

Work In Progress-An Innovative Web-Based Game to Illustrate Basic Traffic Control and Safety Concepts

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Abstract - Effective education in the field of traffic operations and control requires efficient delivery of theory, applications, and live demonstration or tutorials to help students understand the subject. While practical engineering knowledge is usually imparted through carefully designed experiments conducted in laboratories, traffic operations require repetitive observation of traffic behavior (or simulated traffic) under different control actions. This paper describes a web game developed on a .NET framework to complement a Traffic Engineering course. The game is assessed for its impact on student engagement using survey questions based on the Situational Motivational Scale (SIMS).

Index Terms –Assessment, Traffic Control, Traffic Engineering, Web Game.

INTRODUCTION

The field of transportation engineering requires high levels of both practical expertise and conceptual knowledge. In general, practical knowledge is imparted through carefully designed experiments conducted in laboratories. However, while analysis of traffic stream and traffic signals can be done through simulation, it may be difficult for beginners to work through simulations and understand the concepts as applied to real-world conditions. Furthermore, students must iteratively practice control concepts in order to master material, which may not be engaging for many learners.

To bridge this gap, one viable solution is the development of a web game. Computer-based Educational Games can be modeled to deliver specific learning objectives and can pave the way for adaptive learning and role-play and simulations[1]. Since games can be recreational and engaging, the introduction of a game into a course can motivate students toward better understanding by iteratively covering the course material [2]. This paper describes a web game designed to supplement traditional teaching materials used in a transportation course to help the students understand basic traffic engineering concepts.

DESCRIPTION OF THE GAME

When traffic signals change from green to yellow, drivers have to decide whether they can safely stop (at an acceptable deceleration rate) or continue and clear the stop line before the

start of red. The decision to be made is relatively easy when the driver is close to the intersection or far away from the intersection. But in the interim distances the driver falls into ambiguity whether to stop or go ahead. This zone of ambiguity is called the “Dilemma Zone.”

The objective of the game is to help students understand what might be the drivers’ decision at the onset of yellow based on the existing traffic conditions. The player who is playing the game has to determine the safe time to give the yellow signal so that the least number of cars in the dilemma zone exist and the hazard for the traffic is minimized. There is a countdown timer (**Counter**) starting from 40 and ending at 0. The player has to choose the time before the countdown ends to terminate the green and give the traffic the yellow. The most commonly used dilemma zone boundaries are 2 to 6 seconds of time to reach the intersection, and these values are used as the lower and upper boundaries, respectively. The game is programmed so that it retrieves the decision of the driver from a pre-loaded database. A hazard function is programmed as a dependent on the time to the intersection of each vehicle present in the dilemma zone. The hazard function calculates the hazard value for the traffic and renders it onto the screen. The game provides feedback in the form of **Hazard Value**, **Least Hazard value**, and **Time to Least Hazard Value**. As an instant visual feedback the cars that are caught in the dilemma zone are shown in red and the rest of the traffic is shown in green. The game has two databases in the background which help to collect the information and send decisions to the traffic. The help files in the game provide students with information about both playing the game and about the course content.

The game is programmed in C# ASP.Net. Microsoft Access was chosen to create the two databases used in the game. The game architecture used in the game is the three-tier architecture which is a part of N-tier architecture of the .NET framework[3]. The user interface is created using C# and web interface using ASP.

PRELIMINARY STUDENT ASSESSMENT

The assessment of engagement with the game was conducted by completing a questionnaire with 16 questions framed on the Situational Motivational Scale (SIMS) developed by Guay, Vallarand, and Blanchard [4], using a 7-point Likert-type scale. The results of the survey are presented in Figure 1. The figure includes four different graphs elaborating the four

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different constructs in the self determination theory, namely intrinsic motivation, identified regulation, extrinsic motivation and amotivation. *Intrinsic motivation* describes situations in which a person is interested in performing an activity for itself, in order to experience pleasure and satisfaction inherent in the activity. This type of motivation is the most self-determined and desirable for learning. The other types of motivation represent a continuum of self-determination, with *amotivation* being the least self-determined in which there is no sense of purpose and no expectations of reward or possibility of changing the course of events. The graphs in Figure 1 show increases in intrinsic and identified regulation, and a negligible number of amotivation scores.

