EDUTAINMENT:
PLAYING AND LEARNING WITH MOTIVATION

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ABSTRACT

Game-based learning environment (GBLE) are structured and developed with media resources. The use of these tools can bring benefits in the teaching-learning process respecting criteria based on cognitive and motivational theories. There are many papers describing these theories in Brazil, however, few of them make use of the ARCS motivational model. The objective of this study is to assess how the motivational and the cognitive process are affected by the use of GBLEs according to the ARCS motivational model. With the purpose of measuring the dimensions of the theory, we will make use of the Instructional Materials Motivational Survey (IMMS) in a research with 160 students in a college course in Business Administration from a private University of the city of São Paulo. We will empirically demonstrate that the level of student motivation can be measured based on ARCS model and can be improved through the use of the GBLEs.

Keywords: learning, cognitive load, edutainment, games, motivation.

1. Introduction

The challenge of Brazil is to offer education for all its citizens, however is some regions where there is lack of resources as well as difficult access, this challenge becomes even greater. The distance education is becoming an alternative to education. In 2008 there was an increase of 96.9% of enrollment at the distance education modality over the previous year, while in the conventional classroom teaching this percentage was 10.6% according to the *Instituto Nacional* de *Estudos* e *Pesquisas Educacionais Anísio* Teixeira (INEP, 2009). Despite the growth, there is still concern about the quality issue. According to the second annual report of the United Nations Education, Scientific and Cultural Organization (UNESCO) in 2008, Brazil was in the 93rd position of the 129 assessed countries due to their indicators of quality in education. Besides the problem of quality the percentage of completion in undergraduate courses is not effective. According to INEP (2009) these percentages are distributed as follows: 67% in federal institutions, 64.3% in state institutions, 61.2% in municipal institutions and 55.3% in private institutions, which means that for every 100 students enrolled in 2004 in an undergraduate course of four years in a private institution, only 55 of the students have finished the course in 2008. We must highlight that this result is related to failure and dropout.

The dropout of students is one of the reasons the development of the country is impaired. Investments, both public and private, in teachers, staff, equipment and physical space are underutilized. According to Filho et. Al. (2007), the losses of students who started but did not complete their courses represent social, academic and economic waste. According to studies by UNESCO (2005), academic performance is one of the main reasons that can generate student demotivation consequently their dropout.

Perez et all (2006) has pointed that students demotivation is one of the main reasons of college dropout, according to study accomplished at the University of La Laguna, Tenerife.

An alternative to fight demotivation would be the use of Games-based learning environments (GBLEs). Gredler (1994) points out those games are challenging, fun and volunteers. Advanced researches are being conducted in this area, mainly in Europe, North America and Asia. Innovation in teaching

learning method through the use of virtual games is positive to the student satisfaction.

In northern Italy, the analysis of two groups consisting of students and company employees has been satisfactory. Some variables such as context, usability, freedom of behavior and pleasure were identified and compared. The participants have revealed that they liked the new methodology more than the traditional exercises and training. (PANNESE, CARLESIA, 2007). The experience has proved to be positive in the motivational aspect. The potential of games to improve motivation has been recognized by teachers and students in a survey conducted in Northern Ireland. (ORR; Mc GUINNESS; 2008). The experiment was conducted in five schools. Students were videotaped while playing in a learning environment, they have completed a questionnaire, the teachers were also interviewed and finally a qualitative market research was conducted with a group discussion (focus group).

With the purpose of explaining the student's motivation index we will make use of an instrument based on the Motivational Theory and the Cognitive Load Theory (CLT).

Although GBLEs can be a promising alternative in education, encouraging motivation, integration of students and satisfaction, it is a tool that should be used by respecting certain principles, avoiding its indiscriminate use. The bad structured of the GBLE may contribute to demotivation and even to the disruption of the learning process (ANG; ZAPHIRIS; MAHMOOD, 2007), situation that can be avoided by applying the principles of Motivational Theory and the CLT.

The excess of cognitive load expended by the student, especially by the less experienced ones, should be avoided through the use of some strategies (ANG; ZAPHIRIS; MAHMOOD, 2007). The goal of these strategies is to avoid unnecessary stress of students on irrelevant issues to learning; priority should be given to the most important ones. In order to get a satisfactory result in the use of games in education, it is necessary that this tool aligns with these cognitive and motivational principles.

