Short and Long-Term Impact of Active Simulations on Student Learning and Retention [1]

Matthew R. Hallowell

Students in my courses are challenged to learn and apply concepts like risk analysis, contract management, and project delivery with very little or no prior professional experience. The lack of professional context can make it difficult for students to make the emotional and experiential connections that can drive learning and retention. However, in lieu of professional experience, students in applied courses can apply *personal* experience during simulation activities to enable learning and contextualization of new knowledge[1]. For example, students may not have experience in construction but the theory of productivity measurement, optimization, and risk can be simulated through the building of small-scale models.

I plan to conduct an experiment with my students to test the hypotheses that active simulations (1) increase positive emotions, interest, and achievement of learning objectives in the short term and (2) improve achievement of learning objectives in the long-term (retention). I will test three simulations: a risk simulation that shows the relationship between probability and severity for various project scenarios; a dispute resolution simulation to illustrate the theories of contract law; and a project delivery simulation to show the interchange of information among designers and constructors under project delivery scenarios.

I will test the hypotheses in two sequential courses that I teach each year (CVEN 3246 Introduction to Construction and CVEN 3256 Construction Equipment and Methods). The first course is a pre-requisite for the second and approximately 80% of students in CVEN 3245 take CVEN 3256 the next term (n=50). This offers me the unusual opportunity to perform longitudinal study with internal controls and measure differences in knowledge retention over an extended period of time with a sufficient sample size.

My overall strategy is to establish a set of baseline control measurements, implement three new active simulation methods, and measure short and long-term impacts on learning and retention by comparing to the baseline control. The specifics of the two-year study are detailed below.

1. Term 1: I will establish a baseline control measure of emotional response, situational interest, and achievement of learning objectives in CVEN 3246 when using my traditional means of teaching. I will measure emotions with Rotenberg's emotional valence questionnaire[2] and interest with the individual interest scale[3]. I will measure the achievement of learning objectives using standardized and anonymous quizzes that will be completed in class. I will also ask students to keep learning logs to reflect on their depth of knowledge, approach problems, and application of knowledge.
2. Term 2: I will establish a baseline measure of long-term ability of students to achieve the learning objectives from CVEN 3246 (retention) resulting from teaching using traditional teaching means from Term 1. I will make this long-term baseline measurement at the

start of CVEN 3256 in Term 2 for those students who participated in CVEN 3246 in Term 1.

3. Term 3: I will introduce risk, contract management, and project delivery simulations in CVEN 3246 and measure emotional response, situational interest, and achievement of learning objectives using the same protocol as Term 1. Again, I will also ask the students to keep learning logs. This will be a new cohort of students who were not involved in Terms 1 or 2.
4. Term 4: I will measure of the long-term ability of students to achieve learning objectives (retention) using simulations in CVEN 3256 using the same protocol as Term 2.
5. I will test the hypotheses by comparing the results from Terms 1 to 3 and Terms 2 to 4.

This plan will allow for longitudinal study of a cohort of students and comparisons across teaching methods. The learning logs will provide an important opportunity to qualitatively assess depth of knowledge and why any differences were observed. As with my previous research on teaching and learning, I will publish these results in an academic journal and will share my results with the members of the President's Teaching and Learning Collaborative Boulder Campus that I presently direct.

[1]Ruben, Brent D. "Simulations, games, and experience-based learning: The quest for a new paradigm for teaching and learning." *Simulation & Gaming,* 30.4 (1999): 498-505.

[2]Rottenberg J., Ray R. B., Gross J. J. (2007). "Emotion elicitation," in Emotion Elicitation & Assessment, Oxford Univ. Press.

[3]Garcia, L.L. et al. (2010) "Measuring situational interest in academic domains."
Ed. and Pysch Measurement, 40(1): 1-25.

Groups audience:
President's Teaching Scholars Program

Source URL:https://www.cu.edu/ptsp/short-and-long-term-impact-active-simulations-student-learning-and-retention

Links
[1] https://www.cu.edu/ptsp/short-and-long-term-impact-active-simulations-student-learning-and-retention