

ATINER CONFERENCE PAPER SERIES No: MAT2013-0471

**Athens Institute for Education and Research**

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**ATINER's Conference Paper Series**

**MAT2013-0471**

**Integrating Community Outreach  
Research and Learning (CORAL)  
Projects in Teaching Graduate  
Statistics in the Social Sciences**

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**ISSN 2241-2891**

31/07/2013

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Dr. Gregory T. Papanikos  
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This paper should be cited as follows:

**Thompson, C.J. (2013) "Integrating Community Outreach Research and Learning (CORAL) Projects in Teaching Graduate Statistics in the Social Sciences" Athens: ATINER'S Conference Paper Series, No: MAT2013-0471.**

## **Integrating Community Outreach Research and Learning (CORAL) Projects in Teaching Graduate Statistics in the Social Sciences**

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### **Abstract**

Two or more graduate statistics courses are required as core requirements of all students enrolled in graduate programs in the social sciences in the United States (education, sociology, psychology, humanities, health sciences, and others). The need for high quality student engagement and appropriate real world learning experiences is critical for promoting student interest and student success in statistics. Based on a conceptual model grounded in community engagement theory, the use of Community Outreach Research and Learning (CORAL) Projects for teaching graduate statistics has shown some potential benefits for engaging graduate students. CORAL projects involve graduate students participating in real world research applications in field site locations in the community, designing community based research projects, developing project management skills, conducting/delivering data-driven research efforts, and writing/presenting original research reports, publications, and conference paper presentations. Five years of evaluation data representing 354 graduate students who have participated in the CORAL Projects program are reported specific to the preparation of graduate student researchers. Pre and post assessment data collected from 354 graduate students who participated in CORAL research projects focused on three areas of analyses: statistics knowledge, statistics anxiety, and leadership skills. Data retrieved from graduate students from the CORAL Projects program indicate positive increases in graduate students' cognition or knowledge levels, significant decreases in graduate students' statistics anxiety levels, and substantial increases in students' leadership and project management skills. Implications of the study findings are relevant for workforce development of social science researchers and the preparation and placement of future research professionals.

**Keywords:** Social Science Statistics, Community-based Research, and Statistics Anxiety

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## **Introduction**

Statistics is a core or general requirement of all students enrolled in graduate educational and social science programs in the United States. Graduate students often postpone their statistics courses to the end of their degree program because of their fears related to mathematics/statistics, anxieties surrounding their lack of knowledge base in statistics, and their feelings of uncertainty regarding the use or applications of statistics (Onwuegbuzie, 2004). Students express general feelings of apprehension and uneasiness concerning the use of statistics in applied social science research. Correspondingly, graduate students express feelings of ineptness relative to their abilities for using research design and statistical procedures appropriately. These indicators serve as preliminary alert messages for graduate programs interested in developing high quality professionals in research and scholarship. This study focuses on the use of Community Outreach Research and Learning (CORAL) Projects for teaching graduate statistics in the social sciences, for engaging graduate students in community based research and scholarship, and for promoting high quality professional researchers and scholars.

