

Design of an Intelligent Tutoring System that Comprises Individual Learning and Collaborative Problem-Solving Modules

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Abstract

This paper describes the design of an Intelligent Tutoring System that comprises individual learning and collaborative problem-solving modules. The individual tutoring module was designed to provide appropriate lessons to individual learner based on his/her background knowledge level, interest, and learning style before and prior to using the tutoring system. A software agent was used to monitor and process these parameters to arrange the learning topic, including exercises, for each individual. The collaborative problem-based tutoring module was designed to present tutorial problems and provides facilities to assist learners with some useful information and advice for problem solving. The tutor will provide remedy and advice when learners encounter difficulties during learning session. In addition, the system was also designed in such a way that learners can switch between modules during the tutorial session at anytime they want. This feature helps learners to quickly review and gain knowledge to be used during brainstorming process.

Keywords: Intelligent Tutoring System, Individual Learning, Collaborative Learning, Problem-solving, Learning Style.

1. Introduction

The meaning of the intelligent tutoring system development covers the fields of information and knowledge development that can support student-centered learning approach. It aims to develop the potential human resources in order to possess the higher ethics and reduce the gap in accessing the education and learning opportunities as well as develop the society as the society of knowledge and learning. The main issues in the process of the system are the effective administration, the qualified education materials production, the use of the intelligent tutoring system for the diversity, and the focusing of the achievement of student-centered learning approach [1].

Intelligent tutoring system (ITS) is the electronic tutoring system that is able to serve the different needs of learners. The system is processed through artificial intelligent system and specialized system in managing the knowledge and analyzing learners in accordance to their potential. At present, ITS has been applied more efficiently for being the supporting system for the diverse needs of learners [2] and able to enhance the potential of the learners for better understanding of the lessons. In doing so, we put Computer-Supported Collaborative Learning (CSCL) [3] into the system in order to strengthen the tutoring

system as a part of “problem-solving”. It adapts the problems the learners face as the supportive elements in creating the interaction between learners and finally leads to better understanding.

2. Intelligent Tutoring System: ITS

Currently, there are a number of researches studying intelligent tutoring system in various ways as shown in fig. 1.

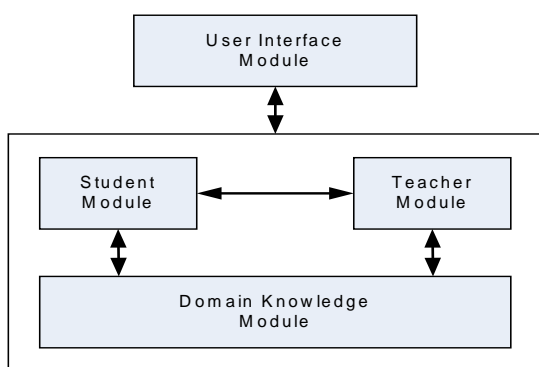


Figure 1 Architecture of ITS [4]

Stankov et al [4] proposed 4 elements in the ITS, as depicted in fig. 2 system. The first one is “domain knowledge”, which is the academic and related information storage. The second is “teacher module”, which is the teaching pattern for the learners. In case that the learners want to revise the previous studied contents or the system presents new issues for learners, this element will store this information for helping the decision making of students afterwards. The third element is “student module”, which is the part that stores basic knowledge and fundamental information of the learners. The last element is the “interface module”, which plays the roles of presentation and interaction between the users with ease of use.

The ITS presented in this paper comprises of ITS (fig.3) and CSCL (fig.5). The shared elements in the systems of every scholar, are; student model, pedagogical

model, domain model, and expert model (fig.3).

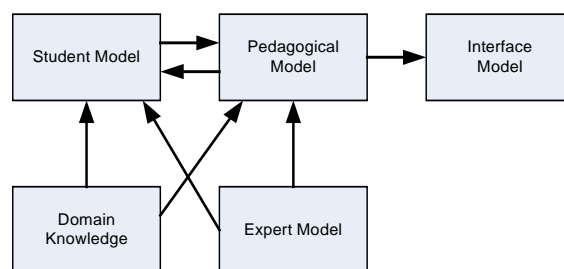


Figure 2 Architecture of ITS [5]

According to the work of Joseph et al [5], we can see that there are 5 crucial elements in their system; namely, student model, domain knowledge, pedagogical model, interface model, and expert model. It is obvious that their system added “expert model” to the system.

3. Design of ITS for Individual and Collaborative Learning

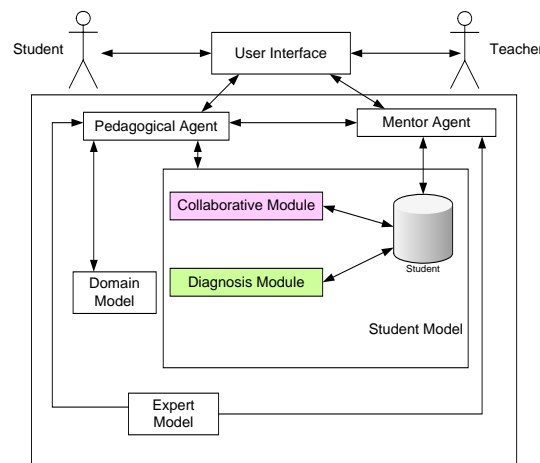


Figure 3 Architecture of ITS for individual and collaborative learning

Fig. 3 shows the general elements found in ITS for individual and collaborative learning. The details can be elaborate as follows.

