

EMOTIONAL MODEL FOR LEARNING

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Abstract: The aim of this paper is to put forward a new model for emotional interaction that uses learning and cognitive styles and student emotional state to adapt the user interface, learning content and context. The model is based on a constructivist approach, assessing the user knowledge and presenting contents and activities adapted to the emotional characteristics, learning and cognitive styles of the student. The intelligent behaviour of such platform depends on the existence of a description of the characteristics of the student– the student model. The contents of this model and emotional state of the student are used by a domain and interaction model to select the most appropriate response to student’s actions.

Keywords: Learning Styles, Adaptive Systems, Affective Computing.

1 Introduction

The learning platforms have over time become increasingly important as a tool of learning. This fact is reflected both in educational institutions as well in the corporate level. Proving essential in teaching people of different age groups, from teens to senior [1], [2], [3], [4].

In spite of its unquestionable importance and success, learning platforms is far from being a non-problematic issue in many ways. Several studies point out different problems of making learning platforms a part of the current learning process. These problems include the cost of an learning system that poses a problem for certain institutes and corporations [5]. This added to the cost of keeping instructors and teachers that require awareness about online teaching, as they must use teaching methods that diverge from the ones used in traditional teaching process. In all of this a key point remains why people not always liked learning platforms and are hesitant to partake in courses and in e-learning sessions [6]. This happens because of several factors from the degree of technical skills necessary to the students to work the courses from the emotional state of the student (like boredom or frustration) that result on the student dropping out to be left behind in their studies or in their work trainings [6].

In a traditional teaching process the teacher takes the role of facilitator of the learning process and tries to lessen these problems by using several teaching techniques to recapture de student’s attention to the learning process. In a e-learning environment the this real time role does not exist that worsen the problem the students face, therefore the significance of the research to try to near the gap between students and their learning platforms by introducing techniques of Affective Computer that can capture the student emotional state and base on that change the course parameters (flow, organization or difficulty) in order to recapture the student attention.

2 Affective Learning and models

There are numerous types of learning. In 1956 Benjamin Bloom [7], identified three domains of educational activities: the Cognitive: mental skills (Knowledge), the Affective: growth in feelings or emotional areas (Attitude) and the Psychomotor: manual or physical skills (Skills). The combination of all the domains influences the way we learn and the way rational decisions are made. So what is Affective Learning? According to recent definitions, “Affective learning involves the melding of thinking and feeling in how people learn. Importance is placed on social learning environments for knowledge construction and application wherein deeper awareness and understanding of the role played by mental dispositions in how a person views, engages, and values learning can result in better understanding and use of knowledge and skills. Learning outcomes are focused on enculturation of norms, values, skillful practices, and dispositions for lifelong learning.” [8].

The goal of the use of a model is to understand how the emotions are evolving in the learning process. So learning systems can be developed in order to recognize and responded appropriately to an emotional state. In 2004 Picard indicated that the theories that influenced the learning process need to be verified and further developed. Most of the models have been developed like a model for pervasive e-Learning platform [9] had as a starting point models like Russell’s Circumplex model [10] to describe user’s emotion space and Kort’s learning spiral model [11] to explore the affective evolution during learning process.

The Circumplex Model of Affect proposed by Russell in 1980 [10] consisted in the distribution of emotions in a system of coordinates. In this system of coordinates the x-axis measures the valence, from positive to negative emotions. The y-axis measures the level of arousal. Affective model falls to in a circle and where we can find emotions like pleasure (0o), arousal (90o), displeasure (180o), and sleepiness (270o).

Learning typically begins in quadrant I or II in which the quadrant I the student investigates a problem, one experiences emotions like curiosity or satisfaction. But if something happens it will take the student to fail. This causes the student to move to the quadrant II. The quadrant II the student will feel confusion or disappointment towards the problem. If the situation failure is kept the student falls into quadrant III. In this quadrant the student experiences feelings of frustration and begins to discard the old ideas. This allows the student to move to the quadrant IV bringing a new approach to the problem that originates feelings of hope and determination. Circular flow of emotion through the learning process is represented by Figure 1.

