



## User Study of Emotional Visualization Dashboard for Educational Software

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Reza Ghasemaghaei, Ali Arya and Robert Biddle

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# User Study of Emotional Visualization Dashboard for Educational Software

Reza GHASEMAGHAEI<sup>a,1</sup> Ali ARYA<sup>b</sup> and Robert BIDDLE<sup>b</sup>

<sup>a</sup>*School of Computer Science, Carleton University, Ottawa, Canada*

<sup>b</sup>*School of Information Technology, Carleton University, Ottawa, Canada*

**Abstract.** This paper describes a user study on the MADE Dashboard, our proposed data visualization dashboard that supports educators to inspect and reflect on the emotional states of students using web learning applications. Our goal was to support the system designer, and indirectly also teachers and students. Our dashboard follows affective learning models, and monitors online learner emotions. It uses an open source library that supports tracking of facial features and detection of emotions in real time, identifying six different emotions. We present a user study to determine whether the data visualization graph can be interpreted properly.

**Keywords.** Education Software, Design, Affective Learning, User Testing

## 1. Introduction and Background

Our recent work has involved the design and evaluation of multimodal software for *affective* education, where the software supports emotional aspects of the learning process. We reviewed interaction design and evaluation methods, adapted them, and then conducted several case studies.

We introduced the Multimodal Affect for Design and Evaluation (MADE) framework; our proposed structure for designing and evaluating affective multimodal education systems [1]. Our approach involves interaction design and techniques from human-computer interaction (HCI). We focus on how the interface and interaction should be designed to support and *help* a teacher's affective and multimodal strategies, rather than replace the teacher. Our framework therefore involves the system designer working to create a system that supports the teacher's affective strategy, to further support their learning objectives for the students. Our design methods involved the emotional cycle in learning identified by Kort et al. [2], to better support the teacher, as well as the student. In particular, we created the MADE dashboard [3] to help teachers understand the affective states of students as they worked through tasks (see Figure 1). On the left side of the dashboard we have the student list; the instructor is able to see the details of a specific learner on the graph and can zoom-in. For the selected activity and learner, it shows six different emotions shown by colored lines as they vary over time. Emotions associated with positive valence (e.g. happy) are shown above the axis (0 to +1), and emotions associated with negative valence (e.g. sad) are shown below the axis (0 to -1). Vertical lines with "balloons" show specific learning events, allowing the

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<sup>1</sup> Corresponding Author: Reza GhasemAghaei, School of Computer Science, Carleton University, K1S 5B6, Ottawa, Canada; E-mail: Reza.GhasemAghaei@carleton.ca.

teacher to relate cognitive events to emotional states. When the teacher hovers their cursor on the balloon, a tooltip with descriptive text is shown.

## 2. User Testing

As part of an iterative and user-centered design process, we wish to evaluate the MADE Dashboard. We aim at obtaining feedback on the design and function of MADE dashboard from participants who are instructors in our university.

### 2.1 Research Question:

Do teachers understand the graphs and indication of different affective learning phases on the dashboard?

To understand the utility of the dashboard, we propose two research hypotheses (below). For the first hypothesis, we would like to see if the participants can understand different affective learning phases. *H1: Participants can understand the affective learning phases on the dashboard and relate that to four phases of Kort et al's affective learning model.* For the second hypothesis, the participants will check on the dashboard if students emotions are the same on the dashboard and the video recording of learners facial expressions during different task. *H2: Participants perceive the same emotions on dashboard and the video.*

### 2.2 Tasks:

After a briefing, a user will be given a list of tasks to be executed during the study. There will be a total of 4 tasks which will be given to all test participants to perform. These tasks are presented in Table 1. To evaluate the usability of the dashboard, we are considering learnability, efficiency, memorability, errors, and satisfaction [4].

### 2.3 Procedure:

The study will take thirty minutes for each participant. We will teach the participants how to interact with the system before the study, for five minutes. We will use a think aloud protocol, and will do audio recording. The procedure has four steps: *training session, tasks, usability questionnaire, and semi-structured interview.*

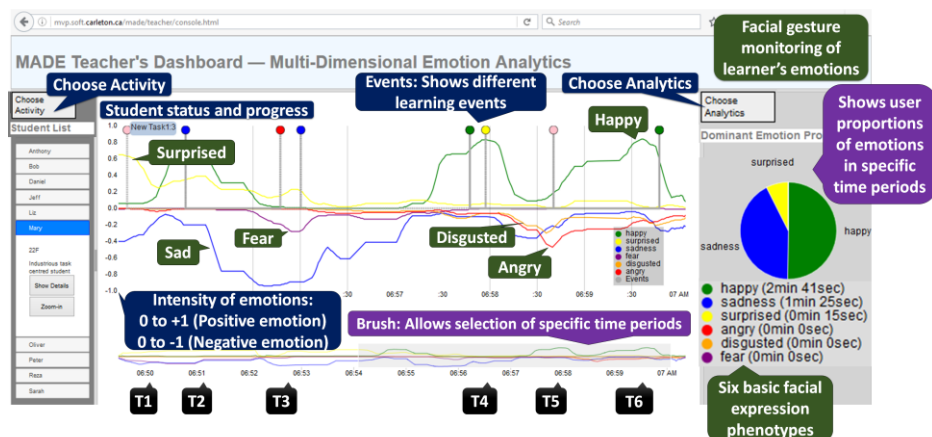


Figure 1. Data Emotion Visualization Dashboard.

## 2.4 Analysis Plan:

We will evaluate the hypotheses based on the performance of the participants performing the tasks. We will then evaluate the usability with the System Usability Scale (SUS) questionnaire [5]. The statistical analysis module will be implemented in R, and will provide statistical techniques for hypothesis testing. To gain a deeper understating of the participants reflection on the dashboard and general issues of the affective education, we will analyze our semi-structured interview using the Grounded Theory approach [6].

**Table 1.** Task List and Measurements

Tasks	Derived Measure	Description
Is the student engaged with this task between 9AM to 10AM?	Learnability	How easy is it for users to accomplish basic tasks the first time they encounter the design?
Does the student receive affirmation feedback when the task is done?	Efficiency	Once users have learned the design, how quickly can they perform tasks?
Is selecting persona for a particular student helpful?	Memorability	When users return to the design after a period of not using it, how easily can they reestablish proficiency?
Is selecting the four affective learning phases useful?	Errors	How many errors do users make, how severe are these errors, and how easily can they recover from the errors?
	Satisfaction	How pleasant is it to use the design?

## 3. Conclusions and Future work

In this paper, a user study plan of our emotional educational dashboard is presented. The purpose of this dashboard is to help both teachers and students. We hope that this user study allows us to validate and help to improve the design, and ultimately help teachers understand the affective states of students.

## 4. Acknowledgements

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