

Human – Computer Interactions, emotions, e-Learning and their interconnections

2.1 Introduction

In traditional face-to-face learning systems, teachers can identify student's emotions by observing them. The methodology of teaching can be changed in order to achieve constructive learning. This is practiced by experienced teachers to create an effective and productive learning environment within the class room.

Learner's emotions play a key role in effective learning. Candy Lawson [26] refers in her research on connection between emotions and learning, "Prilla Vail, an expert on learning quotes, **emotion is an *On – Off switch to learning***". This indicates to us how much emotions can affect learning.

But, in eLearning, the situation is totally different to a class room. Basically, two aspects are covered, most of the time in such system, one, being producing eLearning material to educate and the other, is assessing students through quizzes and exams. Though interactivity is enabled in some eLearning systems, students are only guided through a pre-defined order of study material content providing.

In the above e-Learning methods, student's emotions which play a key role in learning productivity and effectiveness is not addressed. However, a student in a classroom interacting directly with a teacher has the privilege of affect based input to learning.

As part of the problem to solve, which is to develop an eLearning system that adapts itself to emotional states of the student who interacts with the system, we try to identify different quantitative parameters we can obtain using the interactions between the learner and the system that contributes to find user emotions for constructive learning.

There has been significant amount of research carried out in the fields of education, psychology and computing to find out the connection between emotions in learning and e-Learning.

2.2 Study on human emotions

A thorough understanding about human emotions is needed in this exercise.

According to wikipedia website[39], “emotion, in its most general definition, is an intense mental state that arises automatically in the nervous system rather than through conscious effort, and evokes either a positive or negative psychological response. An emotion is often differentiated from a feeling.” Also it states that it is not easy to come up with a very general acceptable definition for emotion. It uses the ABC model to define Emotions [39] by “Many psychologists adopt the ABC model, which defines emotions in terms of three fundamental attributes: A. physiological arousal, B. behavioral expression (e.g. facial expressions), and C. conscious experience, the subjective feeling of an emotion. All three attributes are necessary for a full fledged emotional event, though the intensity of each may vary greatly.”

Lawson [26] and Langelier [25] have stated that emotions originate from the brain, specifically in the limbic system. Also [26] refers to Dr. Paul Ekman’s (an expert in the field of emotions) definition of core emotions, fear, anger, sadness and enjoyment. It also mentions that many researchers believe that there are many families or dimensions of emotions and their varied blends breaks out other emotions. This is further supported by wikipedia [39].

A universally accepted definition for human emotions could not be found. Emotions arise physiologically in the brain and are subjective to arousal, behavioural expressions and sometimes conscious experience. Emotions create responses in the mind that arises spontaneously, rather than through a conscious effort, i.e. emotions are physical expressions or responses. But psychologists have identified many human emotions, both primary and blends of primary emotions. These also vary between different psychologists [23, 39, 37], for example Robert Plutchik and Paul Ekman,

Hence, for this study, research done on connections between emotions and learning were studied in order to identify emotions.

2.3 Study on connection between emotions and learning

A thorough understanding about human emotions is needed in this exercise since it is needed to identify relevant emotions in the field of eLearning. Further to this, behavioural outcome of such emotions need to be identified in the same context.

In the study on connection between **emotions** and **learning**, Lawson [26], a Clinical Psychologist, states that emotions affect learning, for example, emotions such as anger, anxiousness disrupts learning ability and joy, satisfaction enhance learning ability.

2.4 Study on analysis of emotions in computing and affective computing

Affective computing is the branch of AI that deals with design devices which can process emotions. This spans across the fields of computer science, psychology and cognitive sciences.

Various researches have been carried out in this area of study and most of them are focused on detecting emotions and implementing emotions in machines. To achieve this, extensive efforts were made in the various areas. Facial expression recognition [22,23,7,27,19], voice recognition [23, 11], postures [22,7] using posture sensing chairs, studies on affective gesture recognition in different emotional states [8,9,22].

2.5 How user interactions are used in human emotions capture in computing environment

In the studies above mentioned, interactions used were different facial expressions, voice recordings, and motion capture information. The problems in using results of above studies can be listed as follows.

- Experiments were carried out in controlled environment
- Sophisticated equipment were used to capture data, for example, The Intelligent Tutoring System [7], sensory channels used are facial expression recognition using IBM Blue Eyes Camera and Body Pressure Measurement System for posture information.

- The parameters defined from data collected are straight forward and need not be tested for significance of explaining emotional state.

Further to this, human's interactions with the computer or the system in study were used to predict a person's availability [14]. Our study focused on this aspect as well in order to find more interactions and capturing methods used and data analysis methods used. This involved capturing information from a person's mobile phone, email, meeting schedules, connection to the computer system using mouse / keyboard, GPS, phone connections, voice etc.

2.6 Problems encountered in using the above methodologies in an e-Learning system

For an eLearning system in Sri Lanka, the most feasible interactions that can be captured are **mouse and keyboard interactions and navigational patterns**. Most of the Sri Lankan students have these two basic input devices. Low internet connection speeds, unavailability of cameras for face recognition for all students are problems that we will face in developing an affect adaptive system.

Hence we intend to develop parameters based on the above interactions that can be captured from every student who uses the e-Learning System.

2.7 Knowledge representation and Analysis

Knowledge representation in all systems was solely dependant on the analysis technique, which were not expressed explicitly. Most analytical techniques of affect based systems used Probability models [5, 8, 9, 12, 13, 14, 17] in the analysis. These include Hidden Markov Chains and Bayesian Theory and are used to analyze real time data.

First we need to identify parameters affecting emotions and hence the above methods can not be used in this framework.

Wikipedia [39] states “Hidden Markov models are especially known for their application in temporal pattern recognition such as speech, handwriting, gesture recognition, musical score following and bioinformatics.”, and “Bayesian networks are used for modelling knowledge in bioinformatics (gene regulatory networks, protein structure), medicine, engineering, document classification, image processing, data fusion, and decision support systems.”. This means, temporal data need to be used if these two methods are to be used.

2.8 Conclusion

The affect based e-learning and other researches have been carried out using sophisticated equipment, knowing what parameters to be used which are defined by the equipment used. Also, the analysis methods used in related studies are temporal, which are not suitable for parameter identification.

Therefore, some other method should be used to find relevant parameters, which are based on mouse inputs, keyboard inputs and navigation through learning material.