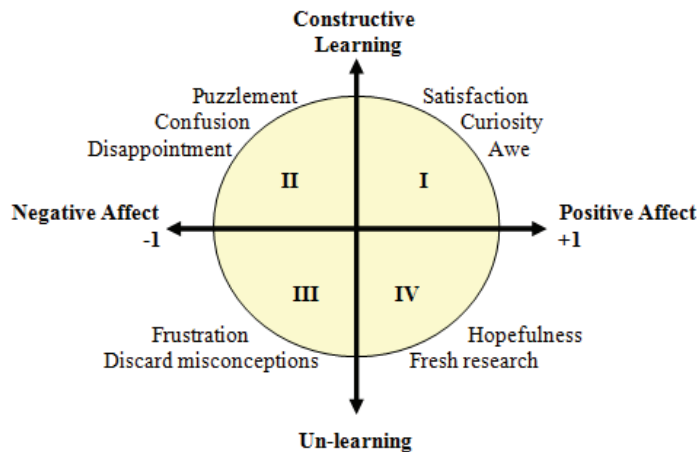


Figure 1 - Learning cycle [11]

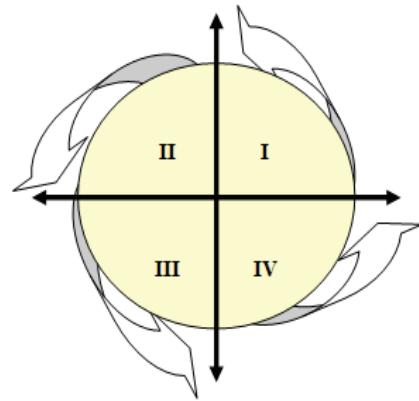


Figure 2 - Circular flow of emotion through the learning process [11]

2.1 The role of affect in learning

Research shows that a slight positive mood can produce an effect on memory, fosters clear-headed, well-organized open-minded, flexible problem solving and thinking as well as more efficiency and thoroughness in decision-making. This can be found in groups of different ages and professions [12] [13]. The effect on cognition is not restricted to positive states of mind. Negative affective states like anger, sadness or fear can influence the brain activity affecting the thought process [13].

The challenges that affective learning faces is the bringing together of theorists and practitioners from different fields in order to refine the language used with respect to affect and learning [12]. To create a model that can provide effective results in the learning process, the model built has to take into account other factor like the model or profile of the user and also the learning style. In the literature of the subject there are several models proposed.

A learning style is the method that permits an individual to learn best [14]. Different people learn in different ways and each one preferring a different learning style. Everyone has a mix of learning style, but some people may find that they have a dominate style of learning. Others may find that they have a different learning style in different circumstances. To find out which is the most suitable learning style for a particular student, the student has to answer a questioner. There are several models developed by several authors that try to model how people learn [14]. The best none models are Learning Style Inventory model, propose by educational theorist David A. Kolb [15] and the Felder-Silverman model [16].

The Learning Style Inventory (LSI) model, propose by educational theorist David A. Kolb, is based on the Experiential Learning Theory, as explained in [15]. The LSI is a helpful resource that assesses the manner we like better to learn by how we take a grip on situations, problem solve and think. The LSI test aids define our strengths and weaknesses, what stage we are at in the Cycle of Learning, and what Learning-Style Type best suit you. Kolb [15] propose a model in which the learner used four different skills: concrete experience, reflective observation, abstract conceptualization and active experimentation and four types of learning styles: Divergent, Assimilative, Convergent and Accommodative. The model proposed starts with an experience that the student has to have, followed by a chance to reflect on that experience. Then students then can conceptualize and draw conclusions about what they experienced and observed, resulting into to future actions in which the students experiment with different behaviors. This begins the cycle again as students have new experiences based on their experimentation. Divergent learners with this learning style have as dominate dimensions concrete experience, reflective observation. This learning style type includes learning from feeling, seeing and listening. This type of student approaches a problem by exploring all view points and possible answers to it. Assimilative learners with this learning style have as dominate dimensions concrete experience, active experimentation. This learning style type learns by thinking, watching and listening. These students have good understanding a wide variety of information, abstract thoughts and notions. They learn best by placing everything into a logical, succinct from. Convergent learners with this learning style have as dominate dimensions abstract conceptualization and active experimentation. This learning style type learns by thinking and doing. These types of student are strong in solving problems and making decisions by logically using ideas and theories. Accommodative learners with this learning style have as dominate dimensions concrete experience and active experimentation. This learning style type learns from feelings and learns by doing. These students are practical and prefer experiencing over logic and facts, and prefer stimulating experiences and joining other people's opinions in their decision-making process.

