Using the Personal Response System and the Interactive Whiteboard to Improve Teaching and Learning in Graduate Level Courses

Project Category: Programmatic and Multidisciplinary Improvement
Research on Teaching and Learning

Principal Investigator Jennifer Randall, Assistant Professor
Educational Policy, Research, and Administration Department; School of Education
171 Hills South
413-545-0227
jrandall@educ.umass.edu

Signature

Investigators

Craig Wells, Assistant Professor
Educational Policy, Research, and Administration Department; School of Education
158 Hills South
413-545-1726
cswells@educ.umass.edu

Signature

Lisa Keller, Assistant Professor
Educational Policy, Research, and Administration Department; School of Education
150 Hills South
413-545-1528
lkeller@educ.umass.edu

Signature

Project Abstract: We propose an on-going project which will modify and extend the year-long community of practice program, initiated and implemented through the Center of Learning and the Office of the Provost for large undergraduate lecture courses, to smaller, more demanding graduate level statistics and assessment courses in the School of Education. Our goal is to work collaboratively at the programmatic level to increase the statistical self-efficacy and decrease the math anxiety levels of graduate students and pre-service teachers, thereby improving student learning.

Funds Requested: $15897.16

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Joe Berger, Department Chair
Educational Policy, Research, and Administration

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Christine McCormick, Dean
School of Education

The purpose of this project is to improve the formative assessment procedures and capabilities, and consequently teaching and learning, in cognitively demanding graduate level statistics courses. The widespread use of Personal Response System (PRS) technology in large undergraduate courses across the UMass campus to help engage students by providing timely feedback and encouraging classroom interaction has led to the development of a PRS Community of Practice where faculty across several disciplines work collaboratively sharing PRS-specific instructional strategies. We applaud this innovative approach to instruction in large courses, and believe that the potential benefits of such technology can be realized at all academic levels regardless of class type or size particularly when assessing student understanding of increasingly difficult course material. This project/study seeks to provide evidence that the use of the PRS system, along with interactive whiteboard technology, will increase the mathematical/statistical self-efficacy as well as decrease the mathematical/statistical anxiety of graduate students in particularly challenging higher level statistics courses by providing timely feedback to instructors and students as well as opportunities for students to truly interact with the course material. By developing a common statistical curriculum in the Research and Evaluation Methods Program (REMP) within the School of Education, which maximizes the instructional and assessment benefits of the PRS/Interactive whiteboard, we aim to determine, describe, and share best practices with other graduate level faculty.

Using the current Community of Practice Program, established under the direction of the Office of the Provost and the Center for Teaching, as a model, this project will support teaching improvement at the programmatic level as well as research on teaching and learning. Because REMP statistics courses are heavily attended by graduate students from several schools and departments, we contend that our project, and its approach to formative assessment, will provide long-term benefits to graduate students and pre-service teachers across the campus. To that end, we are requesting $15,897.16 to both implement and maintain our proposed project.

Project Narrative

Graduate level statistics, unlike undergraduate, courses are typically taught once a week for 2.5 hours. Because statistical understanding is progressive in nature, i.e. one must understand a simpler concept in order to understand the successive, more complex concept, instructors often assign homework, distribute quizzes, and do in-class exercises to insure on-going student understanding of course content. These methods of formative assessment, however, rarely provide the instructor with *immediate* feedback. Homework and quizzes must be graded after classes and then returned the following week. In-class exercises provide the *student* with some feedback, but the teacher is still left with only a general impression of student competency levels. Even if the instructor allots time at the beginning of class for student questions and frequently asks questions through formal and informal review sessions, a true measure of student understanding will not be clear until homework or quizzes have been reviewed. This process is ineffective for both students and teachers as often students 1) mistakenly believe they understand a concept completely or 2) are too embarrassed to indicate they do not understand a concept completely; and teachers must rely heavily on student verbal feedback when formatively assessing student learning in class without the benefit of knowing homework or quiz performance. This disconnect between perceived and actual understanding is troublesome in any subject area, but particularly disconcerting within the fields of mathematics and statistics as many studies have documented high levels of math anxiety in both undergraduate and graduate students (Calvert, 1981; Berstein et al., 1992). Zanakis and Valenzi (1997) report that test taking and lack of statistical understanding were the greatest sources of anxiety among business students; and Zimmer and Fuller (1996) found a relationship between statistics and anxiety and attitude and performance in statistics. Statistics/mathematics anxiety at the graduate level can have far-reaching consequences beyond a particular course as research also indicates that math anxious pre-service teachers feel less confident teaching elementary math and science (Bursal & Paznokas, 2006).

Many coping strategies have been designed to alleviate mathematics anxiety and, consequently, increasing math self-efficacy, in students including the use of a private tutor, practicing systematic relaxation or exercise, and discussing experiences/difficulties related to math courses with the school counselor. However, meaningful and immediate formative assessment (completing homework on time and letting the instructor know when one does not understand the course material) proved to be the most helpful in reducing anxiety (Peskoff, 2000). Research also suggests that students learn and retain more, and are more satisfied with the learning experience when they are actively engaged and receive timely feedback (Chickering & Gamson, 1987; Weimar, 2002).

Currently, dozens of large lecture undergraduate courses are utilizing Personal Response System (PRS) technology to help engage students by providing timely feedback and encouraging class interaction. At present, a PRS Community of Practice has been established, which allows for faculty who teach large lecture undergraduate courses to work collaboratively sharing PRS - specific instructional strategies. We propose the establishment of a similar community of scholars which will address the specific instructional and pedagogical needs of graduate students, in higher level mathematically intense courses. Presently, the Research and Evaluation Methods Program (REMP) within the School of Education at UMass, Amherst offers several small graduate level statistics and psychometric courses which serve students from several departments across the Amherst campus – School of Management, the College of Natural Resources and the Environment, Public Policy, and the College of Social and Behavioral Sciences. These courses include Introduction to Statistics and Computer Analysis I & II, Applied Multivariate Statistics I & II, and Structural Equation Modeling. Furthermore, beginning in fall 2008, REMP will offer a course dedicated to Classroom Assessment in an effort to improve both the formative and summative assessment practices of pre-service teachers.

