

AC 2009-114: ASSESSING RESEARCH ON SELF-EFFICACY AMONG ECONOMICALLY DISADVANTAGED UNDERGRADUATE STUDENTS OF COLOR IN MENTORING PROGRAMS AT PREDOMINANTLY WHITE INSTITUTIONS

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Assessing Research Self-Efficacy among Economically Disadvantaged Undergraduate Students of Color in Mentoring Programs at Predominantly White Institutions

Abstract

Previous research has documented the scope and general nature of undergraduate mentoring programs that expose students to the scientific research process; research examining the influence of specific research-related activities on economically disadvantaged undergraduates' research self-efficacy, however, has been severely limited. The present study investigated whether specific research-related activities, associated with participation in an undergraduate research program, affected the research self-efficacy of 87 economically disadvantaged students at three research extensive universities. Results indicated that research-related activities such as conducting a literature review or collecting/analyzing data were positively correlated with research self-efficacy. Race, graduate degree aspirations, and research methodology also were related to research self-efficacy among the sample, even after controlling for differences in background traits. Implications for future educational practice are discussed.

Introduction

The number of historically underrepresented racial/ethnic minorities in research-related careers has not changed significantly over the last three decades, despite considerable efforts to promote access to and interest in research careers.¹ In response to this trend, colleges and universities, along with the federal government, have invested enormous resources in programs that expose students to research careers and the scientific process. Undergraduate research programs (URPs), like Alliances for Graduate Education and the Professoriate (AGEP) and the Ronald E. McNair Post baccalaureate Scholars Program, are examples of such interventions.²

Theoretically speaking, URPs are designed to expose students to the realities of research careers, involve students in research with a faculty mentor, improve students' perceptions of their confidence to conduct research (hereafter "research self-efficacy") and, subsequently, increase the number of students pursuing research careers.³ The expressed purpose of URPs is critically important given that minorities tend to have lower self-efficacy, lower confidence in their math and science skills, and less access to scientific courses and highly technical learning experiences compared to their majority peers.⁴ And while previous research has focused on the intended purpose and general nature of URPs, as well as sex differences in URP participants' perceptions of the program,⁵ no studies were readily uncovered that measured the influence of URP participation on specific learning outcomes such as research self-efficacy. This is the gap addressed by the present study.

Purpose

The purpose of this study was to measure the influence of background traits and research-related experiences in URPs on research self-efficacy among economically disadvantaged undergraduate students of color who attend predominantly White institutions (PWIs). Specifically, two research questions guided the analysis: (a) What is the relationship between research-related activities

associated with URP participation and students' research self-efficacy? (b) What is the relationship between specific research-related activities and students' research self-efficacy, controlling for differences in background traits?

Method

This study is part of a larger, longitudinal study titled, Investigating the Critical Junctures: Strategies that Broaden Minority Participation in STEM Fields funded by the National Science Foundation (EHR #0747304).

Sample

Participants were recruited from three large, research-extensive institutions in the United States. These institutions were selected because they offer formal science enrichment and/or undergraduate research programs. All 87 participants were enrolled in the 2008 Research Mentoring component of the Ronald E. McNair Post baccalaureate Scholars Program at one of the three campuses. The sample consisted of mostly women (62%); the mean (M) age was 21.89 (standard deviation [SD]=3.83). All participants were underrepresented minorities, hereafter students of color (African American, Latino, American Indian/Alaskan Native), most of whom were African American/Black (69%) and 15% were Latino.

Data Collection

Participants responded to the Survey of Summer Research Programs (SSRP), a 33-item instrument developed by the principal investigator for the purposes of the study. One subscale (3 items) assessed students' confidence in their ability to conduct research. Students responded on a scale ranging from 1 (no confidence at all) to 7 (complete confidence). The reliability coefficient for this subscale for the study sample was 0.80.

