THE UNIVERSITY OF BRITISH COLUMBIA | VANCOUVER

EDUC 500: Research Methodology in Education

Example of Problem and Purpose

Designing Educational Games and Advanced Learning Technologies: An Identification of Emotions for Modeling Pedagogical and Adaptive Emotional Agents

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Statement of the Problem

Understanding emotional reactions and responses with respect to Advanced Learning Technologies (ALTs) is extremely timely and relevant for teaching and learning in digital or virtual (e.g., gaming) environments taking in consideration that technology is now ubiquitous in schools and in students' lives. In this dissertation research, by providing a detailed analysis, I focused on identifying what emotions are relevant to learning in the context of interaction with the educational mathematics game *Heroes of Math Island*. As Petrina (2007) argued, teachers should recognize the importance of technology in the classroom as well as the feelings and values of students: "Our task [as instructional designers and teachers] is to validate, direct, and transform the emotion in our students' experiences" (p. 59).

Contemporary discourses in emotion theory place emotion in a pivotal position in education (Arnone, Small, Chauncey, & McKenna, 2011; Astleitner, 2000; Boler, 1997, 1999; Hascher, 2004, 2010; Ingleton, 2000; Petrina, 2007; Picard, 2003; Picard, Kort & Reilly, 2003; Scherer, 2001a; Weiss, 2000). However, even if the importance of emotion was recognized in "encouraging and inhibiting effective learning and approaches to study… educational research and models of learning have shed little light on the interrelationships between emotions and learning" (Ingleton, 2000, p. 1), and despite the "high relevance of emotions in basic research and in daily school life, for decades, the focus in instructional design and related research was on considering learner's above all cognitive and to some degree motivational processes" (Astleitner, 2000, p. 170). According to Hascher (2010) more should be done since "there is a huge need for further research because we know so little about learning and emotion" (p. 24).

Understanding emotional interaction is also crucial for designing ALTs and Intelligent Tutoring Systems (ITSs) that recognize and respond to emotions in a proper and natural way. Past research related to ITSs addressed cognitive tutors and, privileged cognitive over affective needs by observing learning as information processing and "marginalizing affect" (Woolf et al., 2009, p. 129). As affect has begun to play an increasingly important role in ITSs, research has focused not only on the cognitive aspects of interaction, but also on affect recognition and response. There is increasing evidence that, in order to design an intelligent and responsive tutor, the learner's emotions should be properly identified (Baker, D'Mello, Rodrigo, & Graesser, 2010; Chaouachi & Frasson, 2012; Conati, 2002; D'Mello, Taylor, & Graesser, 2007; Graesser, McDaniel, Chipman, Witherspoon, D'Mello, & Gholson, 2006; Jraidi, Chalfoun, & Frasson, 2012) (Conati, 2002; D'Mello, Taylor, & Graesser, 2007; Graesser, McDaniel, Chipman, Witherspoon, D'Mello, & Gholson, 2006; Baker, D'Mello, Rodrigo, &

Graesser, 2010; Jraidi, Chalfoun, & Frasson, 2012; Chaouachi & Frasson, 2012). There has been extensive work on identifying and detecting emotions elicited by educational software (Baker, D'Mello, Rodrigo, & Graesser, 2010; Conati & Maclaren, 2009; Chaouachi & Frasson, 2012; D'Mello, Taylor, & Graesser, 2007; Graesser, McDaniel, Chipman, Witherspoon, D'Mello, & Gholson, 2006; Jraidi, Chaouachi, & Frasson, 2013; McQuiggan, Robison, & Lester, 2008; Rodrigo, et al., 2012).

Research Questions

The main research questions of this study are:

1. What affective states are important with respect to student's interaction with an educational game?
    a. What affective states are elicited during the *Heroes of Math Island* gameplay?
2. Additionally, this study responded to the following two questions:
3. What are the students' subjective reactions with respect to *Heroes of Math Island* and to the underlying mathematics content?
4. What are students' levels of interest and achievement in the mathematics content after gameplay?

The themes explored in these questions are: empirical identification of emotion (main theme; question 1), cognitive gains and interest in mathematics by playing the game (question 2), and subjective reactions of students with respect to the game and learning mathematics (question 3). These themes will be used in study design and data analysis and discussed in the following chapters.

Purpose of the Study

A high-level goal of this dissertation is to gain a better understanding of emotion interaction in order to design ALTs and ITSs that improve the students' motivation by adapting to their emotional needs. In order for ITSs to recognize and respond to the students' affective states, the system needs to have knowledge of learner's behaviors and states. However, there is a gap between the students' behaviors observable or registered by an ITS and the states and behaviors that need to be modeled (Bondareva, Conati, Feyzi-Behnagh, Harley, Azevedo, & Boucher, 2013). As Jraidi, Chaouachi and Frasson, (2012) stated, strategies emplyed in tutors to enhance the learners' mental states "can be in some cases excessive, inappropriate, or intrusive to the dynamics of the learning session. They can also be approximate or target basically superficial aspects of the interaction" (p. 2). The purpose of this study is to contribute to filling this gap by providing an in-depth understanding and analysis of the students' affective states during learning with an educational game (*Heroes of Math Island*). A detailed description of this game is provided in Chapter Three.

Instead of using a pre-existent set of emotions, this study analyses and proposes an original set of emotions derived from emotion theory, educational literature and affective computing, and from pilot studies and observations during gameplay….

Ultimately, the results and recommendation resulting from this study provide critical information that can be used in design methodologies of ALTs, ITSs and educational games. Its timeliness can be seen in the September 9, 2013 issue of the *Journal of Educational Psychology*, focusing on ALTs and ITSs.