Felder-Silverman [16] this model covers four learning dimensions Sensing/Intuiting, Visual/Verbal, Active/Reflective and Sequential/Global. Sensing/Intuiting learners [16] are the ones that tend to behold the world. Sensing undertake noticing and collecting data through the senses. The intuition includes indirect perception by way of the unconscious: conjecture, imagination, and feelings. Learners will use both of these abilities; most will prefer using one to the other. Visual/Verbal learns [16] are individuals that intake information in 3 different ways: (1) visual – sights, images, drawings, symbols; (2) verbal – sounds and words; and, (3) kinesthetic – taste, touch, and smell. Visual and auditory learning both have to do with learning processes that observe information, and kinesthetic learning have to do with both perception such as taste, touch, and smell, and information processing such as moving, relating, or doing something active. Active/Reflective learns as stated in [16] process information that convert perceived information into knowledge consist of two categories: active experimentation and reflective observation. Active experimentation implicates doing something with information in the external world, such as debating it,

clarifying it, or testing it in some way. Reflective observation implicates investigative and manipulating the information introspectively. Sequential/Global learns [16] the sequential learner learns on a sequential manner will the global learners summaries the information. Sequential learners easily learn information that is presented in a logically ordered progression. They follow linear reasoning processes when solving problems, and can work with material even when they only have a partial or superficial understanding of it. Global learners tend to learn in bit at the time until they can see the big picture. As result, they may comprehend the material well enough to apply it to problems that leave most of the sequential learners lost.

VARK [17], consist on a questionnaire (16 questions) that provides users with a profile of their learning preferences. These preferences are about the ways that they want to take-in and give-out information. VARK preferences can be used to help develop, effective strategies for learning and for improving communication skills. VARK covers four dimensions Visual, Aural, Read/Write and kinetic.

3 Development

In order to prove that emotion can have influence in the learning process. A prototype was developed, a learning platform that takes into account the emotional aspect, the learning style and the personality traits, adapting the course to the student needs.

3.1 Architecture

The Figure 1 shows the architecture of the prototype. The architecture is divided in four major models: the Student Model, the Emotion Model, the Emotive Pedagogical Model and the Application Model.

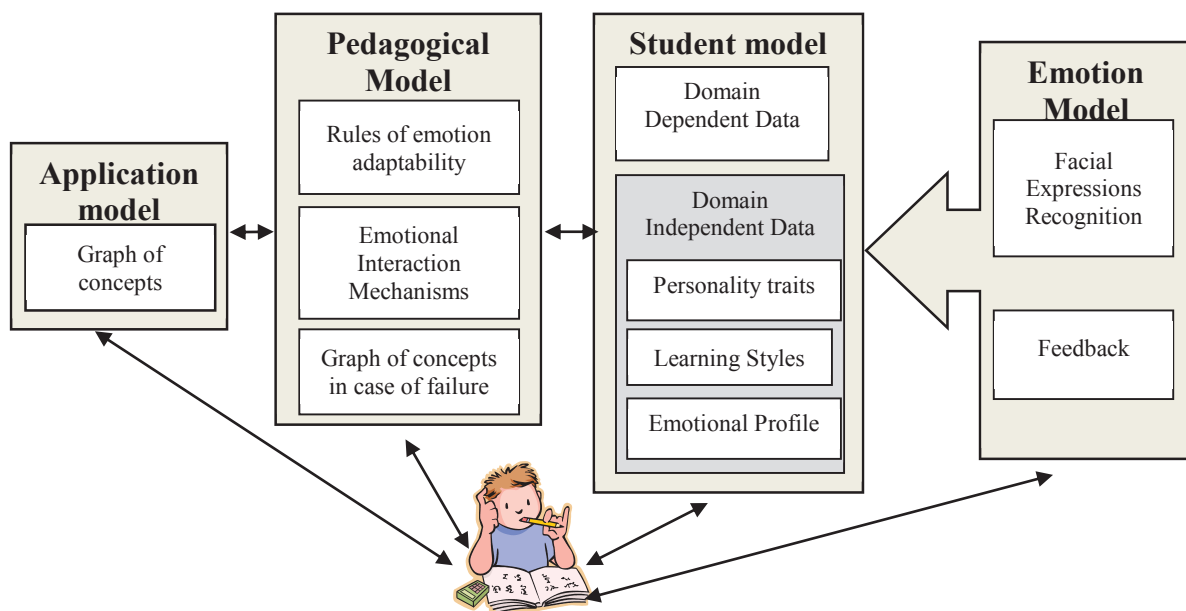


Figure 3: Architecture

3.1.1 Student Model

The student model consists in retrieving the student information and characteristics. This can include personal information (name, email, telephone, etc.), demographic data (gender, race, age, etc.), knowledge, deficiencies, learning styles, emotion profile, personality traits, etc. This information is useful to better adapt the prototype to the student needs.

