DESIGNING AN ADAPTIVE COACH IN COLLABORATIVE LEARNING SYSTEMS USING SERVICE-ORIENTED ARCHITECTURE

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EXTENDED ABSTRACT

E-learning is the application of computer-based technologies to enhance teaching and learning (Waterhouse, 2003). Rosenberg (2001) describes E-learning as a networked activity, which makes it capable of instant updating, storage or retrieval, distribution and sharing of instruction or information. In this Information age, education has made a step from the traditional transmissive classroom to go online. The transmissive paradigm emphasizes on the transfer of knowledge from lecturer to student. Hence, it may not be conducive or meaningful as active learning occurs when students can take a pro-active role in questioning, sharing ideas and applying prior knowledge to develop new ideas. Students are more likely to learn from collaborative learning experiences mediated by technology than from transmissive pedagogies (Johnson & Johnson, 1996; Luca & McLoughlin, 2004). Education is less a process of instruction and more a process of creating environments. As Barry (2004) observes, "In education, one should concentrate less on creating process of instruction, but more on the process of creating learning environments". To develop lifelong learning skills, students need to learn how to learn via inquiry and understand the sociocognitive and metacognitive processes that are involved (White, Shimoda & Frederiksen, 1999).

Collaborative learning serves as an important part of e-learning to increase interactivity and accessibility to various learning resources either synchronously or asynchronously among users. Collaboration has been shown to be an effective medium that exposes
students to diverse and rich perspectives on thinking, creating cognitive dissonance and stimulating reflection, assimilation and accommodation of knowledge (Lee, 1999; Piaget, 1977). Easy coordination of collaborative activities is provided through the incorporation of the cognitive apprenticeship model. In computer-aided instruction, scaffolds are needed to further enhance the quality of interaction and learning effectiveness among students and between the students and the interactive system. An Intelligent Tutoring System (ITS), broadly defined, is any computer system that provides direct customized instruction or feedback to students, i.e. without the intervention of human beings (Joseph, 1988). It consists of the Domain Model, Student Model and Pedagogical model.

Service-Oriented Computing (SOC) is widely accepted as a new paradigm for delivering useful functionality in a cost effective way. It forms a new trend to be adopted by organizations in mitigating legacy system problems. Due to distributed resources everywhere, Service-Oriented Architecture (SOA) plays an important role to enable reuse of components, pedagogy and learning activities in this heterogeneous environment. Distributed interactivity which includes learning activities and personalized coaching through Web services enhances the interoperability, flexibility and reusability of e-learning content in a collaborative environment. The resulting SOA-framework can be used as a basis for implementing specialized e-learning services, specified by future standard frameworks and reference models. Many research have identified and created common services, which are essential for the creation and authoring stages of a typical e-learning system.

Conclusively, we research on how to enhance learning outcome through identification and correlation between common and individual goals and how to increase the degree of coaching and advice provided to students through the incorporation of artificial intelligence techniques. We also address the implementation details for the service design aspects, incorporating Web-service, BPM and e-learning. We will present an approach of intelligent tutoring in distributed environment which is personalized to a specific user group. The mapping between the adaptation and pedagogical modules in ITSs which leads to more effective adaptation of tutoring techniques is to be improved.
RESEARCH OBJECTIVES

Our main focus in this research is to increase the efficiency and effectiveness of collaborative learning in terms of Reusability, Interoperability, Accessibility and Modularization. The specific objectives of this work are:

1. To identify what features are meaningful in collaborative learning.
   - To enhance learning outcome through identification and correlation between common and individual goals.

2. The need to identify how to guide users meaningfully during collaborative learning.
   - To investigate whether explicitly stating learning goals (individual and common) and modelling through the provision of real-life cases and concept maps will enhance the quality of learning experiences in virtual collaboration.

3. To identify a framework for reusable learning services.
   - To address the implementation details for the service design aspects, incorporating BPM and service components

4. To identify how to facilitate personalized intelligent tutoring in a distributed and reusable environment.
   - To improve the mapping between the adaptation and pedagogical modules in ITSs which leads to more effective adaptation of tutoring techniques.

5. To design a visualization framework for web service discovery and selection.
THESIS CONTRIBUTIONS

1. Identification of users’ perception towards collaborative learning using concept map within a common knowledge space.

2. Identification on how to guide users meaningfully during collaborative learning.

3. Designed a framework for reusable learning services.

4. Identification on how to facilitate intelligent tutoring in a distributed and reusable environment.

5. Designed a visualization framework for discovering and selecting web services.
THESIS OUTLINE

Chapter 1 provides an overview of the research work. It highlights the motivation for the thesis which includes problem statements, research questions and main objectives. It presents a solution framework to illustrate the proposed solution. It is then followed by the thesis contribution and the overall thesis organization.

Chapter 2 includes the state of the art survey of the concept of collaborative learning, cognitive apprenticeship, and different types of tutoring techniques with the application examples. It also provides the literature review for Service-oriented Architecture (SOA) with its existing standards and methodologies. It shows the benefits of incorporating SOA to e-learning in an effort to increase reusability and learning services’ interoperability. It also includes the study of visualization to show the complex behavior of service discovery and selection process from several web services applications.

Chapter 3 discusses the effects of learning goals and modeling on virtual collaboration. It describes how cognitive apprenticeship is incorporated with a collaborative concept map within a common knowledge space. It also describes how the task planning/learning goals and modeling aspects are being improved and what are the effects brought on to virtual collaboration. Experiment is carried out and discussions on the findings are included.

Chapter 4 focuses in identifying the way to guide users meaningfully during collaborative learning. It describes the design and the improvement done on the coaching strategies. The improvements cover both the aspect of the chat tool as well as the coach in the collaborative concept map. Proposed solution with the detailed architecture is included in this chapter.

Chapter 5 examines the feasibility of SOA in realizing reusable collaborative learning environment. The first part of the chapter includes the adoption of SOA by information systems. Concepts of SOA adoption models will be described. The final part of the chapter highlights the services implementation using proposed SOA methodology. Key
artifacts in service-oriented development, verification paths and criteria and proposed methods for verifications will be shown. The chapter concludes with the experimental results discussion.

Chapter 6 includes the framework design for collaborative learning using SOA. The collaborative learning services will be identified and the details of the proposed framework will be included. The methodology of designing the services will be presented as well.

Chapter 7 extends from the previous chapter by including the framework design for intelligent tutoring in collaborative systems using SOA. Design rationale for learning companions will be presented and how the learning companion agents are realized using SOA will be shown. The methodology of designing the SOA-based learning companions will be included. Simulation will be carried out and the chapter concludes with the experimental results discussion.

Chapter 8 presents a visualization framework for web service discovery and selection. Application user interface design and criteria will be discussed in the first part of the chapter. The overall framework architecture will be discussed in details. The design patterns applied into the visualization framework design will be described as well. The design of the framework which includes both provider and consumer console will be presented. The chapter ends with the evaluation results and discussion.

Chapter 9 concludes the project with the summary of main contributions. Future research work that can be done will be included too.
REFERENCES