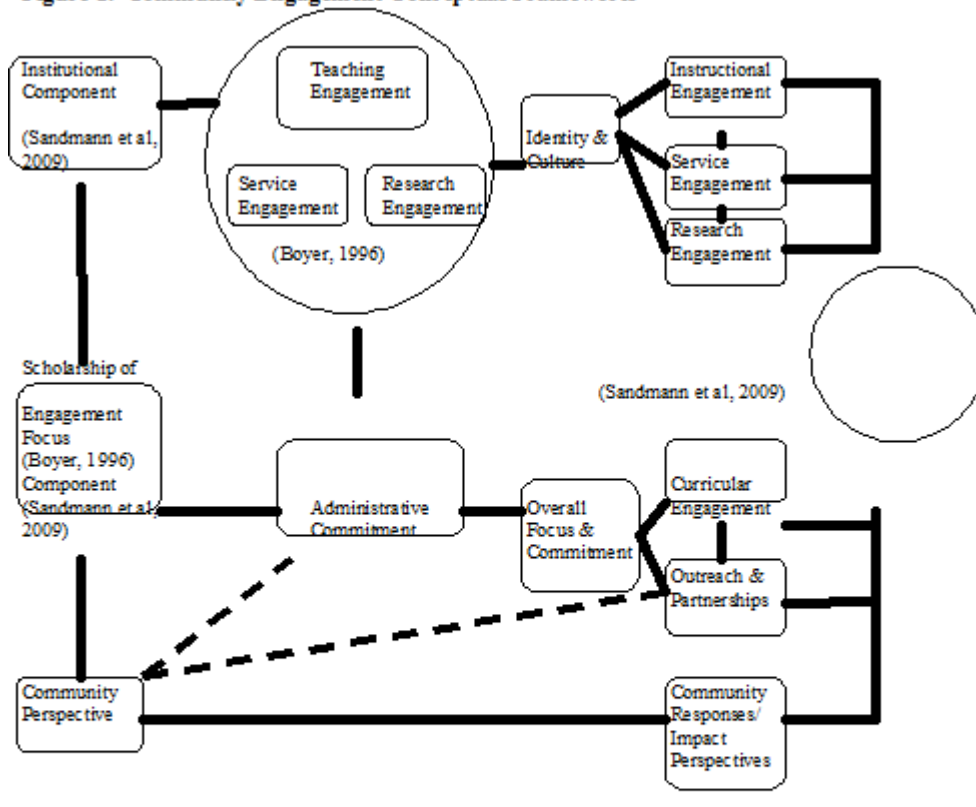
The need for high quality student engagement with real world statistics and research experiences is critical for promoting student interest and student success in graduate statistics courses within the social sciences. Engaging graduate students in community outreach research and learning (CORAL) projects promotes the development of project management and leadership skills, community based research skills, and engaged scholarship experiences. The community outreach research and learning (CORAL) projects utilizing leadership and statistics skills are spearheaded by a university-based Community Outreach Research and Learning (CORAL) Center. The graduate social science statistics program includes: (1) developing real world research questions generated by community based research projects; (2) providing opportunities for graduate students to engage in team driven quantitative research efforts prior to the thesis or dissertation experience with projects generated from community agencies; and (3) connecting graduate students with community-based research projects as research managers, leaders, and presenters.

Engaging graduate students in real-world learning experiences involving the use and application of statistics while addressing the research and statistics needs of local community agencies provides a symbiotic relationship between the university and the community agencies as well as an environment ripe for scholarly engagement. Based on the work of Boyer (1996) and (Sanmann et al, 2009), a conceptual framework focused on community, instruction, and engagement is one option for approaching the teaching and learning of educational statistics.

## Conceptual Framework

Two theoretical focus areas frame the conceptual base for the study: the institutional and community component consideration (Sandmann et al., 2009) and the instructional engagement and scholarship engagement component consideration (Boyer, 1996). The conceptual framework for the current study is depicted in Figure 1.

**Figure 1. Community Engagement Conceptual Framework**



As indicated in Figure 1 the conceptual development of community engagement as a vehicle for the scholarship of engagement perpetuates the following definition of scholarship of engagement: the scholarship of engagement is the combined influence of institutional identity and culture (comprised of instructional engagement, service engagement, and research engagement) and institutional focus (comprised of curricular engagement and community outreach and partnerships) on community impact/perspective. This definition serves as the foundation for the model and provides a conceptual integration plan of action for the implementation of the Community Outreach

Research and Learning (CORAL) program. Variables identified by the model include outcome measures of interest focused on the graduate student (instructional engagement, service engagement, and research engagement), the institution (curricular engagement and outreach and partnerships), and the community impact (community responses/impact and perspectives). The totality of the scholarship of engagement is therefore assessed in terms of multiple variables and multiple outcome measures indicative of the interactive components of graduate students, the institution, and the community. Each of these components is highlighted within the context of assessment and outcome measures incorporated into the CORAL program of study.

