Dynamic Learning Environment Switching

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Project Description

In this project, I will be working with Professor Vincent Aleven, project director Jonathan Sewall, and several undergraduate research programmers. I will be working on integrating former PhD student Erin Walker’s thesis project, Adaptive Peer Tutoring Assistant (APTA), with current PhD student Kenneth Holstein’s project, Lumilo. Through this integration, I aim to create a flexible and intuitive system for pairing of students into tutor-tutee pairs and switching between individual and collaborative learning environments.

APTA is an AI-based learning software which allows pairs of students working on individual laptops to tutor one another, with one designated as the tutor and the other as the tutee. Each step the tutee takes to solve the problem must be verified as correct or incorrect by the tutor before the tutee can move on to the next step. The tutor is also able to send hints and explanations to the tutee to guide them through the problem.

Holstein’s project, Lumilo, is meant to aid teachers’ orchestration of classrooms in which the students are using personalized learning software. While students work individually with the software, the teacher is able to use mixed-reality glasses to view the real-time progress, attention level, and areas of struggle for each student. Through this, teachers are able to gain more insight into and control over their classroom as the students work individually.

Many widely-used instructional methods combine both individual and collaborative phases. During classroom pilots of Lumilo, teachers reported feeling overwhelmed at times because they had an increased awareness of their students’ need for help and their inability to help everyone in the limited class time. One solution to this is to pair students into tutor-tutee pairs, allowing students to get the help they need while lifting some of the teacher’s responsibility of having to give help to every student. Through an integration of Lumilo and APTA, teachers will be able to view the progress of students with the mixed reality glasses and utilize APTA to facilitate the peer tutoring of one student to another, thus leading students to switch between individual and collaborative learning.

The control of the switch between learning environments for each individual student, and their collaborative tutor pairings will be implemented in three different ways. The first will be where the pairings are preselected by the teacher purely from their own judgement, and the students are paired with the same partner for the entire duration of the class. In the second method, pairings are still controlled by the teacher; however, they are able to dynamically re-pair students with different partners throughout the class. The final is a method in which the teacher utilizes suggestions from the software based on each student’s current progress and skill mastery to dynamically pair students.

This project will consist of various classroom pilots and iterations of software based on feedback from the pilots, leading to a classroom orchestration tool which allows teachers to seamlessly monitor and control a classroom working both individually and collaboratively on
personalized learning software and thus maximizing the learning done in the limited amount of class time.

**Project Goals**

- **75%**: Completion of APTA re-implementation, syncing of Lumilo with the re-implemented APTA
- **100%**: First classroom pilot conducted. The teacher is able to control and/or monitor the pairing of students into tutor-tutee pairs. Feedback from in-lab prototyping, classroom piloting, and various other design activities will collected early and often, and will be taken into account continuously, throughout the project.
- **125%**: Completion of the switch between individual and collaborative learning environments. Second classroom pilot conducted. Through the control of the teacher and the support of the software, the students switch between individual and collaborative learning depending on their current progress.

**Milestones**

- **1st Technical Milestone for 15-300**
  - By the last day of this semester, I plan to have finished the re-implementation of APTA for use with Lumilo. This will allow me to focus on the parts of the software regarding switching between individual and collaborative learning environments and the pairing of students next semester.
- **Bi-Weekly Milestones for 15-400**
  - **1/27/20**: Prototyping pairing method 1 with teachers and possibly students, and iteration based on feedback from prototyping
  - **2/10/20**: Prototyping pairing method 2 with teachers and possibly students, and iteration based on feedback from prototyping
  - **2/24/20**: Develop metrics for software suggestions for student pairing in preparation for prototyping pairing method 3
  - **3/16/20**: Prototyping pairing method 3 with teachers and possibly students, and iteration based on feedback from prototyping
  - **3/30/20**: First classroom pilot conducted. Iteration based on feedback from the first classroom pilot, and development underway for the switch between individual and collaborative learning software
  - **4/13/20**: Completion of software able to accommodate switching between individual and collaborative learning environments.
  - **4/27/20**: Stretch goal: in-lab prototyping with teachers and students and/or second classroom pilot conducted
Literature Search / Resources Needed

I have collected and read Walker et al. [2] for APTA and Holstein et al. [1] for Lumilo. This has allowed me to become familiar with the motivation, implementation, and current state of both projects, giving me a good idea of what will be needed to be done to integrate them. I have also read other papers on classroom orchestration, gaining a background of the current existing technologies and the ways in which they have benefitted teachers, including Maldonado et al. [3] and Lachand et al. [4]. This has made me aware of other needs and desires of teachers in the classroom that I can be sensitive to and attempt to address as I work on this project. I currently have all of the resources needed to conduct my study, mostly consisting of the current APTA software and data from previous classroom pilots.

References


