Dissertation Defense

Doctor of Philosophy in Computer Science

"Modeling and Supporting Middle School Mathematics Collaboration using Student Motivation across Different Digital Learning Platforms" by Ishrat Ahmed

Date: July 17, 2023
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Zoom: https://pitt.co1.qualtrics.com/jfe/form/SV_0jKkUeUopM73RMW

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Abstract:
Adaptive collaborative learning support (ACLS) aims to design efficacious support that models students' collaboration and provides intelligent feedback to facilitate collaborative learning. Existing ACLS systems have been applied in various collaborative environments, ranging from co-located collaboration in the classroom to online learning environments. While these technologies show promise, they primarily focus on supporting students within a single activity in a given platform and do not consider that students often collaborate across multiple learning platforms. Furthermore, the adaptive supports are primarily based on student participation and do not take into account how students are motivated to collaborate. Student motivation is a critical factor during collaboration as it can encourage active participation and enhance overall learning outcomes. When participating in different types of learning platforms, along with the affordances of the platforms, motivation can influence how a student chooses to collaborate. Therefore, students' motivation may interact with different platforms' affordances, requiring individualized collaborative support. Hence, in addition to the cognitive model within an ACLS, the adaptive support model should also consider student motivation as it interacts with context. To address this, we have developed UbiCoS (Ubiquitous Collaboration Support), a collaborative learning environment that encompasses three different digital platforms: a discussion-based synchronous environment, a question-answer-based asynchronous environment, and a virtual teachable agent. The specific collaborative skill we are interested in is help-giving, as giving help to others encourages students to reorganize and clarify content, reflect on misconceptions, and fill gaps in their knowledge.

We deployed UbiCoS in a middle school classroom, where several experiments were conducted to enhance help-giving across the different platforms. We investigated how the same students collaborated on the three platforms and identified factors that influenced their help-giving. Using the collected data, we developed an explanatory participation model where individual characteristics and platform properties intersect, which can then be used to design
collaborative support. Additionally, we discovered that platform features affect individual characteristics, leading to changes in motivation when collaborating on different platforms. To assess this dynamic aspect of motivation, we developed an interactive persona tool for students to report their motivation prior to each digital collaborative activity. As a final step, we designed collaborative support that took student motivation into account and implemented a badge system to reward student participation. The thesis makes significant contributions in the fields of Human-Computer Interaction, Computer Science, and Learning Science in the following areas: 1) The design of a collaborative learning environment encompassing multiple platforms instead of a self-contained environment, 2) The adaptation of traditional Intelligent Tutoring Systems (ITS) to model student collaboration using individual and platform characteristics, 3) The design of an interactive tool for the dynamic assessment of student motivation, and 4) The provision of personalized support across platforms, using student motivation to facilitate effective collaboration.