LTRC RESEARCH PROJECT CAPSULE

JANUARY 2010

10-1SS

TECHNOLOGY TRANSFER PROGRAM

Evaluation of Knowledge Transfer in an Immersive Virtual Learning Environment for the Transportation Community

JUST THE FACTS

Start Date:
January 1, 2010

Duration:
12 months

End Date:
December 31, 2010

Funding:
LTRC

Principal Investigator:
Glynn Cavin, Ph.D.
TTEC Administrator
225-767-9112

Co-Principal Investigator:
Mary Leah Coco, M.S.
TTEC Training & Development Program Staff Mgr.
225-767-9167

Administrative Contact:
Mark Morvant, P.E.
Associate Director, Research
225-767-9124

Technical Contact:
Glynn Cavin, Ph.D.
TTEC Administrator
225-767-9112

SPECIAL POINTS OF INTEREST:

- Problem Addressed
- Objectives of Research
- Methodology Used
- Implementation Potential

PROBLEM

In 2008 alone, 720 individuals were killed in a construction or maintenance work zone in the United States. However, since 2003, the total number of individuals killed in a construction or maintenance work zone in the US reached a staggering 5,771 (National Work Zone Safety Information Clearinghouse, 2009). Through an Immersive Virtual Learning Environment (IVLE), this number can be reduced by offering an environment that will allow active experimentation with work zone safety flagging procedures. Currently, active experimentation in a work zone in not plausible for safety reasons, but this IVLE will allow experimentation in a safe and supportive learning environment. This active experimentation will provide learners with an opportunity to apply concepts in a realistic, although simulated, environment.

The proposed research project will test the use of web 3D technology in an IVLE simulating real-world highway work zones. The IVLE supplements traditional course content and delivery methods to enhance the transfer of work zone safety procedure knowledge. This learning environment consists of real-life case studies within a 3D virtual world, similar to a CAD-like environment. The research is unique due to the evaluation of effectiveness of the knowledge transfer across socioeconomical, racial, and generational differences. Studies show that learners are more apt to apply encoded instructional knowledge in the IVLE because mistakes can be made without negative consequences, encouraging application and building confidence (Blumel, Termath, and Hasse, 2009). This research will expand the scientific knowledge of adult education, specifically that which deals with knowledge transfer in an IVLE as it enhances and supplements traditional learning through blended delivery methodology. This ground-breaking research motivated the establishment of a strong partnership bringing together the practical adult education experience of the Louisiana Transportation Research Center (LTRC) (in-kind contribution of approximately $275,000), the technological expertise of the University of Louisiana at Lafayette's (ULL's) Louisiana Immersive Technology Enterprise (LITE) (in-kind contribution of $120,000), and the scholarly capability of the Louisiana State University's (LSU's) School of Human Resource Education and Workforce Development.

OBJECTIVES

The objectives of this research study are as follows:

- Determine the factors for a successful implementation of an IVLE in a work zone safety course.
- Evaluate demographics and provide a comparison to the success rate of those in the IVLE as it relates to demographic information.
- Compare the traditional course delivery method to the blended course delivery method.
- Examine participant responses in the IVLE (e.g., reaction time, problem solving' decision making, and accuracy).
- Identify key benefits associated with the IVLE.
- Determine potential risks that cause project failure and how to overcome these risks.
- Evaluate quantitative information as it relates to the IVLE.

METHODOLOGY

An extensive review of current literature on IVLEs aided in identifying gaps in the current body of knowledge as it relates to the implementation and evaluation of an IVLE with a heterogeneous group. Literature identified crucial gaps in the understanding of knowledge transfer with an IVLE as the delivery system of information.

A quasi-experimental design (control and treatment) will be utilized for this research study. The sample will be drawn from the following sources: the Louisiana Department of Transportation and Development, local government, and utility and construction company workers. A mining of multiple databases of the accessible population will result in lists of individuals who are required or interested in participating in the Basic Flagging Procedures course (approximately 250 individuals as the target sample). Trainings will be conducted at the Transportation Training and Education Center (TTEC) over several weeks in the spring of 2010, beginning in mid-March.

