# Student Perspectives on Expressing Academic Emotions in Digital Game-Based Learning

Alex Goslen
amgoslen@ncsu.edu
North Carolina State University
Raleigh, North Carolina, USA

Jessica Vandenberg
jvanden2@ncsu.edu
North Carolina State University
Raleigh, North Carolina, USA

Andres Felipe Zambrano
azamb13@upenn.edu
University of Pennsylvania
Philadelphia, Pennsylvania, USA

Nidhi Nasiar
nasiar@upenn.edu
University of Pennsylvania
Philadelphia, Pennsylvania, USA

Stephen Hutt
stephen.hutt@du.edu
University of Denver
Denver, Colorado, USA

Jaclyn Ocumpaugh
ojaclyn@upenn.edu
University of Pennsylvania
Philadelphia, Pennsylvania, USA

Jonathan Rowe
jprowe@ncsu.edu
North Carolina State University
Raleigh, North Carolina, USA

## Abstract

Game-based learning environments can foster student engagement in learning, offering an important venue for exploring epistemic emotions. Data from this study were collected as part of a larger effort to develop an in-game self-reporting tool for epistemic emotion that could be applied in a wide range of venues, including computer science systems. This study examines how students retrospectively discuss such emotions and experiences, and the degree to which their concerns about the reporting tool align with their learning needs. These themes have implications for understanding both the development and interpretation of in-game self-reporting tools.

## CCS Concepts

• **Applied computing** → **Interactive learning environments**.

## Keywords

Affect, Science learning, Game-based learning

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## 1 Introduction

Research shows that unpleasant emotions, like confusion and frustration, are necessary for learning [5]. However, when unresolved, these emotions can impact the overall learning experience [3]. Game-based learning environments (GBLEs) are common in CSEd and provide the potential for better understanding and supporting students' epistemic emotions [7]. This study examines focus group feedback on a novel self-reporting tool designed to investigate student emotions.

## 2 Study Context: Crystal Island

Crystal Island is a GBLE in which students are investigating a mysterious illness. Students learn about diseases, pathogens, and treatments by interacting with virtual characters, reading informational texts, and conducting virtual laboratory tests. Like many CSEd games, Crystal Island is aligned to state standards and has been shown to improve learning [8].

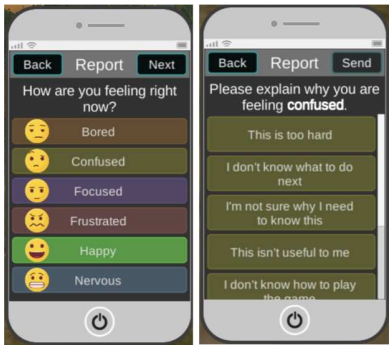


**Figure 1: Self-reporting tool.**

In this study, we piloted a novel two-stage experience sampling tool that elicits epistemic emotions [6]. Specifically, students were prompted at various predetermined game milestones to report how they were feeling emotionally and why (Figure 1). They could select from six affect options (i.e., bored, confused, focused, frustrated, happy, and nervous) that are aligned to previous research on epistemic emotions. In the second stage of the survey, students were presented with at most nine options describing the reason behind


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their feeling. These options were derived from major theoretical frameworks that postulate the causes for these emotions.

We conducted focus groups with 18 volunteers, who all identified as male from the same school in the Southern US, following a one-day study in which 47 students played Crystal Island during their regular 1.5 hour science class. Two project members conducted each session with about 5 students per session. Notes were collapsed by themes and are described below.

## 3 Findings and Implications

Two major themes emerge from the analysis, both with important implications for studying and supporting epistemic emotions.

**Theme 1: Game-based Learning is Motivating.** Students found that playing Crystal Island was engaging and many reported that they have new interest in learning more about microbiology because of the game. Moreover, those who did not report novel interest still reported that they game found the game play motivating. In discussing specific emotions, students retrospectively self-reported (1) boredom during the early phases of the game, where they had not figured out what to do yet, (2) frustration with glitches in the game or being unable to talk with certain non-player characters, and (3) being "locked in" or focused as they became immersed in the game. Other emotions were not commonly discussed in these focus groups. Instead, students' retrospective self-reports emphasized how the hands-on elements of the game were preferable to text-book based learning.

**Theme 2: *In Situ* Reflection is Hard.** Students indicated that they are unused to being asked about their emotions, especially in the context of learning. Although they reported more global experiences with major academic emotions (e.g., happiness when receiving good grades), they did not like having to stop and reflect on their emotions while going through the game. Several requested "neutral" or "ambivalent" options, which might allow them to circumvent the appraisal processes required to understand their emotions. Others recommended subtle language changes (e.g., "locked in" vs. "focused"). Students' dislike of *in situ* emotion self-reporting was aligned with their opinions about other self-reflection during learning. For example, students who otherwise liked to read did not enjoy answering questions afterwards, and there was widespread agreement that having to explain your reasoning in any class was unpleasant. Although the tool prompted at most five times during the game, they still felt the self-reporting tool appeared too often.

**Implications.** The information gathered in these focus groups has several implications for improving educational opportunities and for understanding different types of data about epistemic emotions. First, students report having better experiences with game-based learning than with traditional classroom experiences. While these global, retrospective reports may not fully align with their *in situ* experiences (not analyzed in this paper), this not-so-novel finding adds to the growing motivational research on game-based learning. Second, our findings have several implications for eliciting data about students epistemic emotions. For example, we may be able to make students more comfortable expressing emotions by allowing them to suggest terms they better understand. We may also toggle the frequency of these *in situ* self-reports, so as to minimize any additional frustration that the tool could induce. It is possible that the two-stage survey is more extensive than 'traditional' thought probes, generating an additional burden on the learner that we could seek to lessen [9]. If that is the case, the use of automated affect detection using multimodal data, such as trace logs and facial action unit analysis [2] could alleviate the joint cognitive and affective burden [2]. Reflective activities are critical to navigating challenging learning tasks [1], and it may be better to support students through these cycles than to reduce or remove them. This could include providing in-game pedagogical agents that use more natural dialogue with the student and respond in an affect-sensitive manner. Emerging methods for investigating these moments of interest, such as data-driven classroom interviews, may also help us to support these students [4].

## 4 Conclusion

Focus group data suggest that students find gameplay, such as Crystal Island, to be engaging and motivating. It also raises questions about how we should solicit this information from students. When asked about their experiences retrospectively, they primarily reported frustration with procedural issues (technical glitches or game capabilities). This suggests that even though they thought the self-reporting tool was being deployed too often, they could not retrospectively report emotions that were related to the learning process. Although these findings are based a science learning environment, they have implications for other CSEd GBLEs.

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