim of this work is to increase the learners' focus on mastering learning outcomes in particular in the context of PBL. One issue is that the specific learning outcomes are typically not known at the outset of the project but are continually identified (and mastered) throughout the project [5].

2 Background (Technology)

In order to increase the learners' focus on mastering learning outcomes, it is necessary to represent exactly what these knowledge items and skills are, as

well as the degree to which they are mastered, and to be able to add to them; this means the user model needs to be open (and editable by the user) [6]. A prototype to test the concept of the multi-domain, sustainable, open learner model was written in HTML/JavaScript, and uses Google Drive to store the learner model (as a spreadsheet). It uses the Google Drive SDK to create and update the learner model (the app only has access to files it creates on the user's drive). This can be done both directly through Google Sheets (as shown in Figure 1) and also through a custom build user interface emphasizing a frictionless, efficient updating the user model (this interface can be used on desktop or tablet computers). This use of cloud services is relatively novel; additionally this work enables linking of any number of domains to create a lifelong learning model, and exploits the use of revisions in Google Drive to enable learner's growth over time to be visualised as an animation. Note that while the prototype uses Google Drive it could be readily extended to use a different cloud service (such as Dropbox).

3 Demonstration outline

The demo enables users to play with the tool using content generated from an undergrad course that uses PBL. This shows how a user's proficiency in a number of different areas is visualized, and how it can be used for assessment. Specifically, in the demo users can perform the following actions:

- authenticate demo account [using a Google account set up for the demo or participants can use their own Google account if they wish]
- view mastery level (treemap) this can be seen in Figure 1 and it shows many of the learning outcomes required in the PBL course, split into the areas (git, JavaScript, JIRA, Box2D, Havok, and C++). Figure 1 shows the treemap after one zoom (into the JavaScript area)
- zoom into a specific area to see sub areas and zooming in further to see the learning outcomes an area contains
- choose an area and select a learning outcome from it and view a corresponding learning object
- add a new learning outcome; add a new area; add a learning object (a multimedia heavy webpage that assists in the mastery of a learning outcome)
- search for existing learning outcomes (and corresponding learning object);
- modify mastery level of a learning outcome;
- see growth over time (see the treemap visually change over time animating at a speed of a week every 2 seconds);

Running through this demo should enable participants to see the potential of this tool in scaling into the numerous areas covered in the four year degree programme, and beyond into the workplace and informal lifelong learning.

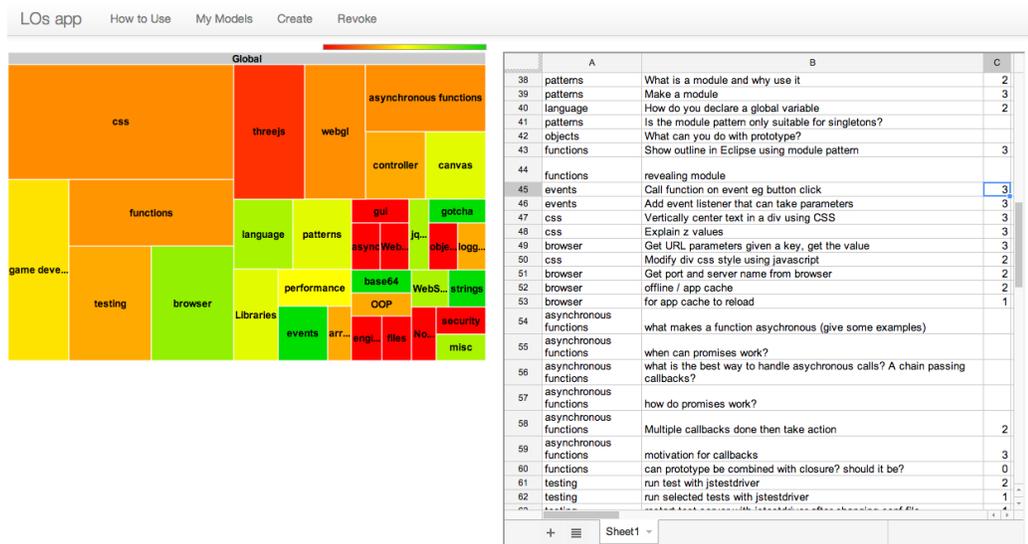


Fig. 1. A screenshot from the app. On the left is a treemap showing the user’s proficiency broken down by area, clicking zooms into the area to reveal sub-areas and zooming further reveals the learning outcomes. The level of proficiency goes from 0 (red) to 3 (green) and the average of proficiency of the individual learning outcomes in an area produces the colour of the area. On the right, the spreadsheet in Google Drive that contains the learning model; editing this updates the treemap.

4 Results and outcomes achieved

A trial of the tool took place in an undergrad course in computer game development that uses PBL. A condensed version of the USE questionnaire [7] was used to measure usefulness, ease of use, ease of learning, and satisfaction. A summary of the results of the survey of the 16 students who completed the course are shown in Figure 2. The instrument’s scales are from 1 to 5, and the tool scored highly in all areas.

The survey’s additional comments section provided some interesting observations. The usability issues identified were minor ones: adding more colours to the treemap and adding numerical comparison such as a percentage progress to accompany the colours. Two areas identified by the participants for future work are programme-wide adoption: “the app should be shared among lecturers and used for all of the courses”, and exploring gamification [8]: “it makes the whole course content seem less daunting. Also slightly gamifies the study, as you try to make the whole graph greener.”

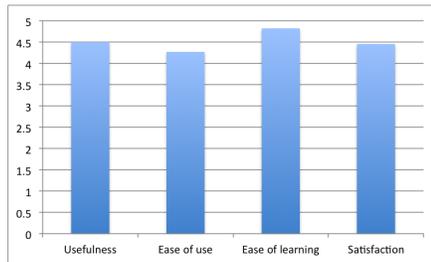


Fig. 2. Results of the USE Questionnaire

5 Acknowledgement

The author gratefully acknowledges support of this work by the Institute of Technology Carlow Research, Development and Innovation Support Fund.

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