Are ILEs Ready for the Classroom? Bringing Teachers into the Feedback Loop

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Abstract. This paper proposes a new approach for incorporating intelligent learning environments (ILEs) into K-12 classrooms that tightly integrates interactions between the students, the classroom teacher, and the ILE. The ILE's ability for continual, fine-grained monitoring and analysis of students' learning activities supports the teacher's ability to more effectively guide student learning.

Keywords: intelligent learning environments, classroom integration, behavior analysis.

1 Introduction

In intelligent learning environments (ILEs), students work to accomplish learning tasks while receiving guidance and scaffolding based on their performance and interactions with the computer-based system (e.g., [1]). While ILEs have shown impressive gains in student learning [2,3], integrating them into the classroom presents a new set of interesting and important challenges that revolve around the question: "How should the roles of the teacher and the ILE complement each other to help students learn in a more effective manner?" We believe that the relationship between the ILE and the classroom teacher is an important but often neglected aspect of designing and deploying ILEs. In this paper, we discuss our current vision for incorporating the teacher more fully into the ILE-enhanced classroom.

2 The Student, Teacher, ILE Relationship

In general, the student-teacher relationship, summarized in Figure 1a, is one where the teacher sets learning goals, and the student works to achieve those goals. Along the way, the teacher is likely to monitor student progress and provide necessary guidance and feedback. ILEs change the student-teacher relationship by providing the guidance and feedback, and also by automatically collecting data on students' interactions with the system. The relationship between the student, teacher, and ILE is summarized in Figure 1b.

The student-teacher and student-teacher-ILE models have advantages and disadvantages. In the student-teacher model, the teacher can more effectively modify pedagogical interactions based on student characteristics and environmental factors outside of the learning interaction. Similarly, in the ILE-enhanced model, the ILE can "observe" all students simultaneously, examine and record how they progress through the learning task, and analyze these observations.

Given these separate and complementary strengths, we propose an extended model of the ILE-enhanced classroom, presented in Figure 2, where the ILE extracts interesting behavior patterns from log traces of student activities, and teachers use their pedagogical expertise to respond to them. Creating ILEs according to this model should allow for more successful integration of ILEs into classrooms.
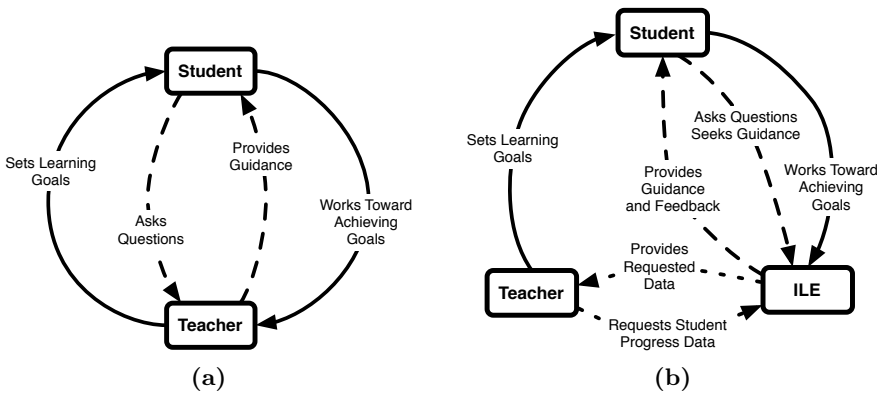

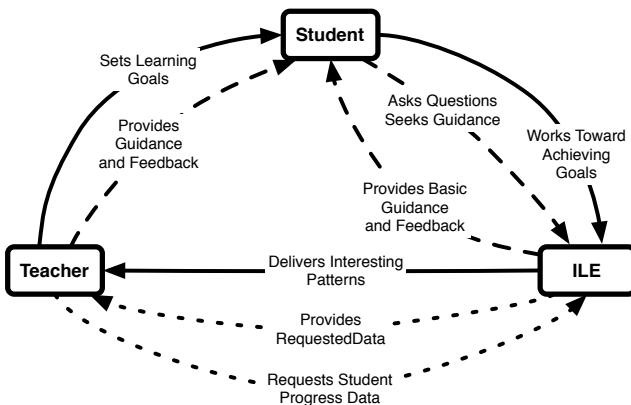**Fig. 1.** Models of the student-teacher and student-teacher-ILE relationships

Fig. 2. Our extended model of the student-teacher-ILE relationship

3   Exploring the Extended Model

We explored the usefulness of the extended model by incorporating new tools into Betty's Brain [4], our ILE for teaching middle school students about scientific processes. In Betty's Brain, students are instructed to learn about these processes and then teach them to a virtual agent called Betty. They accomplish this task by reading textual resources and building a causal concept map (a set of entities and their relationships) that describes the information they've learned. When asked, Betty can answer questions and take quizzes. To answer questions, she employs qualitative methods to reason through "chains of relations" in the map. The students' goal in the ILE is to continue learning and teaching Betty until her concept map correctly answers all questions.

As a first step toward realizing the extended model, we provided teachers with information on the number of correct links about their students' concept maps daily. The teachers could track these numbers for individual students or the class. An innovative tool developed produced step-by-step movies of students' concept maps.

As we continue moving toward the extended model, we plan on automating the process by which the ILE delivers relevant information to the teacher. We also plan to expand the type of information reported. For instance, the ILE should also be able to report indicators of disengagement, such as goal-less button clicking. In order to support this near real-time information reporting, we plan on designing a "teacher dashboard" through which the teacher can monitor his/her classroom from a computer, see interesting behavior and performance trends, and "zoom in" on particular students to view more information about them.

4   Conclusions

In this paper, we proposed a model for ILE-enhanced classrooms that utilizes the complementary expertise of ILEs and teachers to optimize the learning experience for students. When implemented properly, it should lead to more successful incorporation of ILEs into classrooms.

References

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