

## Change In Undergraduates' Research Self-Efficacy: A Pilot Study

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### ABSTRACT

Research self-efficacy is defined as confidence in one's ability to successfully execute research-related tasks. This pilot study investigated the effect of a semester-long active-learning, course-based approach to the instruction of social science research methodology on undergraduates' research self-efficacy. Undergraduates ( $N = 32$ ) completed the semester-long social science research methods course involving didactic and experiential components including a 10-step process for the development of an original research project. They completed measures of research self-efficacy (conceptualization, early tasks, implementation, and presenting the results). RMANOVA revealed that all facets of research self-efficacy significantly increased by post-test. Implications for undergraduate curricular planning are discussed.

Keywords:

## INTRODUCTION

The critical importance of research training has gained greater attention across higher education (e.g., Boyer Commission, 1998) including within the social and behavioral sciences (Dunn, McCarthy, Baker, Halonen, & Hill, 2007; Parker, 2010; Shostak, Girouard, Cunningham, & Cadge, 2010). Undergraduate research experiences are valuable for a number of reasons; for example, they socialize undergraduates to the career field, improve practical skills, and enhance global skills such as critical thinking, problem solving, and communication (Hunter, Laursen, & Seymour, 2006). Moreover, research training is also associated with increased likelihood of graduate educational pursuit (Hathaway, Nagda, & Gregerman, 2002).

### Engaging Undergraduates in Research Training

Given the importance of research at the undergraduate level, actions to expand the number of students involved in research have been implemented across a number of academic disciplines (May, Cook & Panu, 2012). Likewise, greater emphasis has been given to scientific training in undergraduate social and behavioral sciences programs, with research methods course offerings growing substantially in U.S. institutions over the last several decades (Perlman & McCann, 1999; Shostak et al., 2010).

Although efforts to involve students in undergraduate research training have expanded, challenges do exist (May et al., 2012; Perlman & McCann, 2005). For example, opportunities to participate in undergraduate research may be few due to limited institutional resources. Additionally, extramural undergraduate research assistantship opportunities may also be limited. Moreover, experiences such as these are typically highly competitive and available to only a limited number of students; thus, they have limited utility for providing research education to a general undergraduate population (May et al., 2012).

Another option to enhance students' exposure to research is through undergraduate coursework. However, research training at the course level is often textbook-based with students relying upon class readings to orient them to methodological terminology and concepts (Ciarocco, Lewandowski, & Van Volkom, 2013). Utilizing this approach, students may gain knowledge, but not true comprehension of research methodology because they have not experienced science "in action" (Ciarocco et al., 2013, p. 21). Engaging students in a more hands-on and personalized approach to research methods training can help students fully recognize the worth of research to their discipline; moreover, it may also improve undergraduates' perceived efficacy for various facets of the research process (Ciarocco et al., 2013). Improving undergraduates' efficacy for research may be one of the best ways to increase their future involvement in scholarship (Love, Bahner, Jones, & Nilsson, 2007).

### Research Self-Efficacy

Research self-efficacy is a form of self-efficacy. Self-efficacy refers to individuals' beliefs that they possess the skills necessary to accomplish a goal (Bandura, 1977). Self-efficacy varies in generality (Bandura, 1977, 1982). For example, self-efficacy may be broad; individuals may possess confidence in their overall ability to master a variety of tasks. However, self-efficacy may also be specific and vary from domain to domain (Bandura, 1977, 1982). For example, an individual may possess self-efficacy for mathematics but not for athletics. Self-efficacy also varies in magnitude (Bandura, 1977). The greater magnitude of self-efficacy an individual possesses for a task, the greater the likelihood that the individual will attempt that task (Bandura, 1977; Phillips & Russell, 1994). Moreover, self-efficacy also varies in strength; the greater an individual's self-efficacy for a task, the greater effort the individual will devote to that task, even in the face of challenge (Bandura, 1977, 1982, 1989). Additionally, self-efficacy is dynamic, developing in response to an individual's experience. Following perceived successes, individuals engage in positive self-attributions for favorable outcomes; in turn, these positive self-attributions heighten the individual's confidence and strengthen expectations for future success. With a heightened sense of self-efficacy for the task, the individual is more likely to tackle more challenging domain-specific goals in the future (Bandura, 1989).

