Mood-Driven Pervasive and Personal Learning Environment Model for Autistic Learners

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ABSTRACT

With the emerging e-learning technologies, learning models are being developed to help us understand the integration of technologies in the learning process and how technology serves to enhance learning effectiveness. Each models provide a structure to the learning experience and a context in which learning material can be presented, enabling the learner to achieve optimal experience. Recognizing and interpreting a human's facial expressions or mood are an important challenge for computer vision in learning environment perspective today. Mood or emotions can have enormous effects on learning and play a vital role in decision making, managing learning activities, timing, and reflecting on the studies. The introduction of mood as context of a user opens up many opportunities for the design and development of learning system for autistic child. Children with cognitive disorders, such as autism or Asperger's syndrome (ASD) has been thought to be characterized by dysfunction in emotion, socially impaired and usually do not attend to the people around them. Thus, a special model to support learning of special children particularly the autistic learners is considered for their optimal engagement in any learning material in e-learning platform.

Keywords
Mood-driven, pervasive and personal learning environment, autistic, e-learning

1 INTRODUCTION

Mood is a mental or emotional state commonly depicted through our facial expression. Our facial expressions play an important role in human interactions and non-verbal communication. Classifying the facial expressions could be used as an effective tool in behavioural studies on a learning process. Negative moods can affect judgement, perception, and physical and emotional well-being, while a positive mood can enhance creativity, problem solving and careful thinking. The ability to make critical decisions and creative strategies can be increased if the person is in a positive mood. In the context of special learners, using the facial expression or the mood of autistic children in educating them is a great challenge. Identifying the mood of an autistic child is generally different from identifying the facial expression of a normal person. Autistic learners have a psycho-educational profile that is different from typically developing individuals.

Children with autisms have complex developmental disability. Autism is a brain disorder that affects a person's ability to communicate, form relationships with others, and respond appropriately to the environment. Autistic people are described as being "locked in their own world" and struggle to communicate with others. People with autism are known to possess deficits in processing emotional states, both their own and of others. They often have a hard time figuring out what others are thinking and feeling. Since learners are different, an individualized instruction and education must facilitate learning whether it is for
normal or special learners. When it comes to learning, children with autism have difficulties in five main areas: communication, social interaction, sensory processing, repetitive behaviour or restricted interests and information processing or learning style.

The learning difficulties of these special children could actually be supported with a computer aided learning materials or an integrated e-learning program. In the study of Moore & Calvert, 2000 [1], computers are being used in educational settings as a new method of teaching children with autism. With the advancement of Information and Communication Technologies (ICT), computer-aided learning or instruction (CAL/CAI) is considered as a key method for handling autism interventions, particularly for young children. Today, mobile technologies possess educational potential for today’s generation. E-learning and m-learning can enable a personalized learning experience, in fact, there are a lot of computer aided materials out in the market. The Apple iPad have remarkably created mobile applications for assisting children with autism spectrum disorder or other special needs. iPad programs have provided means of communicating for some children with autism who cannot speak or have language delays. Other apps help children learn to handle social situations that can be stressful, like crowds at malls. And many programs can help develop fine-motor skills, which promote functions like writing or manipulating small objects. (Pradnya Joshi, New York Times, November 2011)[2].

Despite of the existence of these applications for autistics, we cannot really ensure whether or not a learner was really engaged in doing the activities or using the learning material. Polaine(2010)[3] in his study, stated that “the act of learning needs to be pleasurable in itself (and perhaps this is more important than the final accomplishment) is to remain engaged”.

Applications mentioned above and e-learning programs where created and provided utilizing common e-learning framework and digital media considerations. However, the existing framework does not address the real problem of learning deficiencies of the special children. Careful design and analysis of technology integration in the learning process of autistic learners must be considered to ensure that the learners achieve an optimal experience. Through this study, a specialized model derived from common e-learning frameworks will be created to address the learning needs of special learners. The fact that most organization and schools are venturing in e-learning programs and m-learning, a lot of considerations must be put in place for effective learning process. Khan(2001)[4] mentioned that institutions venturing onto e-learning initiatives should explore “What does it take to create a successful e-learning experience for diverse learners”.

E-learning today is the era of learner-centered with emphasis placed upon pervasive and encompassing with personal learning technologies thus making the learner better engage in the learning process. As mentioned earlier, diverse learners must achieve optimal experience or must be in a flow state in the learning process regardless of your condition. Learning varies from people to people that makes methods or approach varies too. As per evaluation, the current e-learning systems cannot instruct students effectively since they do not consider the emotional state in the context of instruction. One of the factors that have been evidenced to affect learning in the physical world, the degree of assimilation of knowledge, achievement and enjoyment of students from education, is the architectural design and physical building characteristics of the space in which students learn.
Artificial intelligence in education continue to integrate pedagogical model in building computerized mechanisms that will accurately, immediately and continually recognize a learner’s affective state. Many emotion recognition approaches are built using facial expressions and majority of studies investigating the recognition of facial expressions have focused on static displays of intense emotions. Most of the studies that recognizes the facial expression or mood of the user did not gauge the learning engagement of the learner.