According to Nelson and Erlandson (2008), the processing of multiple information increases the cognitive mental effort of students. GBLE with the

Motivational Theory demand multivariate tasks, contributing to the improvement of cognitive learning.

According to Keller (1983), there are common principles found in the literature of motivational theories in the learning process. He has identified and ranked them in the following categories: attention, relevance, confidence and satisfaction. After several years of research, these principles became well known as the ARCS model (Attention, Relevance, Confidence and Satisfaction). The instructional model was expanded (KELLER, 1987), and other variables, specially the volition and self-regulation were added to guide behaviors and attitudes that can help students to overcome obstacles and persist in their objectives (KELLER, 2008).

The ARCS model has been applied in research and has presented positive results. In a recent study by the ARCS model, 2345 post were analyzed in a 12 week course. According to these students, the support for motivation in learning was essential to ensure satisfactory results (LIN, JUAL, 2009). In this study significant results were indicated in relation to the dimensions of the ARCS model.

There are international studies related to the theme, however, in Brazil, there are no works that evaluate the impact of a GBLEs in the learning process based on the model ARCS and CLT.

Therefore the objective of this work is to assess how the motivational and cognitive process is affected by GBLE, (i) how is the impact of a motivational process of GBLE on the student learning?, (ii) how is the impact on the mental effort of students in GBLE having as base the cognitive theory, (iii) what is the relationship between motivational process and the cognitive process according to the ARCS model (KELLER, 1983).

The ARCS is an instructional model used to guide the construction of virtual learning environments (VLEs). The characteristics of the motivational process were classified into four basic principles, attention, relevance, confidence and satisfaction.

The first principle, attention is related to the stimuli and curiosity of students. The purpose of this feature is to gain the attention of the students through exciting graphics, animations, problems and other techniques, all of them directed at encouraging and maintaining the curiosity of students. The

second principle, the relevance is associated to the student's perception on the content learned. The challenge is to give meaning to the content in order to make the student realize the value of the knowledge being acquired. The third principle, confidence concerns to the encouragement of the students in building positive expectations about the success, demonstrating them that the result is related to his own effort and investment rather than external factors, as for example, luck or low degree of difficulty of the test. The fourth principle, the satisfaction is related to the feeling of the students on the content learned. The fifth principle, the volition (KUHL, 1987), is related to the behavior and students attitude to overcome obstacles and achieve goals. It is important to say that there are three concepts that support this principle, active control (KUHL, 1987), additional implementations (GOLLWITZER, 1999) and self regulation (ZIMMERMAN, MARTINEZ, 1986), it concerns basically to the use of strategies to support his own learning. Cheng and Yeh (2009) have concluded in their research that the instructional material contributes to the improvement of the learning process.

According to Keller (2008), in his theory of motivation, volition and performance (MVP) the complete cycle of motivation in learning is divided into the following stages: motivation and volition, processing the interface of motivation and information processing, psychomotor and information results. The implication of this theory is to avoid competition between the stimuli and the cognitive overload of the student.

With the objective of measuring the dimensions of the motivational theory, Keller (1993) has developed a model called Instructional Materials Motivational Survey (IMMS). Huang et al (2006) reported positive points on the validation of the instrument.

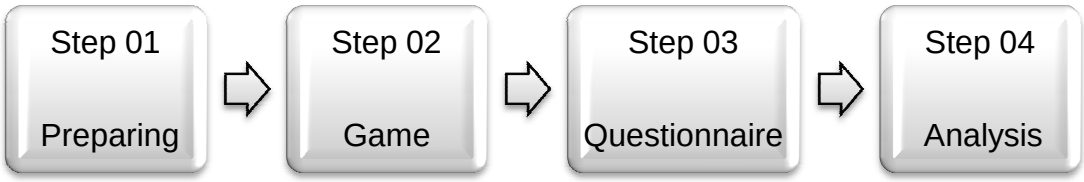
Moos and Marroquim (2009) have measured the impact of the use of multimedia, hypermedia and hypertext in the motivational process through the ARCS model as well as have stressed the importance of CLT. According to Mayer and Moreno (2003) the cognitive load takes the lead role in developing the environment. In their study they have shown nine strategies to reduce cognitive overload in an environment of learning based on multimedia.

