Using Scrutable Learning Models to Support Personal learning Objectives on Mobile Devices

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Abstract
Personal Learning Environments (PLEs) refer to systems that allow individual learners to manage and control their own learning in their own space and at their own pace. In previous work we have proposed a 4D model of informal learning to analyse the informal aspects of a learning experience. The model includes dimensions for learning objectives, the learning environment, learning activities and learning tools, and reveals how much of the experience is really under the control of the learner. In an analysis of mobile tools we showed that many emerging m-learning systems focused on informality in the environment dimension but not in the others. In this paper we propose a scrutable learning model approach that allows personal learners to take control of their learning objectives while still allowing the system to intelligently support them with appropriate learning activities and resources.

1. Introduction

Personal Learning Environments (PLEs) are systems that allow individual learners to manage and control their own learning using their own mix of (often third party) tools (Wilson et al. 2006). Because of the level of independence that they grant to a learner they are often associated with informal learning. In previous work we have proposed a 4D model of informal learning that can be used to analyse and review the informal aspects of a learning experience, and used it to examine a number of mobile personal learning tools and systems (Chen, Millard et al. 2008 A). The model includes dimensions for learning objectives, learning environment, learning activities and learning tools, and reveals how much of the experience is really under the control of the learner. In an analysis of mobile tools we showed that many emerging m-learning systems focused on informality in the environment dimension (they allow students to use them where and when they liked) but not in the others, therefore although it is claimed that these kinds of systems support personalised learning, the reality is somewhat more mixed, with little student choice and control of learning objectives and activities (Chen, Millard et al. 2008 B).

This may be because it is a challenging for personal learning systems to support learning in a more structured way without students losing the flexibility and control that characterised them as personal learning in the first place. But flexible yet structured support is exactly what is needed to enable adaptive and personalized learning systems that can solve the one-size-fits-all problem that arises in conventional educational technology. For example Adaptive Educational Hypertext (AEH) systems such as AHA! (De Bra, Aerts et al. 2003) and The Personal Reader (Dolog, Henze et al. 2004) employ

a user model to record interaction between the system and users, to model their evolving knowledge and skills, and then to present content to them through adapted navigation and presentation.

We believe that a similar problem of system intelligence verses user control has already been faced in the more general Adaptive Hypermedia literature, when users cannot control the adaptation process (and therefore cannot correct it when it goes wrong). The solution in that case is to allow **scrutable** user models that can be examined and changed by the user (Kyriacou 2008).

In this paper we propose to apply the same principle to learning models, in order to allow them to be used in a system while retaining the spirit of personal learning. We believe that a scrutable learning model would allow personal learners to make informed decisions about their learning objectives while still allowing the system to intelligently support them with appropriated learning activities and resources.

We propose a simple AEH system that uses a learning model that is composed of two parts, a subject domain modeled in Simple Knowledge Organization System (SKOS) and a collection of alternative learning paths through that domain (modeled using IMS Simple Sequencing). By making these models scrutable, we believe that we will allow user to take advantage of the adaptation and guidance, while retaining the feeling of control and choice expected in a PLE.

2. Models

To model the learning process in our scrutable AEH prototype we have employed the SKOS (Miles and Bechhofer 2008) as the data modeling approach for organizing the subject domain. The SKOS, developed by W3C, is a semantic web language used to describe simple knowledge structures for the web. This approach employed aims to structure the subject matter content in a hierarchical, graphical representation.

Our prototype application uses SKOS to model the domain of culture shock (our intention is to make the prototype available to international students arriving in the UK). Figure 1 shows an example portion of the SKOS structure developed for this application. It is in effect a simple taxonomy of topics in the domain that we have created by analyzing a number of culture shock textbooks and websites. Our model includes top level subjects such as ‘Life’ that are broken down by the ‘Narrower’ relation into sub-topics such as ‘Fitting In’ or ‘Food and Drink’. By associating each SKOS node with appropriate learning activities and resources we can then generate a hypermedia content page for any concept.