Research self-efficacy is defined as confidence in one's ability to successfully execute research-related tasks (Bieschke, Bishop, & Garcia, 1996). Bieschke et al. (1996) conceptualized research self-efficacy as four related components: conceptualization, early tasks, implementation, and presentation of results. Conceptualization encompasses the ability to generate research ideas, both individually and collaboratively. Early tasks refer to the ability to locate resources related to one's

research topic as well as consider ethical concerns related to that idea. Implementation incorporates behaviors related to the execution of the study such as development of experimental procedures, selection of measures, instruction of research assistants, data collection, and data analysis. Finally, presentation of results involves tasks necessary to present and publish one's results (Bieschke et al., 1996).

Studies investigating correlates of research self-efficacy have yielded positive results. For example, research self-efficacy has been predictive of interest in doing research (Bishop & Bieschke, 1998; Kahn & Scott, 1997; Lambie & Vaccaro, 2011) and research productivity (Lambie & Vaccaro, 2011; Phillips & Russell, 1994; Syzmanski, Ozegovic, Phillips, & Briggs-Phillips, 2007). Additionally, the research training environment has been found to be related to research self-efficacy in graduate students (Gelso, Mallinckrodt, & Judge, 1996; Phillips & Russell, 1994; Syzmanski et al., 2007). Furthermore, early research training experiences enhance research self-efficacy; positive experiences with faculty mentors, peers, and research teams have all been predictive of research self-efficacy (Love et al., 2007). Unfortunately, studies of research self-efficacy typically focus on graduate students; little is known about this construct in undergraduates.

### The Current Study

Given the importance of early research training experiences on research self-efficacy (and indirectly, later scholarly interests), the purpose of the current pilot study was to investigate the effect of a semester-long active-learning, course-based approach to the instruction of social science research methodology on undergraduates' research self-efficacy. An active-learning approach was chosen because research indicates that these instruction methods produce better learning outcomes (Prince, 2004). Active-learning's central characteristic is student engagement – students are not passive recipients of information (e.g., sitting in a lecture hall); rather, students actively use course information in discussions, writings, and activities (Prince, 2004; Unrau & Beck, 2004). A course-based approach was chosen because it can be utilized to educate a general undergraduate population (as opposed to the limited opportunities available through independent faculty/undergraduate research partnerships and external research placements). It was hypothesized that all facets of participants' research self-efficacy (conceptualization, early tasks, implementation, and presentation) would significantly improve following this semester-long research methodology course.

### Method

#### Participants

Power analysis was conducted using G\*Power 3 (Erdfelder, Faul, & Buchner, 1996; Faul, Erdfelder, Lang, & Buchner, 2007). A power of .90 and an alpha level of .05 were used to calculate the minimum number of participants needed to detect a medium effect size. The analysis indicated that data from a minimum of 32 participants would be needed for this pilot study. Data collection occurred over the course of two semesters; 20 students participated during the Spring semester and 16 participated during the Fall. After completion of the two semesters, the initial sample was composed of 36 participants; however, data from four participants were excluded because these individuals withdrew from the course prior to completion of the study. Therefore, the final sample included 32 undergraduates ( $n = 23$ , 71.9% female;  $n = 9$ , 28.1% male). Participants' age ranged from 19 to 36 ( $M = 23.03$ ). The sample was ethnically diverse; 62.5% ( $n = 20$ ) identified as Latino/a, 15.6% ( $n = 5$ ) identified as Black, and 15.6% ( $n = 5$ ) identified as White. The remaining participants identified as either Asian (3.1%,  $n = 1$ ) or multiethnic (3.1%,  $n = 1$ ). Finally, the sample was comprised of 5 sophomores (15.6%), 12 juniors (37.5%), and 13 seniors (6.3%). Two participants (6.3%) chose not to provide information about college classification.

Participants were recruited from a medium-sized university in the southwestern United States. All participants were enrolled in research methods for the behavioral sciences courses during the Spring and Fall semesters. This course is required for all psychology, sociology, rehabilitation science, and athletic training majors and optional for criminal justice majors. Participants were offered five bonus points toward the first course assignment as incentive for participation.

#### Materials

**Demographic information.** Participants completed a questionnaire to gather information about age, sex, ethnicity, college class, and major.

