

Examining High Impact Practices in Graduate Statistics for the Social Sciences:

Preparing Professionals

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Abstract

The need for graduate students to develop the necessary skills for effectively using graduate level statistics in their professional roles as researchers and leaders in social science fields provided the impetus for the study. This quasi-experimental study examined the use of high-impact practices with 184 graduate students enrolled in graduate statistics for the social sciences with random assignment of control (N=96) and HIP treatment group (N=88). The study focused on the use of high-impact practices (HIP) for engaging graduate students in community-based research. Three research hypotheses guided the study focused on examining group mean differences on statistics efficacy levels, leadership skills levels, and research ethics scores. Pre and post assessments in statistics efficacy, leadership skills, and research ethics were obtained from both groups. The HIP treatment was delivered over a period of 16 weeks. Results of the ANCOVA procedure indicated significantly higher average leadership skills, research ethics scores, and statistics efficacy levels within the HIP treatment group. Implications of the findings for developing highly skilled professionals in statistics and research fields are documented by the study.

Introduction and Overview

Graduate students enrolled in statistics for the social sciences represent a myriad of disciplines, including psychology, education, social work, criminal justice, and related areas. The need for graduate students to develop the necessary skills for effectively using graduate level statistics in their professional roles as researchers and leaders in social science fields provided the impetus for the study. One approach for engaging students that has had strong momentum in undergraduate programs is the use of high-impact practices integrated into teaching and learning

environments. The merits of high-impact practices for engaging students include the use of learning communities, writing-intensity activities, collaboration in learning assignments and projects, community-based learning, common intellectual experiences, and other educational practices aimed at developing learners appropriately prepared for the workforce. This quasi-experimental study examined the use of high-impact practices with graduate students enrolled in graduate statistics for the social sciences. The study focused on the use of high-impact practices (HIP) for engaging graduate students in community-based research. The theoretical framework has underpinnings in community-based research framed within the HIP model. The overriding research question was: “What is the effect of implementing a high-impact practices (HIP) approach in the teaching and learning of graduate statistics for the social sciences relative to statistics efficacy, leadership skills, and research integrity considerations? The study examined mean differences in statistics efficacy, leadership skills, and research ethics knowledge/confidence levels between graduate statistics students who participated in a HIP approach to teaching and learning statistics and graduate statistics students who participated in a non-HIP approach on statistics efficacy, leadership skills, and research ethics. Graduate statistics class sections were randomly assigned to HIP and non-HIP approaches producing a two-group research design. Pre and post assessments focused on statistics efficacy, leadership skills, and research ethics were conducted for both HIP and non-HIP statistics sections. Analysis of Covariance was utilized to analyze the data. Results of the data analyses revealed higher levels of average statistics efficacy, higher average levels of leadership skills, and higher average research ethics scores for graduate students who experienced the HIP approach as compared with outcomes of graduate students who experienced a non-HIP approach to statistics. Study findings

hold strong implications for graduate statistics education and for preparing professional researchers in the social sciences.

Theoretical/Conceptual Framework and Related Literature

Recent publications by the American Association of Colleges and Universities (AACU) have prompted institutions across the United States to focus on high-impact practices (Kuh, 2008; LEAP, 2011) in teaching and learning environments. Although the use of high-impact practices (HIP) has been prevalent in undergraduate programs of study for more than a decade, the implementation of HIPs into graduate programs of study has not been emphasized in the literature (Kuh, 2008, Humphreys, 2013). This study extended the research for HIPs into graduate statistics for the social sciences.

The High-Impact Practices (HIP) model has underpinnings from the work of Kuh (2008) and LEAP (2013). Ten educational practices comprise the HIP theoretical/conceptual framework: (1) first-year seminars and experiences; (2) common intellectual experiences; (3) learning communities; (4) writing-intensive courses; (5) collaborative assignments; (6) undergraduate research; (7) diversity/global learning; (8) service learning/community-based learning; (9) internships; and (10) capstone courses and projects (LEAP, 2013). More than half of these practices were included in the current research effort: common intellectual experiences, learning communities, writing-intensive activities, collaborative projects with community-based learning, and diversity learning. These HIP practices align with the NCTM (2014) *Principles to Actions: Ensuring Mathematical Success for All*, especially with the guiding principles of teaching and learning, access and equity, and professionalism.

The high-impact experiential learning experiences utilized within the study treatment group focused on connecting graduate students to community agencies for the purpose of

conducting community-based research projects within a mutually beneficial partnership relationship. Several community educational, social, and behavioral science agencies partnered with the university to serve as research partners for engaging graduate students in community-based research. The teaching and learning focus of the partnership projects emphasized three areas of student learning: (a) the use of statistical skills within real world settings; (b) the use of leadership skills for conducting high quality research efforts; and (c) the use of integrity/ethics in leading and developing research projects within the community.