The SKOS model is a good way to structure content about the domain, but it does not contain any pedagogical information that might help a learner navigate those structures. To enable the learning process to be sequenced and personalised by our AEH system we have used another set of models built with IMS Simple Sequencing (IMS 2003). This is used to model alternative learning paths through the subject domain (as represented by pages generated from nodes in the SKOS graph). Our system uses a single SKOS model but contains many alternative learning paths, in this way it can use a traditional adaptive hypermedia engine to suggest next steps (and related topics) to users when they browse any concept page.

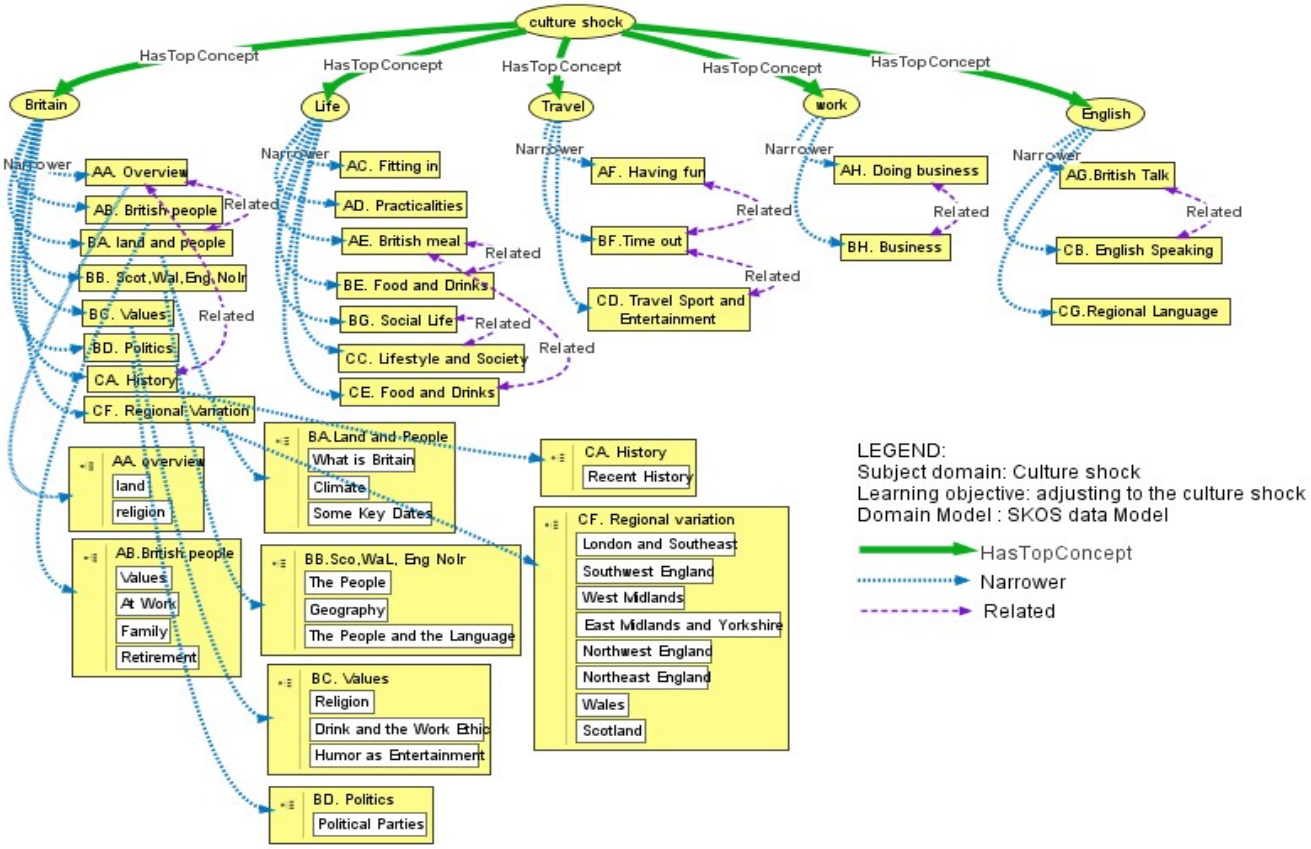

Figure 1. An example of graphical representation of learning process modeled in SKOS

