Construction and Inspection of Learner Models

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ABSTRACT

Learners working on the creation of conceptual maps become involved in a creative learning activity that involves "making sense" of new concepts and their relationships through modelling. These models can be seen as representations of the learners' understanding of a particular topic domain. During subsequent learning activities, students can reflect upon the models they have built. In addition to domain knowledge, models can contain information about learners' knowledge profiles and social aspects of learning. This paper explores different ways to interact with models in order to support reflection, negotiated assessment, and knowledge awareness. We have developed ConceptLab, a knowledge construction and navigation system that uses XML-based conceptual maps to represent the learner's view of the domain. ConceptLab has been used by students and teachers as part of an exploratory study carried out in a Colombian elementary school.

Keywords

Conceptual maps, Learner models, Collaborative and Negotiated Assessment.

INTRODUCTION

Constructivist environments promote reflection and meaningful learning. Computers should be used as cognitive tools helping learners to acquire responsibility of their planning, decision-making, and self-regulation (Lajoie, 1993). We claim that inspectable learner models can be constructed collaboratively or individually. Learners and teachers can inspect their models in order to support reflection and knowledge awareness. Learners can benefit by looking inside these models and reflecting upon their content. ConceptLab makes the learner model inspectable to learners and teachers. We believe that it promotes reflection, and interactive assessment. Teachers can use ConceptLab as an assessment tool. ConceptLab has been used by students and teachers as part of an exploratory study carried out in a Colombian elementary school. This paper presents some preliminary results obtained from this study.

CONCEPTLAB

ConceptLab (Zapata-Rivera et al. 2000, Zapata-Rivera & Greer 2001), is a knowledge construction and navigation system that allows students to engage in collaborative construction of conceptual maps. These maps represent the learner's view about the domain. ConceptLab considers the object resulting from the learner's work as his/her representation. Learner models in ConceptLab maintain basic learner information (i.e. preferences and personal information), the learner's current level of knowledge on every concept, social aspects of learning (i.e. helpfulness, eagerness, assertiveness, etc.), and the XML representation of the map (map structure, links, and presentation preferences).

Students and teachers can create their own map collaboratively or individually. Students working on groups assume different collaborative roles (i.e. leader, speaker, resource manager, critic, and time vigilant) in order to co-ordinate their interaction. Students can use a predefined list of concepts (common vocabulary given by the teacher) or their own new concepts, in case they consider the concept is important and should be included in the system. We have experimented with students creating their model using paper, markers of different colours, and labels. A digital picture of the model was used to integrate the model within ConceptLab.

Once the map is imported into ConceptLab, class resources can be linked to the concepts in the map. Students can use their own map to access class resources. These resources can be suggested by the teacher (initial links) or by classmates. Students can use an existing map as a guide to study the content, or use ConceptLab as a learning tool to facilitate remembering, to create maps collaboratively, to share their maps, and to engage in discussions about a particular topic. Maps in ConceptLab can be overlaid with the knowledge profile of a particular student or group of them, integrating the system's or the teacher's view of the student's knowledge. In addition teachers can visualize how social aspects, such as: eagerness, helpfulness, assertiveness and self-confidence are taken into account in the overall assessment. Initial knowledge values are obtained from an initial pre-assessment quiz that feeds a Bayesian model that integrates information about the domain, self-assessment and social aspects of learning.

Initial evidence for the Bayesian model is gathered by carrying out a pre-assessment quiz. The results are mapped to the nodes of the Bayesian model. Hence, an estimate of the student's knowledge is available to be used within ConceptLab. Special interfaces have been designed to allow students and teachers to interact with the model. Students interacting with the model may realise what they really know or do not know and perhaps use this information to focus their learning activities. Learners and teachers use the model to engage in discussions that support knowledge reflection. We are interested in knowing how students and teachers will react to the model. What kind of support is needed in order to promote learners' reflection? What should be the teacher's role in this process? and how teacher and learners interact with the model during the creation, reflection, and negotiating based on the model.

EXPLORATORY STUDY

An exploratory study was conducted in May, 2001 in a classroom at the Joaquin Aristizabal, a Colombian public elementary school. Participants were eighty fifth grade students and six teachers. Students in a science class were introduced to the cell, were told about conceptual maps, ConceptLab, and learner models. Students were asked to create a map of a cell using paper, markers, and labels. They were prompted with some of the main concepts but were free to include some extra ones. Students worked in groups, dyads, or individually.

SOME PRELIMINARY RESULTS

Based on an initial analysis of the information gathered during the study, we report some general findings.

- *Students became engaged while creating the map using these new and different kinds of media*.
- *Students understood their roles and were able to create group or individual representations of a cell.*
- *Students successfully explained their work as a group or individually.*
- *Student used books and asked questions*.
- *Teachers were greatly surprised by students' participation during the whole experiment.*
- *Reflecting upon the model facilitates a new learning process*.
- *Explaining why matters*.
- *Dialogue between teacher and students was enhanced by the model*.
- *Social aspects of learning are a must to have for teachers.*
- *Teachers valued ConceptLab as a tool that supports negotiated assessment*

CONCLUSIONS

ConceptLab combines a knowledge construction tool and open learners models. It has been interesting to begin to investigate the advantages of using these technologies to support learning and reflection. Different learning outcomes can be observed at different stages of the experiment. Support is needed to help groups to interact with a group knowledge profile. ConceptLab integrates constructivist and cognitive approaches by providing a set of tools that emphasises reflection and collaboration. More information about ConceptLab can be found on-line: www.cs.usask.ca/~rjz896

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