Independent variables included age (in years), sex (0 = male, 1 = female), race (0 = non-Black, 1 = Black), year in college (0 = freshman/sophomore, 1 = junior/senior), frequency of meetings with mentor (continuous), nature of project (1 "quantitative" to 3 "mixed methods"), analyzed data (0 = no, 1 = yes), wrote literature review (0 = no, 1 = yes), and mentor's assistance with oral presentation (0 = no, 1 = yes).

Data Analysis

Data analysis proceeded in three stages. First, data were prepared for analysis using a combination of data cleaning (i.e., deleting empty cells, missing case analysis). Also, summated scales (e.g., research self-efficacy) were created by testing the underlying structure of items using factor analysis, calculating the internal reliability of individual items using alpha coefficients, and summing together all items that, according to these statistics, seemed to tap the same construct. Finally, descriptive statistics were calculated for all variables included in the analysis. Hierarchical linear regression tests were employed to measure the influence of independent factors on participants' research self-efficacy.

Results

Results suggest that participants report generally high self-efficacy in terms of research (M=12.61, SD=1.97; range 3 to 15). Men (M=12.73, SD = 1.89) reported higher research self-efficacy than women (M = 12.52, SD = 2.03), although these observable differences were not statistically significant, $t(74) = 0.456$, $p < 0.65$.

Several factors are statistically associated with students' research self-efficacy: race ($r = 0.23$, $p < 0.05$); collecting/analyzing data ($r = 0.30$, $p < 0.01$); conducting literature review ($r = 0.20$, $p < 0.05$); and mixed methods project ($r = 0.22$, $p < 0.05$). In other words, low-income African Americans in the sample reported higher research self-efficacy than their low-income Latino and American Indian/Alaskan Native counterparts. Research self-efficacy, among the sample, was more strongly correlated with collecting/analyzing data than merely conducting a literature review. The only research approach that was correlated with research self-efficacy was mixed methods. Table 1 presents a summary of the correlation analyses.

Table 1

Correlations between research-related activities and research self-efficacy (N = 87)					
Variable	RSE	Race	CAD	CLR	MM
1. RSE	-----				
2. Race	0.23*	-----			
3. CAD	0.30 **	0.41**	-----		
4. CLR	0.20*	0.01	0.03	-----	
5. MM	0.22*	0.17	0.27**	-0.21*	-----

Note. RSE = research self-efficacy. CAD = collecting/analyzing data. CLR = conducting literature review. MM = mixed methods project.

Hierarchical linear regression analyses indicate that research-related experiences significantly influence students' research self-efficacy ($R_2 = 0.53$, $R_2^2 = 0.28$), even when background traits are held constant ($R_1 = 0.37$, $R_1^2 = 0.15$). That is, Model 1 [$F(5,70) = 2.45$, $p < 0.05$] consisting of background traits only accounted for approximately 15% of the variance in research self-efficacy among the sample, while Model 2 [$F(9,66) = 2.84$, $p < 0.01$] explained an additional 13% of the variance. Significant predictors of research self-efficacy include race ($b = 0.59$), graduate degree aspirations ($b = 3.98$), collecting/analyzing data ($b = 0.87$), and conducting literature reviews ($b = 2.21$). In other words, African Americans' research self-efficacy was higher than their non-Black minority peers, controlling for all other differences. Economically disadvantaged minorities' research self-efficacy was related to graduate degree aspirations; those who held high graduate degree aspirations (e.g., aspired to earn a doctorate rather than bachelors degree or lower) had higher research self-efficacy. And, as expected, those who collected/analyzed data had higher research self-efficacy than their peers who did not. The influence of "conducting a literature review," however, was greater than the influence of collecting/analyzing data (comparison of unstandardized beta coefficients). Table 2 presents a summary of the regression analyses.