We seeded our prototype with three different Simple Sequences created from a number of the source textbooks and online resources. Figure 2 gives an overview of how a set of concepts is organized into a SKOS graph, and then a path through them is created in a Simple Sequencing model.

Node A is sequenced with the rollup rule ‘all’ and its children activities (BCJ) are sequenced with rule ‘any’. This means that Node A is satisfied only if all its children have been visited and satisfied, but B and C can be satisfied by viewing any combination of their children. Therefore, given this simple sequence, the available learning paths through Node A are: ABECGJ, ABFCGJ, ABECIJ and ABFCIJ.

Together the two models can be used to generate links and guidance for students viewing the material. For example, if viewing Node I we can the SKOS model to suggest parent C or siblings G or H, and use the Simple Sequence to suggest moving back to G or forward to J.

3. System

To enable our prototype to be run on mobile devices we designed it as a Rich Internet Application (RIA), under the framework of HTML5, CSS3, and JavaScript. The application tools employed for our system development is Sencha Touch, a mobile JavaScript framework, allowing us to develop a web application that simulates the look and feel of apps on the iPhone. We have developed two distinct versions of our system.

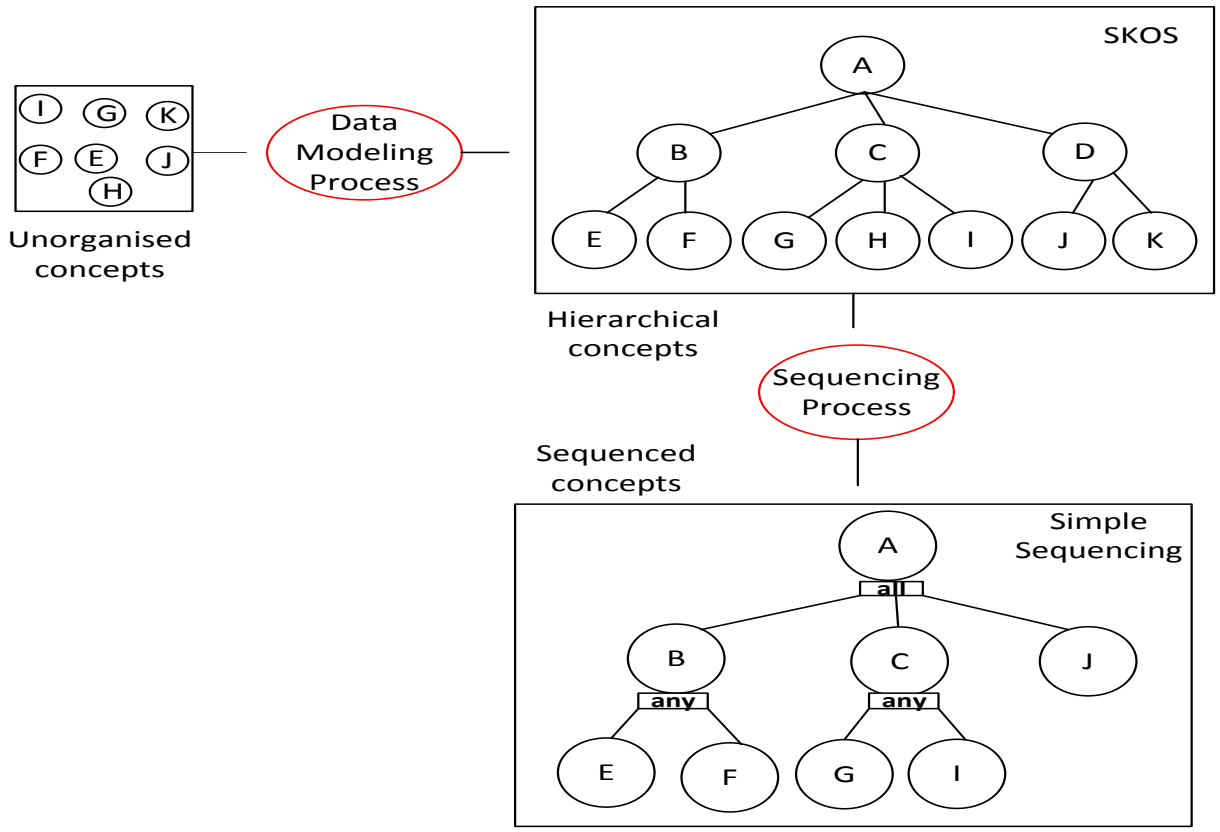

Figure 2. An example of possible learning paths to the subject domain

The first as shown in Figure 3 is a non-scrutable version that functions exactly as a traditional AEH system. Users navigate concept pages and the AEH engine uses their history, the SKOS model and their current Simple Sequence to suggest next pages and related topics as hyperlinks at the bottom of each page.

The second shown in Figure 4 is a scrutable version that maintains all of the functionality of the first AEH, but also allows users to see visualizations of both the SKOS and SS models. In this second system users are free to use either the SKOS model or the SS models to jump around the content (or just to orientate themselves). In this way users will be able to see the reasoning behind the hyperlinks offered in the standard content view, and are free to deviate from then at any time (or switch to an alternative learning path). By comparing the user experiences of the two applications we hope to be able to understand the impact of scrutability on personal learner's perceptions of independence.

Figure 3. Screenshots of the designed system (non-scrutable)

Figure 4. Screenshots of the designed system (scrutable)

3.2 Scenario of use for scrutable models

