Novel Approach For Online Learning Through Affect Recognition

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Abstract. Online learning is commonly accepted as a support tool for educators as well as a medium of delivery of any-time, any-where content of a wide range of study programs to a widely dispersed learner community. Web-based learning environments are a relatively new medium of learning to Sri Lankan universities. There are predictions of a near future boom of digital learning in Asian educational context, challenging the conventional face to face learning environments. Like any learning process, digital learning depends on effective communication of human knowledge, whether this occurs in a face-to-face classroom or across the internet. Within the state university settings, learners experience varied emotions and interest towards learning. Although both emotions and interest can increase learners' likelihood to engage in traditional learning, little is known about the influence of emotions and interest in learning activities in a digital environment. Moreover, recent research on the emotional response to digital learning has focused on the importance of learners' feelings in relation to the community of learning. Major objective of this research study is to introduce a new model of online learning with relevance to the emotional response of the learning community.

Keywords: online learning, emotions, learning environment, online learner

1. Introduction

Emotion is one of the most controversial topics in psychology and it plays a vital role in many human activities. Research in neurosciences and human psychology has identified and proved that emotions exert influences in various behavioral and cognitive processes of a human being, such as decision making, motivating, long-term memorizing, etc. [1]. Human learning may occur as part of education, personal development and learning should always be goal-oriented and motivated. Education in the largest sense is any act or experience that has a formative effect on the mind, character or physical ability of an individual [2, 3]. The linkage between complex learning and emotions has received increasing attention in the fields of psychology, education, neuroscience and information technology [4, 5, 6, 7]. Goleman [8] has mentioned in the book, Emotional Intelligence, that expert teachers are able to recognize a student's emotional state and respond in an appropriate manner that has a positive impact on the learning process. In the past decade, e-learning has evolved from Computer Aided Instruction, through Intelligent Tutoring System, to Smart Classrooms, and to Mobile Learning anytime [9,10]. During the last decade researchers in education have made extensive progress towards identifying the cognitive processes that are significant to learning [11, 12]

2. Theoretical Frameworks and Previous Studies

Today, e-learning has becomes heavily learner-centered and a personalized learning technology. Past research has shown that there is a limited number of explorations of extent that emotions are associated with learning on line. [11,13]. Most of the past research has been on the physiological factor of the learner is based on the traditional class room face to face learning [9,11]. Moreover research on emotions based on the e-learning platforms has been less acknowledged. E-learning has been depicted as less emotional and more impersonal or as lacking in emotional richness (e.g., lack of body language, facial expressions, and gestures)

when compared to face-to-face learning [14]. Adult learners experience on affective learning is in a range from positive and energizing to negative [13]. One of the most ubiquitous notions in human psychology is that some emotions have a special status when categorized as basic, primary, or fundamental emotions [4]. The approaches behind recognizing learner behavior has evolved since 1970s and two approaches that compete most predominantly in the area of education. [8, 15]. The first one is the basic categorical structure and the second is dimensional structure [8]. The basic categories approach was one of the earliest to be developed and was applied by Plutchik [6]. According to Plutchik [6], the eight primary emotions are joy, acceptance, surprise, fear, sorrow, disgust, anticipation and anger [16]. Plutchik arranges them in a circular pattern, which he likened to a colour wheel.

The second approach to defining emotional structure is the dimensional approach, which says all emotions can be identified as displaying association with one or more dimensions, such as intensity, pleasantness or degree of activation [15]. Most often, the two broad dimensions of pleasure and arousal have been identified using factor analysis and multidimensional scaling (MDS) techniques. In this model emotions are not clustered the axes but have been tendency arrange in a circular pattern around the dimensions hence being referred to as a circumplex. This dimensional approach has been identified by James Russell in 1979- 1980 and invented the circumplex model of representing emotions. Affective e-learning model is explored by Liping Shen, Minjuan [10] Wang and Ruimin Shen in Shanghai China. This study has experimented about how emotion evolves during learning process and how emotion feedback could be used to improve learning experience using emotion detection technologies from biophysical signals. The research study was guided by Russell's Circumplex Model of Affect [17] and Kort's Learning Spiral Model [18, 19].

3. The Research Problem

The modern education system uses multiple methods and tools to facilitate learning such as electronic learning, mobile learning, problem based learning, project based activities, online discussion groups and chat forums. Today, many reputed higher education institutions allow their learners to acquire knowledge and skills in open and distance mode giving the learners flexibility in time, location and pace of their [20]. Adult learners especially prefer to have more freedom in learning phase [21]. One of the major problems in distance learning is the lack of methods to recognise learner behavior. Therefore, the current study addresses the problem of recognizing e learner's emotional state during learning. The same problem has been addressed in much research on face to face environment but not on distance learning environment. This research model will help to identify e learner emotional state with respect to their level of learning.