We also conducted a student focus group at the end of the semester to hear feedback from students. They stated that the game was relevant to learning in general in the course, in contrast to games they had played in other courses. For example, compared to a “virtual stock exchange” game they played in another engineering course, this one was “very relevant to the class,” and they were more motivated to do the homework associated with the course module. Students also stated that game modules dealing with more complicated subjects would be even more effective, and that this game

would be very useful in an introductory course on Transportation Engineering.

CONCLUSION AND FUTURE WORK

A web based game has been developed to help students to gain understanding of the basic concepts of a course. The game format aims to supplement traditional methods and positively engage students. The game is carefully designed to emulate realistic traffic behavior at intersections so that students can learn visually in addition to listening to lectures and reading the text.

The students’ responses to the survey suggest that the game has been successful as a motivating tool for the students and helped them understand the concepts better. The assessment clearly indicates that a well crafted game in a course might be a fun activity for students working in tandem with meeting the learning objectives of the course.

The future work is to analyze the results obtained in the students’ homework through statistical tests in order to better understand the direct impact of the game in the performance of the assignments.

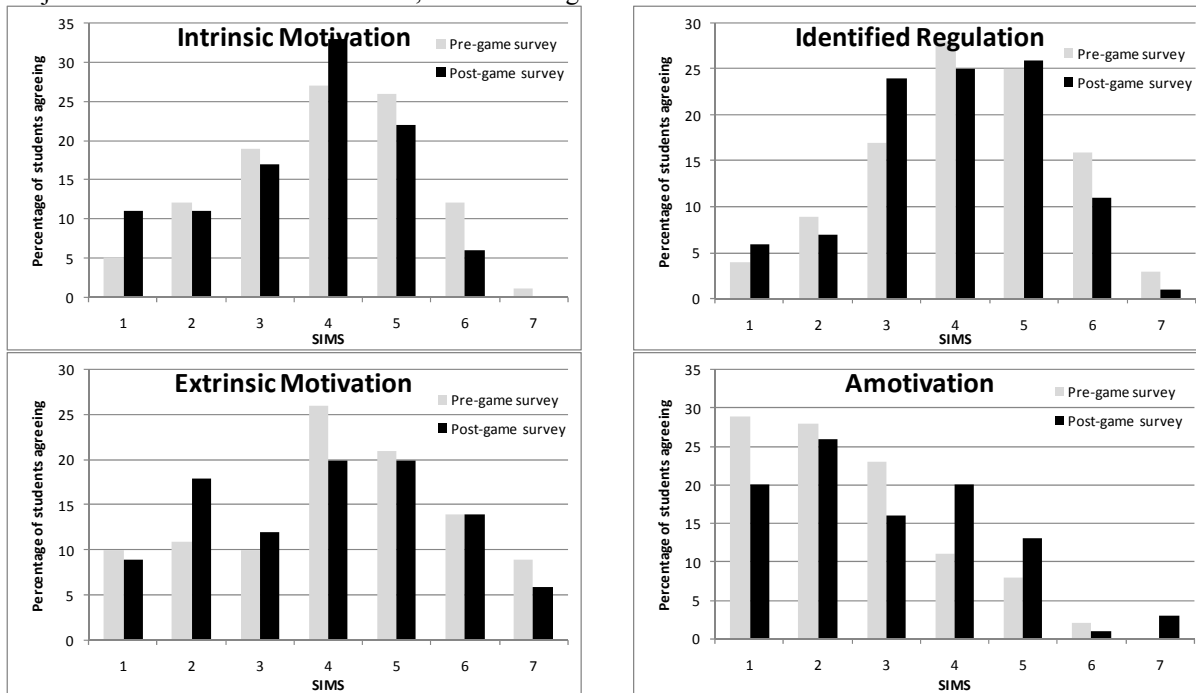


FIGURE 1: GRAPHS SHOWING THE SURVEY RESULTS OF CONTINUUM OF MOTIVATION CONSTRUCTS IN SELF-DETERMINATION THEORY

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