3.1.2 Emotion Model

Facial Expression Recognition allows video analyses of images in order to recognise an emotion. This is done by making use of an API called ReKognition. This API allows detection of the face, eyes, nose and mouth and if the eyes and mouth are open or close. In addition specifies the gender of the individual, an estimate of age and emotion. In each moment a group of three emotions are captured and each one has a number that shows the confidence.

The feedback consists in a series of questions at the end of each subject. That aims to discover the impression and rate of the subject, the student has learned. Questions like: “Did you find this helpful?”, “How would you rate this subject?” ☆☆☆☆☆ or “What emotion are you feeling?”

3.1.3 Application Model

The application model is composed by a series of modules that contain different subjects. The subject consists in a number of steps that the student has to pass in order to complete the learning program. Some of these steps are optional, others are not.

First step is the subject placement test (PT) that can be optional. This is designed to give students and teachers a quick way of assessing the approximate level of a student's knowledge. The result of the PT is a percentage PTs that is added to the knowledge (Ks) of the student on a subject and places the student on one of five levels of knowledge. $kpt = \sum_{i=0}^5 exercise_i$

If the PT is not performed Ksp will equal to zero and the student will start with any level of knowledge.

The SC contains the subject explanation. The explanation of the subject depends on the stereotype (Student Model and the combination of learning styles, personality dimensions and motivations). Each explanation will have a practice exercise. These exercises will allow the students to gain points to do the final test of the subject. The student needs to get 80% on the TotalKsc to do the test.

The ST is the evaluation of the subject learned. It will give a value kst to the knowledge of the student on the subject. $kst = \sum_{i=0}^5 exercise_i$ Only if the kst is higher than 50% the student is successful in completing the subject. In this case the values of the ksp and kst are compared to see if there was an effective improvement on the student knowledge.

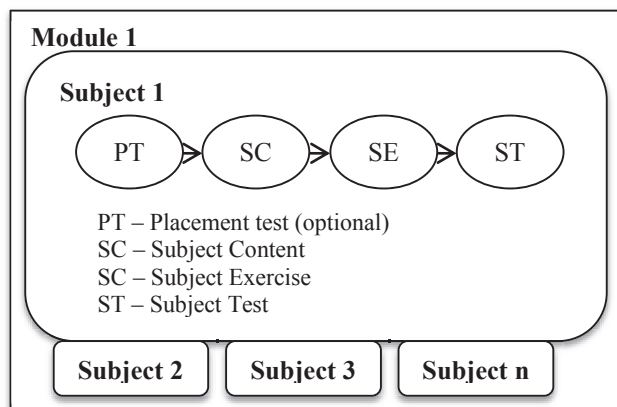


Figure 4: Concepts Graph

3.1.4 Emotive Pedagogical Model

The Emotive Pedagogical Model is composed by three sub models; the Rules of emotion Adaptability, the emotional interaction mechanisms and the Graph of concepts in case of failure. In each step of a subject the emotional profile is updated by facial expression recognition software. The emotional expression in order to establish an emotional profile and with this information make some adjustments to content of the application or trigger an emotional motivation action or emotional interaction.

The Rules of emotion Adaptability consist in the way the subject content is presented. The subject content is presented according to the learning style and personality of the student. For a determined personality there is a manner in how the information and exercises can be formulated and according to a specific learning style. The information and exercises can be presented a certain way that is more agreeable to the student.

The Emotional Interaction Mechanisms consist in triggering an emotion interaction, when an emotion is captured that needs to be contradicted in order to facilitate the learning process. The emotions to be contradicted are: anger, sadness, confusion and disgust. The interaction can depend on the personality and on the learning style of the student.

The Graph of concepts in case of failure are the steps to be taken when failing to pass a subject. To pass the module the entire subjects must be completed, and only with a subject completed you can pass to the next.

Inside of a subject the student has to complete the placement test, the subject content plus exercises with a grade equal or higher than 80% and the subject test with approval with a grade higher than 50% to complete the subject. In case of failure it has to go back to the subject content and repeat all the steps.



Figure 5: Graph of concepts in case of failure

1. CONCLUSION

To near the gap between a student and his learning platform in order to improve efficiency of the learning process, it is addressed in this paper, under the proposed approach for an adaptive learning system. This model will try to capture the emotional state of the student and together with his learning style and cognitive profile, will adapt the learning context to the learning requirements of student. In order to evaluate the prototype it has chosen a course of the first year of Polytechnic school of engineering.

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