As a result of blind selection as to which courses (control or treatment) will be held on which date, the probability of randomization improves. Invitations will be sent to the accessible population to participate in the course in which participants will be able to select from 15 available class dates; however, participants will be unaware as to which class is control or treatment. The total sample size will be split randomly and equally between the control and treatment groups. For practical reasons and to obtain an optimum instructor-to-student ratio, trainings will be conducted in small groups (20–25). Control groups will be trained using existing instructional design and delivery methods, which includes group exercises. The treatment group will also use the existing instructional design; however, the group exercises will be replaced with individual activities that occur within the IVLE. To minimize an internal threat to validity, the same individual for each training will present the lecture.

A pretest and posttest of the course content will be created and pilot-tested prior to implementation in the class. Once this testing is complete, the final instruments will be used as the pretest and posttest in each course session. A demographic survey will be administered for the purpose of determining possible correlations of learning transfer success and propensity to use technology within various demographic groups. A fourth instrument will examine the treatment group's use of technology and their level in which they use technology. This instrument will be pilot-tested and will be administered after participants engage in the IVLE. An IVLE utilization detection database will be embedded in the IVLE software and will gather data on the movements of the participants' avatars and how well they were able to apply the lecture material to given scenarios. At the conclusion of the class, a fifth instrument will be used for treatment group interviews for qualitative research of their affective state regarding acceptance of, and knowledge transfer from, participation in the IVLE. These interviews will provide a more in-depth understanding of the participants' perceptions of their IVLE experiences and identify what changes are suggested to improve the IVLE.

The researchers' parent organization, LTRC, has formed a partnership with ULL's LITE for the purposes of this project. LTRC will provide LITE with training scenarios for this course. LITE will then develop the IVLE for the scenarios, which will include tracking database software embedded in the scenarios to track each participant's movements during their training. This database will be used for analysis and to refine of the scenarios.

Computer skills for this project will be minimal as LITE's programs will only require participants to operate the computer using one simple input device, similar to those commonly utilized in computer games. This will aid in reducing the computer use learning curve and users' anxiety. Each participant will see themselves as an avatar in the IVLE and will be able to move their avatars to perform the required flagging training.

Reliability will be determined for each instrument used in this study and an item analysis will be conducted on the knowledge-based instrument in order to establish a sound assessment instrument. A pretest will be used to check for equivalence of groups prior to the treatment. If group equivalence is not established, then the pretest score will be used as a covariate. Analysis of variance will be utilized to compare the posttest scores of the control and treatment groups and an effect size will be calculated (if necessary the pretest will be used as the covariate). Correlation will be used to compare the treatment group's posttest scores to the technology instrument mean score. If the correlation is significant, a regression analysis will be used to determine the amount of variance, if any, in the posttest score of the treatment group which may be explained by the participant's use and knowledge of technology. Interviews conducted with the post-treatment group participants will be analyzed using grounded theory and will be utilized for program improvement.

IMPLEMENTATION

The research findings will be reported in subject specific monographs and journal articles (e.g., *Advances in Human Resources* and *Journal of Technology Education).* The areas of practice impacted by this research will be instructional design of both internal and external training initiatives. Technology will be utilized in courses where it will increase the learning transfer and where real-life practice is beneficial to the learner. Those affected by this research study will be transportation workers (public and private sector), maintenance and construction work zone crews (public and private sector), instructional designers (primarily internal), adult educators (primarily internal), and higher education. This research will be utilized to gauge if the knowledge transfer is increased by the use of an IVLE, thus all findings will be shared with, but not limited to, the National Transportation Training Directors (NTTD), Transportation Research Board (TRB), National Highway Institute (NHI), LSU, ULL, and other industry partners.