### **Related Literature**

Using real world applications and experiences for engaging students in research projects is inherent within the community engagement conceptual framework. This perspective is captured in the related literature substantiating the current study. Engagement theory is Schuyten & Ferla (2007) support the present study framework and implementation by advocating an ‘evidence-based society’ generated by graduate students who will competently “take part in the production, interpretation, and communication of data pertaining to problems they encounter in their professional life (p. 1)”. The importance and framework of tasks within real world learning environments in higher education has been the focus of several learning researchers (Brown, Collins, and Duguid, 1989; Lebow and Wagner, 1994; Young, 1993; and Herrington, 2005). The faculty of education at the University of Wollongong, Australia (Herrington, 2005) offer a summary of the framework for learning tasks for graduate students within higher education environments with the following descriptors: (1) ‘context that reflects the way the knowledge will be used in real life’; (2) ‘activities which have real-world relevance’; (3) ‘access to expert performances and the modeling of processes’; (4) ‘the opportunity for students to examine the task from different perspectives, using a variety of resources’; (5) ‘the opportunity to collaborate’; (6) ‘the opportunity to reflect’; (7) ‘opportunities to articulate (tasks)’; (8) ‘collaborative learning environments’; and (9) ‘opportunities for students to be effective performers with acquired knowledge’ (p. 2). Additionally, Carlson (2002) supports real world applications in learning to allow learners opportunities to pursue their own projects of interest while emphasizing autonomy, socialization, and relatedness to their lives.

A second area of related literature supporting the CORAL program and current study effort is advocated by Allen and Moore (2010) who describe the need for higher education programs of study to focus on the development of engagement scholars. The term, engagement scholars, refers to the emerging goal of higher education institutions within the United States to prepare graduate students to focus on assisting their communities. Included in the development of engagement scholars is the preparation of graduate students in



research skills, collaboration and teamwork experiences, and community outreach for public service (Austin & Barnes, 2005). Therefore, the preparation of future higher education faculty, social scientists, and social science researchers must also include the development of community based professionals sensitive to the research needs of the community. The current study examined these characteristics of graduate students relative to the CORAL program effort.

### **CORAL Program Description**

Based in community engagement theory the community outreach research and learning (CORAL) program provides graduate students enrolled in social science statistics courses opportunities to engage in managing, conducting, and delivering real world data driven research community research projects utilizing leadership and advanced statistics concepts and procedures. The CORAL program is spearheaded by a university based Community Outreach Research and Authentic Learning (CORAL) Center. The CORAL program objectives include the following: (1) reconfiguring statistics courses to include community based research projects and appropriate pre and post assessments; (2) providing opportunities for graduate students to engage in team driven quantitative research projects prior to the thesis or dissertation experience with projects generated from community agencies; and (3) connecting graduate students with community research projects as project managers, leaders, and presenters.

### **Research Question and Hypotheses**

The research question that spearheaded the study focused on the overall evaluation of the use of the community outreach research and learning (CORAL) program as an effective means for preparing graduate students in the social sciences. The specific hypotheses generated to determine the effectiveness of the CORAL program focused on three areas of consideration: (1) There will be a significant increase in the average cognition or statistics knowledge levels of graduate students between pre and post assessments after completing the CORAL program; (2) There will be a significant decrease in the average statistics anxiety levels of graduate students between the pre and post assessments after completing the CORAL program; and (3) There will be an increase in the average leadership skills of graduate students between the pre and post assessments after completing the CORAL program. The assessments utilized for the study focused on each of these three areas of consideration: (a) a self-efficacy or confidence in statistics knowledge levels assessment was used to collect graduate students' perceptions data for hypothesis one; (b) a statistics anxiety level assessment measure was used to collect graduate students' perceptions data appropriate for hypothesis two; and (c) an

assessment measure to discern leadership or project management skills was utilized to collect graduate students' perceptions data for hypothesis three.

### **Data Analyses and Results**

In order to assess the impact of the CORAL program relative to the three hypotheses generated for the study, a pretest was distributed to students at the beginning of the semester (prior to taking the course) and a posttest was disseminated toward the end of the semester (after completion of the course). These pre and post assessments were established as a three part assessment questionnaire. Graduate students were asked to rate themselves on a scale from 1 to 5 relative to various statements. N= 354 graduate students responded to the three assessments. The dependent t test procedure was utilized to analyze mean differences between the students' pre and post assessments relative to the three hypotheses generated for the study. Each of the three areas with their aligned hypotheses is discussed relative to the dependent t test findings.

