1. **Research Description**

This chapter presents the background of the study, research objectives and the scope and limitations.

* 1. **Background of the Study**

Emotions are a significant aspect of the human species. It helps people to communicate more effectively with each other and play a large role in human behavior (Lu, Nie, Shi, & Wang, 2011). Emotions are often accompanied by physiological changes which are involuntary and play an essential role in the basic functions of a human being, from decision making to adaptation to outside stimuli (Quazi, 2012). The emotions of human beings consist of a combination of external physical expressions, internal feelings, and thoughts which is mostly involuntary (Quazi, 2012).

There are a number of available emotion affect models that exist, one such model is studied by Paul Ekman and contains six basic emotions, happiness, sadness, fear, surprise, anger and disgust (Ekman, 2005). Another emotion affect model is put forward by James Rusell, and according to him there are eight basic emotions, namely arousal, excitement, pleasure, contentment, sleepiness, depression, misery and distress (Russell, 1980). According to Quazi (2012), finding relationships between emotions and actions has been an important topic for a number of research fields; and with the recognition of human emotions, computers can greatly facilitate the rules of human to human communication (Kapoor, Burleson, & Picard, 2007).

Aside from the normal emotions, there are a set of emotions called academic emotions. These are the emotions felt by a subject in a learning context and also may affect the way the subject carries out a learning task (Pekrun, 2002), and subsequently classroom instruction and achievement. Many studies have been based around the recognition of basic emotions such as those by Ekman (2005), but there have been questions regarding the relevance of those basic emotions to learning. There are some basic emotions that are rarely experienced by a subject when he/she in a learning context. Some examples of those emotions that are not that suited in a learning context would be sadness, fear and disgust (Baker et al., 2010; D’Mello et al., 2007).

~~According to Pekrun (2002) academic emotions are those that are experienced in student learning, classroom instruction and achievement. In a learning context, academic emotions are are used in lieu of the basic emotions.~~

Recent developments in the field of Affective Tutoring Systems attempt to build computer tutors that are able to adapt to the users’ affective state and respond accordingly. Academic emotions such as confident, frustrated, excited, interested, confused, engaged, and boredom can be recognized and used by such systems in order to intervene appropriately (Arroyo et al, 2009; Baker et al, 2010; Benadada et al, 2008; D’Mello & Graesser, 2010), thereby increasing opportunities for learning to take place.

By integrating an emotion recognition software with an Intelligent Tutoring System (ITS), a subject’s emotions can be recognized such that computer-based interventions can be provided to help the student perform better at the given task (Pekrun, 2011). A number of researches have been done on the field of computer-based learning; the goal of these studies was to provide a way for a computer system to be able to react to the emotion being felt by the subject (Pekrun, 2011). An example of an ITS that responds to a subject’s emotion is the Affective AutoTutor by D’Mello et al. (2011). This system can recognize boredom, confusion and frustration emotional states. Once the ITS detects the student’s current emotion, the AutoTutor agent would then respond with an appropriate action corresponding to the emotional state of the subject.

Over the past few decades, many studies have been conducted in the area of human emotion recognition. Techniques to detect emotions include the use of Electroencephalography (EEG) signals, facial expression, speech, body movements, gestures, and physiological signals (Quazi, 2012). By using EEG signals to classify emotions, researchers were able to overcome the challenge of when the subject is trying to conceal his/her true emotions. However with this technique, the classification promises only an accuracy of 64% with the experiment carried out by Choppin (??) while Bos got an accuracy of 70% (Lu, Nie, Shi, & Wang, 2011). Brainwaves also provide information regarding the cognitive and emotional states of the subject. Some emotions cannot be detected by using the other techniques of emotion recognition; aside from being masked by the subject, there are also emotions that are not readily obvious in the face, body movements or gesture of the subject (D’Mello & Graesser, 2010).

The EEG machine is used to record the brain activities which are a measurement of the electrical activity in the brain of the subject. Those activities are then picked up by the electrodes that are attached to the head of the subject. The measurement would then be used to try and classify the emotion state of the subject. Researchers believe that the state of the brain changes as the feelings or emotions of the subject changes (Rizon, San, Seong, & Yuen, 2009). In order to be able to make the EEG recordings more accurate, pre-processing of the data is generally needed. Some of the data that can be considered as noise includes muscle movements in the eye and head. Those artifacts should be removed in order to make the resulting data lower the amount of noise and capture the EEG signals better. The brainwave signals are normally classified into four frequency bands; alpha, beta, delta, & theta. Each of those signals is associated with a different mental state as shown in Table 1.1 (Mampusti et al., 2011).

**Table 1.1** Brainwave Signals, Frequency and Emotional State

|  |  |  |
| --- | --- | --- |
| **Signal** | **Frequency** | **State** |
| Delta | 0-4 Hz | Deep Sleep |
| Theta | 4-8 Hz | Creativity, Dream, Sleep, Drifting Thoughts |
| Alpha | 8-12 Hz | Relaxation, Calmness, Abstract Thinking |
| Beta | > 12 Hz | Relaxed Focus, High Alertness, Agitation, Anxiety. |

State here other researches that use EEG, such as those of Jay’s… Then proceed to your domain, which is stories…

Your domain – stories – why?

