Viewing Student Affect and Learning through Classroom Observation and Physical Sensors

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Abstract. We describe technology to dynamically collect information about students' emotional state, including human observation and real-time multi-modal sensors. Our goal is to identify physical behaviors that are linked to emotional states, and then identify how these emotional states are linked to student learning. This involves quantitative field observations in the classroom in which researchers record the behavior of students who are using intelligent tutors. We study the specific elements of learner's behavior and expression that could be observed by sensors. The long-term goal is to dynamically predict student performance, detect a need for intervention, and determine which interventions are most successful for individual students and the learning context (problem and emotional state).

1 Introduction and Previous Work

The obvious next frontier in computational instruction is to systematically examine the relationship(s) between student affective and learning outcome (performance) [18]. Human emotion is completely intertwined with cognition in guiding rational behavior, including memory and decision-making [18,11,16,5]. Students' emotion towards learning can have a drastic effect on their learning experience [10]. An instructor who establishes emotional and social connections with a student in addition to cognitive understanding enhances the learning experience. Responding to a learner's emotion, understanding her at a deep level, and recognizing her affect (e.g. bored, frustrated or disengaged) are key elements of quality teaching. If computer tutors are to interact naturally with humans, they need to recognize affect and express social competencies. This research attempts to understand how students express emotion, detect these emotions, and quantify emotional variables.

Previous projects have produced computational tutors that recognized and responded to models of emotion (e.g., self-efficacy and empathy [15]). Projects have tackled the sensing and modeling of emotion in learning and educational gaming environments [14, 17]. A dynamic decision network was used to measure student emotional state based on variables such as heart rate, skin conductance and eyebrow

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