**Research Self-Efficacy.** Participants completed the Research Self-Efficacy Scale (Greeley et al., 1989; Bieschke et al., 1996). The Research Methods Self-Efficacy Scale is a 51-item measure of confidence in one's ability to successfully execute tasks related to the research process. It has four subscales (Conceptualization, Early Tasks, Implementation, and Presenting the Results) that represent the different stages of the research process. Respondents rate their confidence on each research-related task using a scale that ranges from 0 (*not confident*) to 100 (*very confident*). Higher scores are indicative of greater confidence in one's ability to complete research-related tasks. Bieschke et al. (1996) reported internal-reliability coefficients for the full scale ( $\alpha = .96$ ) and Conceptualization ( $\alpha = .92$ ), Early Tasks ( $\alpha = .75$ ), Implementation ( $\alpha = .96$ ), and Presenting the Results ( $\alpha = .91$ ) subscales. In the current study, the internal-reliability coefficient for the full scale was  $\alpha = .98$ . The Conceptualization ( $\alpha = .97$ ), Early Tasks ( $\alpha = .90$ ), Implementation ( $\alpha = .97$ ), and Presenting the Results ( $\alpha = .97$ ) subscales also had high internal-reliability coefficients.

### Procedure

A repeated measures, fully within-subjects (pre-test, post-test) design was utilized to examine change in participants' research self-efficacy over the course of the 16-week semester. Participants completed all study measures during class time; measures were administered on the first and last days of class. The Institutional Review Board reviewed and approved this study.

In addition to doing readings and attending classroom lessons on research methodology in the behavioral and social sciences, participants progressed through a semester-long, 10-step process to develop and present an original research project related to one of their personal interests. First, participants identified two topics of potential interest for a research project. Second, they conducted literature searches to identify a minimum of five scholarly sources related to each potential topic. Third, participants selected a final research topic, generated a preliminary research hypothesis, and located an additional 10 scholarly sources related to this topic. Fourth, participants created a final research hypothesis, operationalized the relevant variables, identified a population of interest, and specified the research design necessary for the study. Fifth, participants completed an annotated bibliography of a minimum of 10 scholarly sources related to the research hypothesis. Participants then organized information from the annotations into a minimum of three themes; these themes were used to organize the sixth step, the introduction and literature review. Seventh, participants designed and wrote the methodology for their studies. Eighth, participants described the analyses that would be appropriate for the data, as well as anticipated results of those analyses. Due to time and resource limitations, participants did not conduct the actual data collection for their studies. However, students were offered the opportunity to generate random data (using a statistical software package) to use for practice with data analysis. Ninth, participants submitted a final research project, incorporating faculty and peer feedback received through the previous steps. Finally, each participant provided a conference-style presentation of the final project.

To mimic the "real-world" research experience, elements of independent, supervised, and team research approaches were integrated into the projects. For example, participants completed all tasks independently (via class assignments), but also utilized feedback provided by a research supervisor (the instructor of the course provided personalized written feedback reports to each participant following each assignment). To mimic the research team experience, portions of class time were devoted to group discussion of individual projects throughout the semester. Participants provided suggestions to one another on issues such as literature searches, refinement of research hypotheses, operational definition of variables, selection of measures, and selection of appropriate analyses.

### Results

It was predicted that all facets of participants' research self-efficacy (conceptualization, early tasks, implementation, and presentation of results) would significantly increase over the course of the semester. A RMANOVA was conducted to investigate change in these variables over time. As predicted, participants' self-efficacy for conceptualization, early tasks, implementation, and presentation of results significantly increased over time, all with moderate effect sizes. Means, RMANOVA results, observed power, and effect sizes are presented in Table 1.

Table 1

*Means, Repeated Measures Analysis of Variance for Research Self-Efficacy*

Variable	Mean			F (1, 31)	p	Observed Power	p <sup>2</sup>
	Pre	Post	P				
Conceptualization	1.18	8.75	8	9.00	<.001	.99	38
Early Tasks	5.55	2.41	9	0.00	<.001	.99	39
Implementation	6.26	0.73	8	4.68	.001	.96	32
Presentation	9.42	2.64	5	5.12	<.001	.96	33