Stories elicit emotions… how does this affect who?

Rephrase the paragraph below. Begin with what a story is…

In order to fully understand the connection of emotions and stories, studying what constitutes a story is important. According to Faas (2002), a story is a piece of art that can affect a person on an emotional level. The form of a story is differs from other types of text since it contains elements that is ‘enriching’ to the story. Another important element of a story is the content of the story. In order to emotionally affect the reader, the story should have a character that the reader can identify with and in order to do that, the idea of a main character or protagonist comes into play. This is one of the most important element of a story, next would be the events that would further the story; events can be think of as a description of a situation and also supplies the necessary information to make the story whole (Faas, 2002). In order to further make the story complete, it would also need states which would later lead to the climax of the story. Without events and states in a story, it would be just a description of some static situation wherein elements in the story would not make sense to the reader (Faas, 2002). With this in mind, it can be said that stories are a system of associations between the elements, events, and their surroundings. Those associations can be categorized as causal, where a character causes an event to take place, or temporal, wherein an event happened either before or after another event. Those associations are then the link between the elements (Faas, 2002).

What about graphic novels…

Then explain the motivation for understanding the relation between emotion and stories…

In this research, the focus is to find the relationship between emotions, EEG signals, and using short stories or graphic novels as stimuli. The results of this study would then create an emotional model that future Affective Tutoring System which teaches English reading and comprehension could incorporate in order to respond to the users’ affect state.

* 1. **Research Objectives**

This section specifies the goals that will aid in the completion of the research.

* + 1. **General Objective**

To create a model of academic emotions based on EEG signals when reading short stories.

* Your model is associating patterns of brainwave signals with academic emotions and the factors that trigger this…
  + 1. **Specific Objectives**

1. To determine the relationship between EEG patterns and academic emotions.
2. To identify the short stories or graphic novels to be used as stimuli.
3. To study the aspects (?elements?) of a story and how these affect the reader’s emotions.
4. To determine what aspect of a short story or graphic novel is needed to stimulate a corresponding emotion from the reader.
   1. **Scope and Limitations**

The proposed participants for this study are high school students between first and fourth year. The EEG data gathered will be used in running experiments on classifying the emotion and analysis. 🡺 why these participants – what is the youngest age group that can express what they are feeling at the same time, the head gear limitations…

~~In order to stimulate the desired emotion, a graphic novel would be used.~~

Why graphic novels? 🡺 relate the participants (their interests or type of genre that they read) with the graphic novels...

Expound on #3 – present some elements or aspects of stories…

The proposed graphic novel would be Trese, written by Budjette Tan and illustrated by Kajo Baldisimo. This graphic novel focuses on stories that deal with crime solving which are sometimes supernatural in origin. While the subject is reading the novel a software module would then be used to capture the data signals from the sensor.

The EEG sensor to be used for this research is the Emotiv EPOC sensor. A product initially used for gaming purposes. This sensor is equipped with 14 channels with the International 10-20 locations. The brainwaves are

In order to clean the data, further studies in data processing would be needed and applied into the resulting data gathered in the research. Sampling rate would also be determined as to what the best window size would be.

In order to classify the gathered data, the classifying algorithm Multi-Layered Perceptron (MLP), K-Nearest Neighbor (KNN), and the C4.5 decision tree will be used and compared. For the research, issue of data storage, memory space and computing time will not be a basis for constraining the algorithm used. The three classifying algorithm would be employed and studied thoroughly and the focus would be centered on those classifying algorithm.

* 1. **Significance of the Study**

This research aims to be able to provide baseline data that could be used in the advancement of affective ITS to support reading and comprehension. This can help future affect-aware system to be able to appropriately react to the subject’s affect state. This can enable the system to provide a correct response using the baseline model. 🡺 why do we want the system to provide a correct / affective response?

The target subject of this study are high school students which could benefit from this research by utilizing an Affective Tutoring System that uses the resulting Academic Emotional Model that was produced. 🡺 why? Why is reading important? Why do we want them to engage in reading?

The resulting model from this research would then help student that are struggling with reading short stories. It can also help people not fully fluent in the English language and are reading English stories. For Example, a reader that registers “confused” on the affective model would need an intervention of an Affective Tutoring System in order to help them better understand.

* 1. **Research Methodology**

The following activities will be undertaken to address the research objectives of this study:

* + 1. **Data Collection and Analysis**

This phase would include a review of the academic emotions felt by a student during learning. Experts in the field of psychology would be consulted in order to determine the academic emotions that are experienced by a person when he/she is reading. The experts would also be consulted in order to determine the best domain to perform the experiment with.

Literature experts would also be consulted about the use of reading materials such as graphic novels to be used in this research.

* + 1. **Literature Review**

A review of researches in the field of academic emotion recognition and detection using EEG signals would be done in order to understand as to how data gathering can be best carried out. Literature relating to academic emotions would also be reviewed in order to determine which emotions can be best used given the target domain. Further studies would be done in the algorithms used in pre processing of the data in order to remove noise and artifacts in the gathered data.

Missing:

* + 1. **Evaluation**

Experts in the field of Psychology and Literature would be consulted as to the results of the test.

* + 1. **Calendar of Activities**

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