#### *Assessment 1: Self Efficacy or Confidence in Knowledge of Statistics (Hypothesis 1)*

The first part of the questionnaire assessed students' perceptions of their self-efficacy levels related to students' confidence levels regarding statistics knowledge. A rating of 1 represents low confidence in the statistical knowledge skill described, while a rating of 5 indicates strong confidence in the statistical skill. Data collected from this section of the questionnaire were pertinent to addressing hypothesis one: There will be a significant increase in the average cognition or statistics knowledge levels of graduate students between pre and post assessments after completing the CORAL program. Results of the dependent t test analyses for hypotheses one are presented in Table 1.

**Table 1.** *Results of Paired Sample T Test for Statistics Knowledge Self Efficacy*

Item #	Item Description	N	Pre	Post	Sig	Result
1	Identify the scale of measurement for a variable	354	2.87	3.98	.001	+ post
2	Interpret the p-value from a statistical procedure	354	2.97	4.2	.000	+ post
3	Identify if a distribution is skewed when given the 3 measures of central tendency	354	3.16	4.0	.020	+ post
4	Select the correct statistical procedure in terms of the research question	354	2.61	3.69	.001	+ post
5	Interpret the results of a statistical procedure in terms of the research question	354	2.83	3.99	.000	+ post
6	Identify the factors that influence power	354	2.64	3.89	.000	+ post
7	Explain what the value of the standard deviation means in terms of the variable being measured	354	3.21	3.97	.003	+ post
8	Distinguish between a Type I and a Type II Error	354	3.22	3.84	.011	+ post
9	Explain what the numeric value of the standard error is measuring	354	2.88	3.36	.321 NS	+ post
10	Distinguish between descriptive and inferential statistics	354	3.45	4.29	.002	+ post
11	Distinguish between the information provided by the 3 measures of central tendency	354	3.43	3.93	.046	+ post
12	Distinguish between a population parameter and a sample statistic	354	3.54	3.69	.319 NS	+ post

An analysis of the mean differences of the pre and post assessments indicates statistically significant mean differences between students' perceptions of their self-efficacy or confidence in statistical knowledge on each item except for items #9 and #12 indicating an overall positive change in statistics cognition confidence levels from pre to post assessment time periods after experiencing the CORAL program approach to learning statistics.

*Assessment 2: Statistics Anxiety (Hypothesis 2)*

The second part of the questionnaire assessed students' perceptions of their anxiety when faced with different statistics or math related situations. A rating of 1 represents little anxiety, while a rating of 5 indicates high anxiety. Data collected from section two of the assessment questionnaire were pertinent to addressing hypothesis two: There will be a significant decrease in the average statistics anxiety levels of graduate students between the pre and post assessments after completing the CORAL program. Results of the dependent t test analyses for hypothesis two are presented in Table 2.

**Table 2.** *Results of Paired Sample T Test for Statistics Anxiety*

Item #	Item Description	N	Pre	Post	Significance	Result
1	Opening a statistics book with a full page of problems	354	4.23	3.08	.036	- post
2	Watching someone use a graph to explain something	354	1.38	1.36	.328	- post
3	Having to use the tables in the back of the book	354	2.71	1.91	.039	- post
4	Figuring a percentage such as sales tax	354	1.25	1.21	.664NS	- post
5	Having someone watch you as you add a column of numbers	354	2.75	1.39	.045	- post
6	Raising your hand in statistics class to ask a question	354	3.38	2.33	.003	- post
7	Reading and interpreting graphs and charts	354	2.71	1.46	.041	- post
8	Deciding how much tip to leave in a restaurant	354	1.13	1.12	.875NS	- post
9	Comparing two prices of cereal with different sizes and characteristics	354	1.38	1.18	.057NS	- post
10	Enrolling in a statistics course	354	3.83	2.11	.049	- post

The paired samples t test procedure of students' perception levels of statistics anxiety assessment revealed decreases in statistics anxiety for more than half of the items with significant mean differences found between the pre and post assessment ratings for six of the items indicating a substantial influence in the positive direction of the impact of the CORAL program approach for reducing statistics anxiety in graduate students in the social sciences.