**Discussion**

This pilot study investigated the utility of an active-learning, course-based approach to the instruction of social science research methodology on undergraduates’ research self-efficacy. It was hypothesized that participants’ research self-efficacy would increase through participation in this educational intervention. As hypothesized, participants’ confidence for executing research-related behaviors increased. Participants reported greater confidence in their abilities to generate research ideas, alone or in collaboration with others (conceptualization), locate scholarly resources related to the research topic and plan for potential ethical concerns (early tasks), operationalize variables, design the study’s methodology, and conduct data analyses (implementation), and organize results for presentation and publication (presenting the results). Students seemed to benefit from an approach that allowed them to experience research “in action” while concurrently learning about methodology in class and through readings. It is interesting to note that students’ confidence in their ability to implement a research study increased, despite that they did not actually implement the research projects developed during this course. This suggests that research-related activities such as locating and critiquing journal articles, operationalizing variables, and planning analyses are beneficial for overall development of scientific confidence and potentially skill.

Improving undergraduates’ research confidence and potentially skill may have implications for these students’ future job search. The majority of individuals who earn a bachelor’s degree will directly enter the workforce (versus enter graduate school); this underscores the importance of marketable job skills in a competitive job market (Landrum & Harrold, 2003). Although employers seek a diverse range of skills in their new hires, research skills are commonly sought after (Aubrecht, 2001; Casner-Lotto, Barrington, & Wright, 2006). With a heightened sense of efficacy for research, new graduates may feel more comfortable discussing their preparedness and fit for positions involving research skills. Moreover, they may be encouraged to consider how findings of applied research may apply to improving their daily work.

**Implications for the Scholarship of Teaching and Learning**

Given that enhancing undergraduates’ research self-efficacy may be one of the best ways to facilitate their involvement in future scholarship (Love et al., 2007), these findings have implications for curricular planning in higher education. This active-learning, course-based approach could be a way to provide research skills training to a broad student population. This approach could be particularly useful in universities with resource limitations that preclude undergraduates from engaging in independent research with faculty mentors (e.g., limited research funding, limited faculty release time to mentor students) or in external research placements. In situations in which practical issues limit students’ opportunities to participate in research, this method may provide a functional approximation of the training, enabling undergraduates to be socialized to the research process and develop foundational research skills. Additionally, experiences such as these that allow students to build confidence in their research skills. This may translate into students seeking out more real-world research training opportunities; increased confidence may facilitate student engagement in additional research-related behaviors. It is possible that this could also increase students’ interest in research-related careers or the incorporation of research into practice-related careers (for example, conducting outcome research as a part of one’s clinical practice); however, there is an equivocal relationship between research training and intention to engage in future research (Lambie & Vaccaro, 2010; Sizemore & Lewandowski, 2009).

Changes in research self-efficacy also have implications for outcome assessment in higher education (Holden, Barker, Meenaghan, & Rosenberg, 1999; Unrau & Beck, 2004). In addition to changes in specific domains of knowledge or skill, educational programs could also incorporate assessment of research self-efficacy change into program evaluation (Unrau & Beck, 2004).

### Limitations and Directions for Future Research

The self-report nature of the dependent variable (research self-efficacy) in this pilot study is a limitation of the current study. Although participants' confidence regarding execution of research-related activities increased, their proficiency to perform these activities may remain unchanged. Confidence in one's ability to do a particular activity does not equate with competence; it is possible that participants may have overestimated their ability to perform these tasks. Kruger and Dunning (1999) and Dunning, Johnson, Ehrlinger, and Kruger (2003) emphasize that individuals with the lowest degrees of competence tend to overestimate their ability to perform tasks the most. Future research may include assessment of participants' ability to execute research-related tasks to determine if enhanced research self-efficacy is related to performance change.

The absence of a control group from this pilot study is an additional limitation of the current study. Without this control group, causal inferences regarding the effect of this educational intervention are limited. Future research is planned to incorporate a control group, such as undergraduates who are enrolled in general education courses. Inclusion of a control group of participants who are not currently undergoing formal research methodology training will enable causal inferences regarding the effect of active-learning research instruction on undergraduates' self-evaluation, specifically research self-efficacy.

### Conclusion

In sum, this pilot study supports the use of an active-learning, course-based approach to social science research methods education as a means to enhance undergraduates' research self-efficacy. This approach may provide a practical solution for orienting a general undergraduate population to the research process, especially in institutions with limited resources for independent undergraduate research. Enhancing undergraduates' research self-efficacy may enhance their workforce readiness. Measurement of research self-efficacy may also have implications for undergraduate curricular planning and program assessment.

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