Computer-based instructors, just like their human counterparts, should monitor the emotional and cognitive states of their students in order to adapt their instructional technique. Doing so requires a model of student state to be available at run time, but this has historically been difficult. Because people are different, generalized models have not been able to be validated. As a person’s cognitive and affective state vary over time of day and seasonally, individualized models have had differing difficulties. The simultaneous creation and execution of an individualized model, in real time, represents the last option for modeling such cognitive and affective states. This dissertation presents and evaluates four differing techniques for the creation of cognitive and affective models that are created on-line and in real time for each individual user as alternatives to generalized models. Each of these techniques involves making predictions and modifications to the model in real time, addressing the real time datastream problems of infinite length, detection of new concepts, and responding to how concepts change over time. Additionally, with the knowledge that a user is physically present, this work investigates the contribution that the occasional direct user query can add to the overall quality of such models. The research described in this dissertation finds that the creation of a reasonable quality affective model is possible with an infinitesimal amount of time and without ‘ground truth’ knowledge of the user, which is shown across three different emotional states. Creation of a cognitive model in the same fashion, however, was not possible via direct AI modeling, even with all of the ‘ground truth’ information available, which is shown across four different cognitive states.

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The public is welcome to attend.