Student Model is the storage part for storing the information of each learner as well as following up them in order to store the feedback from the learner in each system.

The functions of this part can be divided into 2 parts: Diagnosis Module and Collaborative Module.

Diagnosis Module is the part that analyzes various information of learners. The criteria in analyzing are learning style, background knowledge, and learner's interest. The output is used to process appropriate contents and activities for learners (see Fig. 4).

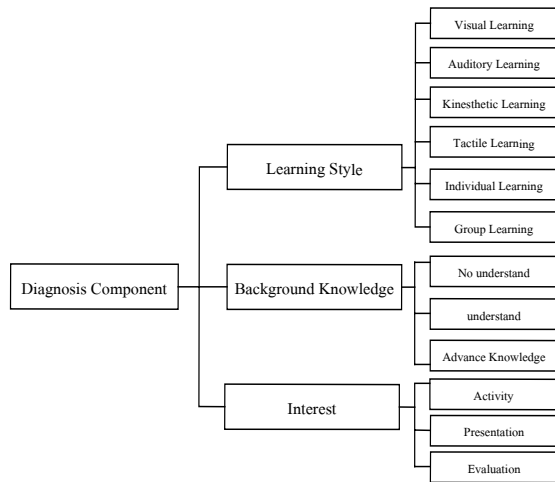


Figure 4 The Structure of Individual Analysis

Collaborative Module (see fig.5) is the supportive part for sharing information, working together, and solving problems together. This module creates new knowledge and better understanding in learning the lessons as shown in Fig. 5.

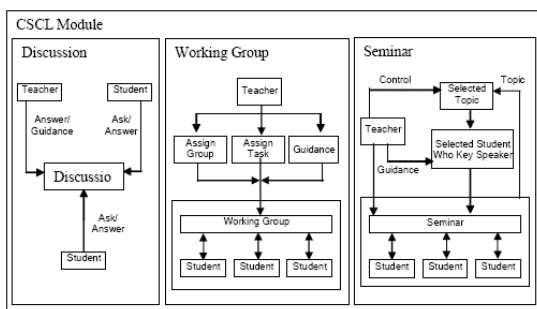


Figure 5 The Structure of Collaborative Learning as the Idea of Hong Guo and Jun-ming Sun [6]

Fig. 5 illustrates working processes of CSCL Module of which the functions can be classified into 3 parts: Discussion, Working group and Seminar.

Discussion: This function runs during the time when the learners is studying through ITS. Since during that period, some learners may not be able to follow or catch the content well, this part would support them by allowing them to discuss both with the learners and the teachers. The conversation may take place in the chat room, etc.

Working Group: This part helps the teacher in grouping the learners and assigning them the work as well as guiding them useful points. In addition, it is helpful for the learners for working in group through electronic whiteboard, chat room, audio conferencing, video conferencing and so on.

Seminar: This is considered as another important part. It works under the criteria that every learner lives in the same learning community (or inquiry community). It helps learners to establish a seminar in accordance to their interests in order to fulfill the weakness in some learners who lack of knowledge or skill in certain issues. The seminar session may be held by either the weak or the strong learners. The teacher is the person who guides and facilitates the agenda in the seminar and selects a learner to act as the speaker for that issue. The teacher, however, can set an agenda in the seminar when realizing that learners seem to have the problems in a particular item. The seminar may run through the chat room, audio conference, video conference, and so on. These activities are help each other, to learn together. The information during the seminar is always stored back in the part of student module.

Domain Model is the storage part for the information as the content, lesson, and teaching pattern. It works in the direction as learning object, which metadata is the indicator for the characteristics of the content [7].

Expert Model is the storage part for rule base in solving problems for both teacher and learners.

Pedagogical Agent is the part for getting the information from student model and expert model and process the appropriate content and learning activities.

Mentor Agent can be comparable to the facilitator of ITS which transforming and storing the information as any parts of the system may require.

User Interface It controls the communication between the learners, teachers, and the system as well as following up the behaviors of them. Then the information is sent back to the student module afterwards.

4. Implementation Plan

This study is an ongoing research which is to be implanted in two phases: the individual Learning phase and the Collaborative Learning phase.

The implementation of the Individual Learning concerns with analyzing of the learners and adjusting the study pattern as appropriated to individual learners. The samples for experiment will be undergraduate students who study computer networks course.

The Collaborative Learning will be implemented as the problem solving part that supports learners in discussing and comparing solutions obtained from the expert model. The results will be analyzed to

determine whether learners have achieved correct understanding for that lesson.

5. Conclusion

This work proposes the framework for constructing a system to be used as an intelligent tutorial system for individual and collaborative learning. The system supports both individual and collaborative learning. The system can be utilized through the web and served for eLearning at anytime. Regarding the individual learning, the system can be used anyplace and anytime while in the collaborative learning, each learner can switch back to the individual module at anytime as well.

6. References

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