Our work is still at a preliminary stage, but the following scenario describes how we imagine the scrutable version of our application might be used.

Valerie, an international student coming to UK for study, has decided to learn how to adjust to the surroundings around her and wants to use the mobile system to learn about culture shock. Although she is an independent learner she still wants guidance from the learning system, however as a new arrival to the UK, and on a new course, she only has limited time to participate in activities.

On a free afternoon she decides to use the system to explore a new aspect of life in the UK. Her current learning path suggests that she order a traditional meal from a pub as part of an exercise about Eating Out, however it's the wrong time to eat, and she doesn't have time that evening. Using the scrutable learning path she discovers that this is part of learning about local and international cuisine, and using the scrutable topic map she manages to find a replacement activity that better fits her current time, place and mood: ordering a traditional English Afternoon Tea.

Not only has she been able to personalize her learning activity, but by navigating the models and seeing the available options, she has learnt a little bit more about how aspects of British life relate to one another. And besides, she can always return to the pub meal on another day.

Our hope is that by using the scrutable system Valerie can freely make informed decision about her learning objectives, rearranging the given learning activities to suit her while still working towards her desired learning outcomes. Then appropriate learning resources and corresponding support activities are given from the system to scaffold the learning process whilst retaining her feelings of control over the entire learning process.

4. Conclusions

In this paper we present the idea of a scrutable learning model, which allows intelligent tutoring, while retaining a student's control of learning objectives and activities. We have also presented the prototype of our system, a mobile web-based application with scrutable topic and learning models (SKOS and Simple Sequencing respectively). We are in the process of finalizing the system and creating models and content from the domain of culture shock aimed at international students coming to the UK.

Once this is completed our intention is to perform a comparative experiment (non-scrutable vs. scrutable) to understand how a scrutable learning model can affect the learning behaviors of individual learners. Our hypothesis is that it will allow learners to benefit from an adaptive educational environment while maintaining their perceptions of control and choice.

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