4. Aim of the Research Study

The aim of the research study is to build a model to recognize the e learner's emotional state with respect to their learning performances. The proposed e learning model will address the issue of not recognizing and responding to e learner's emotions while they learn. This model will also be helpful to identify the e learners' learning performances while measuring the emotional state.

5. Proposed Affective Learning Model

The research study has been designed aiming the first and second year undergraduates following a B.Sc. (honours) degree in Information Technology. The degree programme is offered in a face to face environment and with some course work done in an online mode. The lessons used for the research study are conducted in both open and distance environments and Moodle has been used as the Learning Management System (LMS). The observations collected through the LMS are used to evaluate the learner's level of learning. Research experiment will be carried out in different online activities such as, reading assessment, quiz, online discussion forums, chat forums, lesson assignments etc. The learning time and other time related calculations are measured through the Moodle LMS and grades and marks for the evaluation activities will be calculated after the teacher evaluation. The emotional feed back of the learners is collected through an online questionnaire based survey.

5.1　System Architecture of the Research Study

Online learning comprises many forms of technology supported learning and teaching . providing socio and technological association. The learner facilitation gets improved through online learning; perhaps improved since the concepts of affective computing embedded into it. The combination of technology enhanced learning and affective computing can be applied to the online learning community. The current context of online learning has no provision to recognize learner's emotions while they learn unless it observe the bio-physical signals of a learner [3,12]. The biological information of a learner should be observed through highly confirmed and controlled learning environment and the provision to practice this scenario in open and distance learning environment is quite difficult. Therefore, some other architecture should be followed in measuring such emotions. The current research study proposes a solution to recognize learner emotions in real time environment without measuring any bio-physical signals. The high level system architecture of the proposed solution is shown in Figure 1.
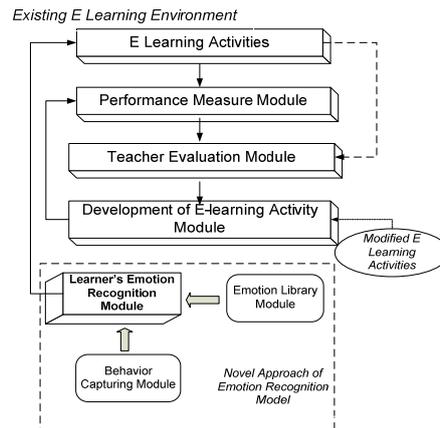

Fig 1: High Level System Architecture

The system consists of different modules in online learning. The upper part of the diagram discusses how the existing online learning environment has been established and the lower part discusses the novel approach to the online environment. This consists of three major modules: performance measure module, teacher evaluation module and development of e learning activity module.

5.2　Diversified Online Learning Activities – Existing Online Learning Environment

This section describes how the existing learning activities takes place in most of the online learning programmes. In Figure 1, the e learning activity module consists of different activities such as reading, online lectures, quizzes, discussion forums, chat forums and example based learning. The learning methods should be constructive to make online learning courses effective. Such methods include constructive discussions on knowledge enhancement, interactive simulation, problem solving scenarios, project based method, collaborative exercises etc [20]. Emotions are experienced during computer-mediated interactions such as those occurring in the online environment. In the online environment it is acknowledged that the learner behavior or associated affective reactions are not monitored in the same way as in conventional systems. When online learning is used for collaborative purposes, the affective reactions experienced while working in the environment result mainly from the interactions between the learners [20]. One of the most important activities among online teaching and learning is performance evaluation or assessment. As given in the Figure 1, the second module discusses the performance evaluation of the online learning structure. Researchers argue that the learner evaluation or assessment in online learning is essentially no different from any other form of learning [20, 21].

Practicing effective assessment activities in online learning is a challenging task for any academic. Appropriate assessment techniques are essential to assess the learner's knowledge level and also to evaluate the teaching methodologies. Irrespective of all the performance evaluation methods, there is no such mechanism to evaluate the learner's emotional feedback together with the graded assessments [9, 11]. Teacher evaluation module discusses how teachers themselves can evaluate the teaching methodologies. Most of the

time in conventional online learning the learners' examination results, online course feedback systems and the learner requests are used as the teacher evaluation methods. The student's emotional feedback is not used as a tool for measuring teacher performances in online teaching. Therefore the problem of addressing the online learner emotions will be addressing once the proposed systems. The technologies and approaches that constitute online learning are diverse, often blended with conventional approaches. So it is difficult to provide a single approach to evaluating impact.

5.2 Learner Emotion Recognition Model

The fundamental concept of learner behavior and their emotions have been addressed by different philosophers and scientists in the past. Many of the past research activities were carried out with the basis of capturing the learner's emotions using bio physical signals. This research study is based on recognizing learner emotions during the e learning process without accessing any of the biological signals as an input. Therefore, the novel approach can be used in both open and distance environment where the learner is physically invisible to the system. As per given in the Figure 1, the emotion recognition module consists of two sub module called emotion library module and emotion recognition thorough behavior capturing module.