Both the dynamics and intensity of graduate level courses differ from those of undergraduate courses. Graduate level courses tend to be significantly smaller than their undergraduate counterparts; yet the cognitive demand/burden also increases exponentially. As a consequence, the need for immediate formative assessment/teacher feedback and student engagement is even more apparent. Because these courses rarely convene more than once a week (due to considerations beyond the scope of this project), the accurate and timely teacher/student feedback is imperative for meaningful formative assessment to take place. The purposes of this project are as follows:

1) to improve both teaching and learning by implementing the Personal Response System technology currently being used in large lecture undergraduate courses into graduate level statistics courses
2) to prepare pre-service teachers to utilize this existing technology in their formative assessment of K-12 students
3) to increase the statistical/mathematical self-efficacy of graduate students and pre-service teachers
4) to decrease the statistics/math anxiety of graduate students and pre-service teachers
5) to develop and foster a community of PRS scholars for graduate level courses as well as a common graduate level statistics curriculum and
6) to increase student engagement in graduate level statistics courses.

This technology, which has proven to be successful, in part, in large undergraduate courses, will allow graduate level instructors to meet several of the goals identified by the Subcommittee on Academic Technology including: assessment of learning's nature

and extend, the measurement of learning improvement, the enhancement of instructor feedback of student work, and assessment that enables further learning, i.e. practice tests and quizzes.

Furthermore, the benefits of the interactive whiteboard/PRS will be augmented through the use of the Course Management and Communication Tool, SPARK. All quizzes and class exercises, presented via the PRS, can easily be uploaded to the course website, so that students can continue to review the main statistical concepts. In addition, students will be encouraged to participate in on-line discussions about the course material. Moreover, principal investigators will meet twice a semester to make curriculum decisions, communicate/share ideas, successes, and best practices. Also, the Center of Educational Assessment (contact: April Zenisky, Senior Research Fellow) will support the project by establishing and maintaining a website devoted to cataloging interactive whiteboard/PRS lessons.

Assessment

With the help of the Office of Assessment (contact: Martha Stassen), we have developed an assessment plan to evaluate the project's effectiveness. The Revised-Mathematics Anxiety Survey (R-MANX) will be used to measure student anxiety levels before and after project completion. The R-MANX scale is composed of 30 everyday life and academic statements, each rated by the respondent on a 1 (no anxiety) to 5 (high anxiety) Likert scale. The R-MANX scale is highly correlated with similar math anxiety scale and has exhibited a reliability coefficient of 0.90. In addition, a revised Math Self-Efficacy Scale will also be used to measure student self-efficacy in math before and after project completion. To assess student learning, current student performance on items measuring various statistical concepts will be compared to previous student performance on those same items before the integration and use of the interactive whiteboard/PRS.

Project Deliverables

- A paper/report which outlines, in detail, the anxiety decreasing and efficacy increasing, if any, effects of the use of the Interactive whiteboard/PRS for formative assessment. This paper will be informed largely by 1) faculty perceptions and opinions of the proposed technology 2) students' responses to the two assessment instruments: R-MANX and the revised Math Self-Efficacy Scale
- An augmented common curriculum which is a product of collaboration of all graduate level statistics course faculty in the School of Education
- A website devoted to PRS/Interactive whiteboard – inspired lesson plans and resource materials for all graduate level statistic courses

Project Budget

Description	Unit Price	Qty	Price
Interwrite Board (77")	1,667.00	1	1,667.00
Interwrite Pad	497.00	1	497.00
Interwrite PRS (Class Set)	1,887.00	1	1,887.00
Shipping	145.00	1	145.00
Installation	200.00		200.00
AAA Rechargable Batteries for PRS Remotes	4.45	36	159.96
Battery Charger	17.12	9	154.08
Supplies- Paper, Copies	250.00		250.00
Travel – Conferences 2 Investigators/Conference	1,025.00	4	4,100.00
Additional Compensation- June Jennifer Randall, Lisa Keller, Craig Wells	2,000.00	3	6,000.00
Benefits – Additional Compensation	100.20		100.20
April Zenisky Benefits	261.54 106.92	2	523.08 213.84
Total			**15,897.16**

The proposed budget includes all anticipated costs for implementing, maintaining, and reporting the findings of the proposed project. Because this project calls for the pilot of the use of the PRS in small graduate level statistics courses (and its benefits in these courses have not been empirically documented to date), we will provide graduate students with the individual PRS weekly. After the benefits of this system have been documented, largely through the implementation of this project, graduate students will be required to purchase the individual PRS in subsequent years. Because data collection will not be complete until the end of the spring semester, as surveys must be completed at both the beginning and end of each semester, the principal investigators will be required to analyze the data and report results during the month of June. Finally, because this project involves research on teaching and includes a very specific and well-developed assessment plan, we expect, and feel obliged to, present our results at professional conferences, specifically AERA, NCME, or APA.

Project Timetable

During the fall and spring semesters, graduate level statistics instructors will integrate the use of PRS technology into their courses. Throughout the year, the instructors will meet regularly to discuss and exchange best practices. Student data and questionnaires will be analyzed at the end of both semesters. Fall 2008 (preliminary) data will be made available for review in December 2008. All data and reports will be complete by June 1, 2009.