The CLT is based on the limitation of human beings to process information simultaneously. According to Mayer (2001), the use of multimedia

resources generally requires more than one channel of student's perception. For Mayer, there are three main types of cognitive load; intrinsic cognitive load, cognitive natural load and cognitive external load.

The intrinsic cognitive load is related to the content complexity of teaching materials. The natural cognitive load is related to activities that support the learning object and the cognitive load is related to the external elements that do not help in the cognitive process; it consists of elements that require cognitive effort, but they do not contribute positively in the results. Therefore, based on CLT, to achieve better efficiency in the learning process, the stimulus of external cognitive load should be reduced.

2. Metodology



Step 01 – Preparation: the test will be applied in an information technology laboratory, four groups of up to 16 participants. The participants will be instructed to read the economic theory and the basic instructions of the game before it starts. This information will be available on GBLE.

Step 02- Game: the game "Trade Ruler" developed by the renowned Nobel Prize Foundation has been chosen to develop this work because it is based on an economic theory and also because it has been developed with media resources, which are suitable for the purposes of this study. The game can be accessed at http://nobelprize.org/educational_games/economics/.

Besides that, this game is subsidized by the Heckscher-Ohlin Theory, winner of the Bank of Sweden Prize for Economic Sciences in 1977 for contributing to the theory of international trade and international capital movements. The study presents the comparative advantages of countries to negotiate among them.

GBLE is constituted of four distinct islands due to the distribution of its resources workers and capital. The traded products are jeans and cell phones, products which are directly related to available resources. The player should choose one of the islands and customize his avatar.

The production of goods is defined by the player and it is possible to negotiate it for three times at the most. This process is repeated twice. The conceptual feedback is performed at the end of each transaction. At the end of the third and last transaction the expected and achieved results are presented by the use of graphs. The results presented are related to the island of the player, the maximum expected results of his island and the maximum expected results from another island and finally the classification of the player.

Step 03 – Quiz: it consists of 20 questions based on the Likert Scale with scores that range from 01 to 09; the classification ranges from “strongly disagree” to “strongly agree”. The items are related to the motivational theory and they observe the basic motivational principles which are: attention, relevance, confidence and satisfaction (KELLER, 1987). An issue related to the intrinsic cognitive load presents grades which range from 01 to 09, its classification ranges from “very low mental effort” to “very high mental effort”; a question related to the natural cognitive load presents grades that range from 01 to 09 and the classification varies from “very easy” to “very difficult”.

Step 04 – Review: four dimensions of the ARCS model are assessed, in this first part of the questionnaire consisted of 20 questions the higher the score found, the better. So, if the grade is 09, the assessed dimension will be fully complete, contributing to the motivational process. As for the question related to the intrinsic cognitive load the higher the score, the better, if the grade is 09 the CLT dimension will be fully met. On the question related to the natural cognitive load, the lower the grade the better, if the score is 01 this dimension will be fully met.

Sample: the sample will be of 160 participants from a Business Administration undergraduate course of a private college located in the city of Sao Paulo.

Instrument: the evaluation instrument for validation of this study is the IMMS Scale (HUANG et al, 2006). This instrument was developed having as base the motivation theory (KELLER, 1993).

Expected Results

The expected results for this work are:

(I) To identify the effects of a game based on the ARCS motivational model in the index of the student motivational process.

(II) To identify the effects of a game based on the theory of the cognitive load, in the cognitive process of the student.

(III) To identify if there is any relation between the cognitive and motivational process that might support the theory of motivation, volition and performance.

(IV) To demonstrate empirically through models that the index of students motivation can be measured having as base the ARCS model. We also would like to observe if this index can be improved by the use of virtual games. We still intend to identify if there is a relation between GBLE, the motivational and the cognitive process of students.

The result of this work could direct the actions of the actors involved in the teaching/learning relation in virtual learning environments (VLEs), minimizing the indiscriminate use of technological tools to support education, specifically the games as well as directing future researches to the study of the relationship between the virtual games, motivational and cognitive processes of students.

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