



Design And Development Of A Digital Game-Based Learning System Using Input-Process-Output Game Theory And Data Mining Techniques

Ellenita R. Red

Malayan Colleges Laguna, Pulo Diezmo Road, Cabuyao, Laguna, 4025, Philippines

E-mail: erred@mcl.edu.ph

Abstract

Digital Game Based Learning (DGBL) has been used as an instructional tool towards the learning growth of students. It is said to be an effective way of teaching since it combines fun and learning in a way that students become motivated and more engaged in using the system. While the number of educational media application increases, the need for an effective methodology in ensuring retention and learning gain is critical. There are many ways in improving an educational game such as utilization of appropriate game design and application of data mining techniques. Game design deals with ensuring a high level of engagement and interest from a student while interacting with the digital game based learning system. The digital game based learning system design made use of defining elements which consists of fantasy, rules, stimuli, challenge, mystery and control or the Input-Process-Output Game Theory, these elements must be integrated and weaved in the design of the game to make it an effective teaching tool that brings fun and engagement. Four game modules were developed which are categorized as classroom, playground, canteen and gym. On the other hand, the test types were categorized per level: easy, average and difficult. Also, this DGBL includes a pedagogical agent which provides motivation by giving appropriate phrases such as “you are doing great” whenever a student gets a perfect score and “you can do it” whenever a student gets a low score in a particular module. The DGBL was further enhanced by the addition of a Dashboard which shows the performance of students per level of difficulty in all the modules of the game and an extraction interface for the retrieval of the different attributes needed for data mining from the game’s database. A Machine Learning tool was utilized to analyze the dataset extracted from the game’s database and Descriptive and Classification Data Mining techniques were utilized to analyze the game play patterns of dataset collected from the game. The study was conducted in four public elementary schools with a total of 128 student records collected from Grade 4 students after using DGBL called “Word Infection” to record their gameplay patterns. A Pre-test and post-test were administered so that there can be a gauge of how knowledgeable students are before and after they use the system. Generally, the students had started slow at the beginning of the game up to the average level and were able to pick-up pace and performance in the difficult level. A usability test was conducted to know the perceived usability, usefulness, and relevance of content of the DGBL to validate the effectiveness of game design and majority of respondents strongly agreed of its usefulness and would recommend it to be used by others to improve their vocabulary. Four clusters were produced to represent the different gameplay styles of the students: gaming, proficient, productive and idle. A model that classified game play patterns of student’s performance is J48 or decision tree algorithm with accuracy and kappa statistic of 52.34% and 0.216 or fair agreement.

Keywords: Digital Game Based Learning System, Game Design, Game Elements, Sequential Strategy, Language Learning, Student Performance