5.3 Emotion Library Module

Figure 2 shows the emotion library module. It incorporates methodologies to use affective computing and kansei engineering to identify emotions. At the same time theories described in the education and as well as human psychology also added to this module. The data pertaining to current studies on online learning are used as a powerful resource in this research. Current study aims to explore the learner behavior using Barry Kort's Learning Spiral Model by observing and analyzing the learning models described in numerous areas as given in the library. The Kort's learning spiral module is depicted in Figure 3.
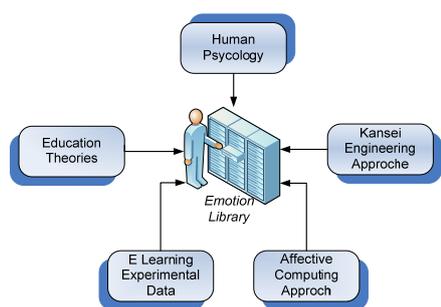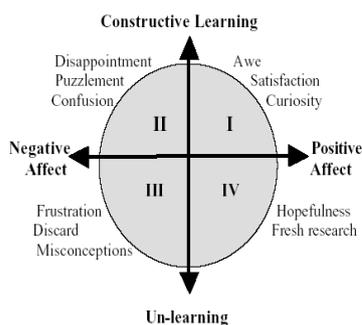
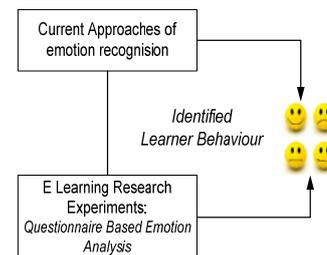Fig 2: Emotion Library Module   Fig 3: Kort's Learning Spiral Model(Kort, 2001)   Fig 4: Emotion Recognition through Learner Behavior

Barry Kort has used emotion detection technologies from biophysical signals, and explored how emotion evolves during the learning process and how emotion feedback can be used to improve learning experiences. Kort [18, 19] proposed a four quadrant learning spiral model in which emotions change while the learner moves through quadrants and up the spiral. Figure 3 shows Kort's Spiral model of affective learning. This model has covered the spectrum of areas which had to be developed in the education methodologies. The Figure 3 shows the relationship between learners' emotions and level of learning. The horizontal axis of the Figure 3 denotes emotion axis and the vertical axis denotes learning axis. The positive (more pleasurable) emotions are on the right side where the negative (more unpleasant) emotions are on the left side. The vertical axis symbolizes the construction of knowledge upward and the discarding of misconceptions downward [18, 19]. The learners are experiencing positive affect and constructing knowledge in quadrant I. The learners move to quadrant II once the discrepancies appear between learner's knowledge structure and the information provided. This part consists of constructive learning and negative affect and then the learners experience affective states such as confusion. When a learner tries to sort out a puzzle but fails, the learner might move into quadrant III. This is the quadrant of unlearning and negative affect, when the learner is experiencing states such as frustration [10]. After the misconceptions are discarded, the learner moves into quadrant IV, marked by unlearning and positive affects [3, 10].

5.4 Identifying Learner Behavior - Recognising Emotions

The second sub module of the learner emotion recognition module is the learner behaviour identifying module shown in Figure 4. Here the study aims to describe how the learner behavior can be recognized with respect to the Kort's learning spiral model. Here the module excludes the use of biological signals to recognise emotions due to difficulties in collecting such data in practice. This study has used the questionnaire based survey method of collecting data in online mode to recognise emotions. Even though this method has been designed to examine mostly cognitive dimensions of the learning process, they have also been used to study emotions with respect to the online learning [18, 19]. Both qualitative and quantitative approach has been used in the analysis of data to generate the results. The emotions that the study is aiming to recognise through the questionnaire are curiosity, satisfaction, confusion, disappointment, frustration, dispiritedness, hopefulness and determination. The survey has being conducted while the learning process and the questions of the questionnaire has categorised in to seven sub sections. The questions are based on the areas such as online access, online familiarisation, engaged in learning activities, learning though online community (chat and discussions), online assessments (quiz, assignments), lesson break activities and network & logistics. Thirty questions have been covered by all the defined areas of subsections as given above.

6. Conclusions

Emotions are important in adult learning because they can either impede or motivate learning. Electronic learning has been portrayed as less emotional and more impersonal or as lacking in emotional richness when compared to face-to-face learning since the learner is physically invisible to the teacher. Online education programs have enabled learning opportunities to learners that allow for breaking away from space and time constraints. In Sri Lankan context this problem become verse since the online delivery mode is quite new for the higher educational system. The aim of the research study is to build a model to recognize the e learner's emotional state with respect to their learning performances. This model will also be helpful to identify the e learners' learning performances while measuring the emotional state. The research study has been designed aiming the undergraduate learners following an honours degree in Bachelor of Science in IT, University of Moratuwa. The high level architecture of the proposed system has described the connectivity of the existing online environment and the novel approach of online learning which enables affect recognition.

7. References

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