ABSTRACT

Computers have been used in education since 1960. The purpose of using computers in assisting instruction is to help students learn more efficiently. Until recently, the computerized tutoring research has been focused on student modeling. Decision making under the environment of uncertainty has also been an area of focus of these researchers. In literature, the student model has been classified based on various factors. Literature survey reveals that the construction of student model can be broadly classified into stereotypes, overlay, and extended overlay. Diagnosis of student's misconceptions is generally through model tracing or constraint-based modeling.

A general methodology for building an Intelligent Tutoring System is proposed and demonstrated. The methodology advocates building an adaptive and generalized Bayesian network student model. The random variables of this Bayesian network denote the stochastic information associated with the mastery states for the knowledge node of the domain knowledge. In an educational environment, a good student model must include all the features of the student's knowledge and preferences related to his learning and performance. This information is used to adapt the system to the student.

Assessment is a necessary part of tutoring. A number of decisions need to be taken about students' knowledge mastery while tutoring. Each decision taken by the tutor for remediation is based on the current information in the student model. In this research, decision theoretic pedagogical action selection strategy is used for making decisions under uncertainty. For assessing the overall progress of the learners' domain competence, the focus of assessment should be on the acquisition of skills in the application of facts in different contextual and non-contextual scenarios and emphasis should be more on the cognitive skills. The diagnostic capability of the student model must be extended to include

the selection of items to match the student's mastery state. This makes the system adaptive and the test items challenging to the students. Providing adaptive feedback to the students when the student needs feedback or help from the tutor is also a prominent problem in Intelligent Tutoring System. The tutoring strategy commonly used by the teachers needs to be formulated. Tutoring strategy is a sequence of optimal actions to be taken by the tutor depending on the student's mastery. This strategy is personalized to the student and this sequence of actions is able to direct the student's learning in the most effective and efficient manner.

For a successful Intelligent Tutoring System, there are three key factors identified: (i) the generation of a cognitive model to facilitate its communication to student; (ii) students must be protected from the potentially high cost of errors by minimizing learning time; and (iii) the ability to monitor student's understanding of the concepts. One such tutoring system developed to address these key factors is BiTutor (Bayesian Intelligent Tutoring System). BiTutor attempts to build a model of the student, and use that model in conjunction with knowledge about the domain of instruction and instructional strategies to modify the order of presentation of material, selection of item and feedback, and style of interaction with the student. BiTutor can be used to teach any computer science courses. The evaluation shows that BiTutor is able to generate the tutoring strategy in polynomial time. Finally, this thesis suggests some areas of possible future work, which may lead to improvements in Intelligent Tutoring System.