Focusing on research ethics and integrity and professionalism has emerged as a strong need for appropriately preparing graduate students as professional researchers and leaders in the workforce (NCTM, 2014; Pike, Kuh, & McCormack, 2010). The HIP also included a three-fold emphasis: (1) professionalism and leadership (NCTM, 2014; Pike, Kuh, & McCormack, 2010) involving the experience of statistical collaboration whereby graduate students served as peer reviewers of statistical skills, professional writing and presenting efforts of their colleagues with formal feedback; (2) responsible conduct of research (RCR) principles (Steneck & Bulger, 2007; Shamoo & Resnik, 2009) whereby graduate students participated in experiential evaluations of role-playing scenarios utilizing resources from the UWF Research Integrity website and materials from the Office of Research Integrity (ORI, 2009); and (3) professional ethics within community-based research (Kuh, O'Donnel, & Reed, 2013; Pike, Kuh, & McCormack, 2010).

Methodology

A quasi-experimental, pre-post assessment, two-group research design was utilized in the study. The HIP treatment was randomly assigned to sections of graduate statistics students and the textbook traditional approach assigned to control sections. The overriding research question investigated was: “What is the impact of integrating a HIP approach into graduate statistics in

the social sciences?” Three research hypotheses were generated from the theoretical framework: (1) Graduate students who experience a HIP approach to learning statistics will report significantly higher average statistics efficacy scores than graduate students who experience a non-HIP approach to learning statistics; (2) Graduate students who experience a HIP approach to learning statistics will report significantly higher average leadership skills than graduate students who experience a non-HIP approach to learning statistics; and (3) Graduate students who experience a HIP approach to learning statistics will report significantly higher average research ethics scores than graduate students who experience a non-HIP approach to learning statistics. A total of 184 graduate statistics students participated in the study with N= 88 students in the treatment group and N= 96 students in the control group.

Data Sources and Analyses

Pre and post measures aligned with each of the three hypotheses included three self-report measures: the *Statistics Self-Efficacy Scale* (Finney & Schraw, 2003), a self-report measure depicting leadership skills (Leadership-Tools, 2008), and a research ethics/integrity measure (Wester, Willse, & Davis, 2008). Pre-assessment measures served as covariates. The ANCOVA procedure with dependent variables of statistics efficacy, leadership skills, and research ethics was utilized for the data analyses. The independent variable was group affiliation (HIP versus non-HIP). Chi Square analyses were performed on demographic characteristics to exonerate possible confounding variables.

Results and Conclusions

Results of the ANCOVA for the N= 184 graduate statistics students with N (experimental) = 88 graduate students and N (control) = 96 graduate students are described below:

Hypothesis 1 (Statistics Efficacy Levels): After adjustment for pretest statistics efficacy scores used as a covariate, graduate students who experienced HIP statistics learning environments reported significantly higher average statistics efficacy scores than graduate students who experienced non-HIP statistics learning environments with

$M(exp) = 47.8$ and $M(con) = 38.4$ ($p < .001$).

Hypothesis 2 (Leadership Skill Scores): After adjustment for pretest leadership skills scores used as a covariate, graduate students who experienced HIP statistics learning environments reported significantly higher average leadership skills scores than graduate students who experienced non-HIP statistics learning environments with $M(exp) = 107.2$ and $M(con) = 105.1$ ($p < .05$)

Hypothesis 3 (Research Ethics Scores): After adjustment for pretest research ethics scores used as a covariate, graduate students who experienced HIP statistics learning environments reported significantly higher average research ethics scores than graduate students who experienced non-HIP statistics learning environments with $M(exp) = 32.8$ and $M(con) = 26.9$ ($p < .01$)

Conclusion: Each of the three hypotheses was empirically supported by the data analyses.

Educational Importance of the Research

Implications of the study for statistics education and professional workforce preparation efforts are three-fold: (a) the use of high-impact practices (HIP) for promoting high quality graduate statistics education programs in the United States aligns with the eight Mathematics Teaching Practices listed within *Principles to Actions: Ensuring Mathematical Success for All- Executive Summary* (NCTM, 2014, p. 3); (b) High-impact educational practices advocated by LEAP (2011) and integrated into the current study as components of the HIP treatment activities include collaboration and learning communities, diversity/global learning, and community-based

research -- critical considerations also listed within the Guiding Principles for School Mathematics (NCTM, 2014, p.4), that is, teaching and learning, access and equity, and professionalism; and (c) 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). Current study results corroborate this goal of developing professionalism.

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