Researchers in many different fields are familiar with Ekman’s work on the detection of emotions from facial expressions (Ekman & Friesen, 1978 [8]. However, the emotions that Ekman intensely investigated (e.g., sadness, happiness, anger, fear, disgust, surprise) have minimal relevance to learning per se (Kort et al., 2001) [9]. The pervasive affective states during complex learning include confusion, frustration, boredom, flow/engagement, interest, and being stuck (Craig, Graesser, Sullins, & Gholson, 2004;[10].Csikszentmihalyi, 1990) [11]. Rao et. al [12] have proposed an efficient method for recognizing emotion from facial expressions using a robust feed-forward neural network., which can be applied to a color image containing the frontal view of the human face.

According to Fragopanagos, N. and Taylor, J. G.(2005)[13], the ideal representation of emotion should not be purely descriptive; it should also concern itself with predicting and/or prescribing actions. It should be also capable of modification through experience, as developmental and cross-cultural evidence indicate human representations. In the study done by Cowie et. al(2001)[14],they discusses the major issues on recognizing the quality and quantity of emotion databases. They considered a hybrid system that has a particular attraction that links the elements that are prominent in reactions to emotion.
Challenges of autism research and affective computing had inspired Kaliouby et al. (2006) [15] to propose a collaboration between autism research and affective computing from developing new tools to assist autistic learners in understanding the socio-emotional world around them to designing and constructing new computational models and theories to have better social-emotional experience to all the users. From here, various models came out to cater the learning needs of the learner. Dou et al. (2012) [16] develop an emotional intelligent e-learning system. It recognizes and analyse the student’s emotion state and a virtual teacher’s avatar is present to facilitate student’s learning. Saleeb et al. (2012) [17] initiated also a framework for architectural design of 3D virtual spaces to augment accessibility, appeal and engagement for enhancing the e-learning experience of learners with disabilities. This comprises capturing student contentment and satisfaction levels from different design elements of the 3D virtual spaces. Moreover, Ip et al. (2011) [18], presented an affective learning model based upon a smart ambience learning environment (SAMAL) that allows students to be engaged in reality scenarios through a series of interactive and immersive learning activities. In this model, the learners will be provided with a unique learning experience away from traditional classroom environment.

Obviously, researchers are creating computers that can read and respond to the emotional state of a person with autism and may be used to provide better therapy. Knowledge relative to how emotions influence learning is a fundamental part of computer-aided affective learning systems. A number of theoretical models of learning assumed that learning occurs in the presence of affective states (Craig, Graesser, Sullins, & Gholson, 2004) [19]. Liu, C., Conn K., Sarka N., and Stone W (2008) [20] studied whether computers can be taught to respond to the affect/emotional state of a person with autism.

According to Bosseler and Massaro [21], children with autism are capable of learning new language within an automated program concentrating on a computer-animated agent, multimedia, and active participation and can transfer and use the language in a natural, untrained environment. Bosseler et al. developed and evaluated a computer-animated tutor, Baldi, to teach vocabulary and grammar for children with autism that was implemented in a Language Wizard/Player, which allows easy creation and presentation of a language lesson involving the association of pictures and spoken words.

Moridis and Economides (2009) [22] demonstrate how various kinds of evidence could be combined to optimize inferences about affective states during an online self-assessment test. They demonstrate how formula-based and neural network-based method could be combined to optimize inferences about affective states during an online self-assessment test. Their work indicates that neural networks can provide a significant prediction of student’s mood using personal preference information and can provide an alternative for and improvements over tutoring systems’ affect recognition methods. Kort, Reilly, & Picard, 2001 [23] also mentioned that an appropriate computer response to a student’s affective state also requires evolving and integrating new pedagogical models into computerized learning environments, which assess whether or not learning is proceeding at a healthy rate and intervene appropriately.

In relation with the above studies, face expression recognition have been done in various ways and it was also used for several purposes. Likewise, computer aided learning for autistics are available also to support learning however none of these researches...
tried to design a learning system that suites the learning needs of the autistic learners and try to measure their learning engagement of a certain activities in an e-learning platform or model based on their mood.

Therefore, this undertaking shall serve as a new approach for people with autism to adopt new learning environment that will boost their confidence in doing a certain activity by engaging themselves on an appropriate learning materials or activity. Using the previous literatures, this will be the researchers’ springboard to come-up with a learning model intended for people with autism. The designed learning model shall play a very important role in the learning process of the autistic learners.

3 CONCEPTUAL FRAMEWORK

The researcher shall be guided with a concept that people with autism have better learning engagement or in the state flow experience in an e-learning activities modelled on the mood-driven pervasive and personal learning environment model. Figure 1 illustrates the conceptual framework of the study.

As compared with the traditional e-learning model or framework, the proposed model shall have a special plug-in called mood detector. This is an application that shall identify and capture the mood of the learner. The moods which the system identify includes happy, sad, surprised, angry, bored and neutral. Once the mood is identified, it shall pass through the analysis of the behaviour of the autistic learner to map the learning needs of the learner. The learning activities of the learner shall be dependent on the analysed mood and behaviour of the learner. The learning objects here will be under SCORM or LOM to make learning pervasive and personalized. A special algorithm approach must be integrated here to identify suited activities for the learner. The activities that shall be undertaken by the learner shall be evaluated or assessed based on the flow principle. This shall determine the learning engagement of the learner as to the time, participation and number of accessed and finished in the different activities presented.

