

Chapter 28

E–Learning Effectiveness in a Quantitative Course: Theoretical Versus Industry–Related Discussion and Exam Questions

Kenneth David Strang

*APPC Market Research, USA & State University of New York, USA
& University of Technology, Australia*

ABSTRACT

A quasi experiment compared the effectiveness of discussion question types on exam scores in an online quantitative methods course at an accredited university. Correlation, ANOVA and MANCOVA were utilized to test the hypothesis that questions exploiting industry examples would increase discussion interaction volume and exam scores more than using theoretical problems. Demographic factors (age, gender), semester timing, and prior ability were tested for moderation/mediation impact. Instructional method, professor, course content, assessment rubrics, and learning context were controlled. The treatment consisted of enhancing all discussion and examination questions from the materials and assessments to approximate authentic industry scenarios. A statistically significant model was validated, using exam question types as a factor, and a count of online discussion interactions (as a covariate), to measure problem-based learning effect on exam score.

INTRODUCTION

Just as higher education practitioners are applying proven education psychology principles to Higher education practitioners are gradually transforming successful classroom teaching techniques

into the online context. Learning Management Systems (LMS) allow educators to leverage communications technology to reach more students. Asynchronous discussion forums and synchronous interaction software (such as Skype) can be used to facilitate e-learning in place of the physical teaching context (Cox, Carr, & Hall, 2004). Modern technology is already being used in the

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workplace for virtual knowledge collaboration (Strang, 2008a, 2009a, 2010a; Strang & Chan, 2010) so it makes sense to encourage students to improve their online interaction skills. Certainly busy working students appreciate the convenience of online education (according to feedback). Nevertheless, teaching online courses effectively takes more effort as compared to the classroom (Evans et al., 2007).

Online quantitative (math-oriented) courses rely heavily on discussions and experiential exercises since interactive lectures and problem-based activities are challenging with online delivery modes. On average, quantitative subjects such as algebra, operations research, finance, and statistics are challenging in the classroom yet more difficult to learn online (Affouf & Walsh, 2007; Cybinski & Selvanathan, 2005; McCabe, 2007; Mills, 2004).

For this reason it is argued online discussions and problems in quantitative courses should be motivating and relevant so as to improve the e-learning experience and effectiveness. In particular, due to the volume and complexity of concepts in the materials, it is asserted that all lecture discussions and problem-based learning questions should apply relevant industry examples rather than theoretical exercises (leaving the text and videos to explain principles). Following this strategy, the way problems are phrased could impact e-learning outcomes.

Literature Review

Just as higher education practitioners are applying proven education psychology principles to e-learning, researchers are replicating experiments to examine cognitive phenomena in the online context. The following sections cite relevant studies and experimental approaches.

Importance of Question Relevance in Problem-Based Learning

The educational psychology literature shows that the choice of written and spoken words impact cognitive functions such as memory retention/recall (Ausubel, 1963; Weinstein, 1991). Replications of early sociological studies testing word impact found that “the tone of word makes a difference here not only in marginals but in a fundamental bivariate relationship” (Schuman & Presser, 1977, p. 155), to a statistically significant level ($n=1430$, $\chi^2=35.75$, $p<0.001$). In fact Schuman and Presser (1977) determined “when the same question is asked in two or more ways, our work suggests that form effects occur with enough frequency so that researchers need to be wary of correlations based entirely on a single question form” (Schuman & Presser, 1977, p. 168). While their work tested USA students using surveys, it is argued discussion and examination question wording impacts e-learning.

Studies show using authentic problems and experiential activities will improve learning (Schunk, 2004). A somewhat relevant experiment arranged problem type as a treatment in an educational psychology course finding that questions relevant to the subject with feedback and graphs improved knowledge retention and score on subsequent tests (Campbell & Mayer, 2009). Campbell’s colleague Mayer is well known in the literature as an advocate of using experiential and authentic problem-based learning to improve online courses (Clark & Mayer, 2003; Mayer, 2003). Campbell and Mayer recommend the “appropriate use of questioning as an instructional method” (Campbell & Mayer, 2009, p. 757), referring to the problem content and disciplinary relevant manner exercised are presented to students.

While there is not a great amount of e-learning research on this, several studies of online courses indicate that authentic experiential learning approaches improve problem-based learning (Clark & Mayer, 2003; Moreno & Mayer, 2000;

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