*Assessment 3: Self Perception of Leadership Skills (Hypothesis 3)*

The third section of the survey assessed students' perceptions of their leadership skills. A rating of 1 represents a poor perception reported of a student's leadership skills, while a rating of 5 indicates a high perception reported of a student's leadership skills. Data collected from section three of the assessment questionnaire were pertinent to addressing hypothesis three: There will be a significant increase in the average leadership skills of graduate students between the pre and post assessments scores after completing the CORAL program. Results of the dependent t test analyses for hypothesis three are presented in Table 3.

**Table 3.** Results of Paired Sample T Test for Self Perceptions of Leadership Skills

Item #	Item Description	N	Pre	Post	Significance	Result
1	I maintain good balance between my personal life and work	354	2.47	3.60	.049	+ post
2	I'm honest with myself	354	4.28	4.44	.294 NS	+ post
3	I communicate clearly to others	354	4.08	3.96	.450 NS	- post
4	I recognize when to delegate tasks	354	3.44	3.80	.083 NS	+ post
5	I am competent in all aspects of my job	354	4.27	4.32	.561NS	+ post
6	I am organized and time efficient	354	3.84	3.80	.824NS	- post
7	I prioritize tasks effectively	354	3.81	3.72	.230NS	- post
8	I invest in my team members/employees	354	4.02	4.52	.038	+ post
9	I am consistently energetic and enthusiastic	354	4.02	3.97	.603NS	- post
10	I hold myself accountable without blaming others	354	4.36	4.40	.746NS	+ post
11	I am a problem solver	354	3.12	4.68	.023	+ post
12	I do things right the first time	354	3.68	3.84	.212NS	+ post
13	I stay within my budget	354	3.84	3.80	.788NS	- post
14	I encourage teamwork	354	2.47	4.14	.043	+ post
15	I stay focused on priorities	354	4.24	4.28	.788NS	+ post
16	I share information routinely	354	4.28	4.44	.356NS	+ post
17	I coach regularly	354	4.20	4.12	.738NS	- post
18	I inspect what I expect	354	3.09	4.17	.004	+ post
19	I contribute new ideas	354	3.40	4.38	.016	+ post
20	I listen intently and effectively	354	4.16	4.17	.728NS	+ post
21	I enjoy working with people	354	3.44	4.29	.024	+ post
22	I take pride in winning as a team not just individually	354	4.60	4.54	.560NS	- post
23	I take time to connect with each team member	354	3.40	4.51	.007	+ post
24	I reward and recognize team members	354	4.27	4.29	.524NS	+ post
25	I have a strong work ethic	354	3.71	4.67	.048	+ post

The paired samples t test procedure for examining students' perceptions of their leadership skills assessment revealed significant mean differences between the pre and post assessment ratings for nine of the items providing some empirical indicators that team work is beneficial in the teaching of social science statistics and supporting the impact of the CORAL Program approach to the teaching and learning of statistics for graduate students in the social sciences.

### **Findings and Implications for Social Science Statistics Teaching and Learning**

The analyses of data from the current study involved examining changes from pre- and post-assessments of students who participated in the CORAL Program. Implications of the study suggest several findings for the teaching and learning of graduate statistics for the social sciences: (1) Graduate students who have experienced the CORAL Program reported increases in leadership skills and confidence in statistics knowledge and (2) Graduate students who experienced the CORAL Program reported decreases in statistics anxiety after completing the course. Implications of these findings for the teaching and learning of graduate statistics provide two key programmatic and operational considerations for encouraging graduate students toward a positive experience in statistics: (a) Developing community partnerships for the purpose of providing real world settings for research and statistics creates a natural environment for designing research and conducting statistical procedures; and (b) Empowering graduate students with learning skills of collaboration, reflection, self-directed learning, exploration, investigation, production, interpretation, integration, evaluation, socialization, adaptation, and real world problem solving aligns with the skills advocated for developing a highly qualified workforce of professionals and future higher education faculty and researchers (Lombardi and Oblinger, 2007).

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