4 DISCUSSIONS

4.1 Design considerations for autistics learners to aid learning process

Study shows that most children with autism spectrum disorder (ASD) can have more frequent or more severe mood swings than others. Mood and affect vary considerably, and may include being unaware of the feelings of others, withdrawn, or emotionally labile. Some people with autism become outwardly anxious or they may become depressed in response to the realization of their problems. Due to these problems, the learning phase of the child might be affected by these behaviours that entail them to have special care, attention and special program to learn.
Information and instructional activities presented to students with ASD should be provided in a format that is clear, focuses their attention, and emphasizes the most relevant information. People with ASD have a psycho-educational profile that is different from typically developing individuals. Some students with ASD have stronger abilities in the areas of rote memory and visual-spatial tasks than in other areas. They may excel at visual-spatial tasks, such as putting puzzles together, and perform well at spatial, perceptual, and matching tasks. They may be able to recall simple information, but have difficulty recalling more complex information. Strengths in visual-spatial skills have been described in personal accounts of individuals with ASD. Grandin (1995)[24] suggests that some people with ASD can more easily learn and remember information that is presented in a visual format, and they may have problems learning about things that cannot be thought about in pictures. Students with ASD may have difficulty comprehending oral and written information, such as, following directions or understanding what they read. Some students may demonstrate strengths in certain aspects of speech and language, such as sound production (phonology), vocabulary, and simple grammatical structures (syntax), yet have significant difficulty carrying on a conversation and using speech for social and interactive purposes (pragmatics). A student who is higher-functioning may perform numerical computations easily, but be unable to solve application problems. ASD students respond well to a structured environment and learn best by consistency and repetition of newly acquired skills. They most often learn these new skills more effectively in a quieter environment with few distractions.[15] These factors were used by the researcher to consider in the design of the mood-driven pervasive and personal learning environment model for autistic learner that will help in the learning process.

4.2 Components of a mood-driven pervasive and personal learning environment model for autistic learners

The mood-driven pervasive and personal learning environment model is divided into three phases namely:

Phase 1: Mood Detector Plug-in
The mood detector is a plug-in to the learning environment of the autistic learner. It is an application that will detect the mood of the learner. The mood of the learner shall be captured first using a personalized software. The mood that will be identified shall be the input for the next phase. Mood identified can be sad, happy, angry, bored and surprised.

Phase 2: Learning Environment
In this phase, the mood that have been identified shall be used in the analysis of the behaviour of the learner. This is a very crucial process since it entails to have an algorithm to map the corresponding behaviour that was based on his mood to an appropriated learning material. The learning materials can be pervasive and personal. Learning objects or sharable course object resource can be utilized to pattern or match the learning needs of the learner.

Phase 3: Learning Assessment
The learners shall be measured in the activities done to assessed whether the learner was engaged in the learning activities presented using the flow principle. The learners shall be evaluated by time spent and its interaction to the learning modules. The interaction here means the number of accessed and accomplished activities of the learner.
5 CONCLUSIONS

Various studies and researches generally indicates that mood or emotion and learning is related. Despite of the emerging trends in e-learning, its model or framework will always support learning needs of the learner. A famous adage reminds us that “Education is for all”. With this, designers of e-learning or any learning materials must always consider the learning needs of every individual. The learning needs of the autistic children may be far from other students. Properly planned and careful delivery of instructional matters must be given priority to meet the learning needs of the autistic child.

Studies on the quality of experience associated with new technologies are especially necessary in that they can help detect experience fluctuations based both on structural characteristics and on content differences. This would allow researchers, technology designers, clinicians and educators to develop a learning system and intervention programs taking into account the users’ opportunity to report rewarding, relevant and challenging experiences. As for designers, the designed activities should allow students to feel in control of their learning environment and confident in their ability thus making a more pervasive and personal learning environment experience. Consideration on the design must also be deliberated to enhance the learning process. Identifying the components of the mood-driven pervasive and personal learning environment model for autistic learners is important to create an appropriate learning module to the autistic learners that correspond to their mood thus achieving an optimal experience. Using the mood-driven pervasive and personal learning environment framework, it was found out that autistic learners consumed more time in doing the learning activities and was able to complete and accomplished the task as compared to the usual e-learning framework. Thus, this implies that the adjustment of the activities based on the mood of the learners have a significant impact on the student engagement.

Autistic children, though given a special care and treatment should also enjoy the optimal experience in doing a certain activity. Based on the findings of the study, the proposed model supports the learner in engaging activities thus achieving the flow state of a learner. Learning platforms may have its strength and weaknesses but what matter most in these learning platforms is the achievement of student engagement in a flow state.

The introduction of the mood-driven pervasive and personal learning environment model for autistic learners shall be a springboard for other researchers to come-up with an applications that will meet the learning needs of the learners that will eventually motivate the learners to be engaged and improve their performance.

REFERENCES