Table 2

Hierarchical linear regression results, predicting research self-efficacy (N = 87)

Variable	B	SE	Std. B
Constant	3.51	2.75	
Race	0.59	0.49	0.14
Aspirations	3.98	1.46	0.33
Age	0.06	0.06	0.11
Sex	-0.18	0.44	-0.05
Quantitative	-0.24	0.49	-0.06
Mixed Method	0.95	0.59	0.21
CLR	2.21	1.10	0.22
CAD	0.87	0.55	0.20

Note. CLR = conducting literature review. CAD = collecting/analyzing data.

Discussion

The purpose of this study was to measure the influence of background traits and research-related experiences in URPs on research self-efficacy among economically disadvantaged undergraduate students of color who attend predominantly White institutions (PWIs). Analysis of survey data from participants at three research-extensive institutions suggests at least three major findings. First, research self-efficacy has little to no relationship with background traits such as age, race, year in college, although race (i.e., “being African American”) was statistically significant in predicting research self-efficacy. Second, a single affective trait, graduate degree aspirations, was related to research self-efficacy with higher degree aspirations being associated with higher research self-efficacy. Lastly, specific aspects of the research experience (e.g., collecting and analyzing data, conducting a literature review, even mixed methods approaches) were associated with higher research self-efficacy. Findings hold promise for future educational practice and may provide clues to broadening participation in research and technical careers among economically disadvantaged racial/ethnic minority undergraduates.

Results presented here provide credible information that URPs may be effective strategies for enhancing research self-efficacy among African Americans but may not necessarily influence Latino and American Indian/Alaskan Native students in the same way. Indeed, additional study is warranted but several factors may account for this finding. First, cohorts at two of the three institutions included in this study were majority African American/Black. In light of previous research findings,^{5,6,7} it seems reasonable to assume that these students benefited from the “critical mass” of Black peers with whom they likely socialized, studied, and consulted about their projects.

That higher graduate degree aspirations were associated with enhanced research self-efficacy may be explained in at least two ways. First, an obvious explanation may be a form of selection bias. In other words, students who hold higher graduate degree aspirations may be more likely to enroll in the summer research component of the McNair Scholars Program. This seems reasonable as the McNair Scholars Program is designed to encourage students’ preparation for and enrollment in graduate school with a stated purpose of increasing the number of PhDs

among the program's target population.⁸ Another possible explanation may turn on students' motivation to engage in undergraduate research. That is, students who aspire to earn a master's degree or doctorate may be more likely to enter research and technical careers (see Science & Indicators) and, thus, realize the importance of engaging in research as part of their ultimate degree goals. As a result, they may be more likely to invest considerable time and energy in their undergraduate research experience, which yields research skills, and competencies that, in turn, may enhance their confidence in themselves. Given the study's design, causal claims are not possible, yet additional research using larger student samples and statistical modeling techniques are warranted.

Findings also revealed that those who engaged in certain research activities scored higher on research self-efficacy than their peers who did not engage in such activities and this finding may reveal ways to nurture students' research self-efficacy intentionally. For instance, those who collected or analyzed data reported higher confidence in their research abilities than those who did not actually collect or analyze data during the summer. By collecting and/or analyzing data with their mentors, students engaged the research process and moved beyond merely talking about (potential) research to doing research (kinetic). It makes sense that carrying out the steps of a research project (e.g., administering a survey, conducting interviews) and analyzing data (e.g., calculating statistics, searching texts for themes) is much more likely to affect students' confidence in their research abilities than talking about the intended purpose of a study, reading literature about a particular topic, and writing literature summaries for one's mentor (see Hu, Kuh, & Gayles). Thus, program administrators would do well to consult this information when working with faculty mentors; program staff might encourage faculty to plan a summer experience that actually engages students in collecting or analyzing data if the goal of the program is to enhance students' research self-efficacy. Additionally, campus administrators and faculty members might use these findings to demonstrate the value added of [summer] undergraduate research experiences.

Conclusion

According to results presented here, students are not only exposed to a faculty mentor and the research process, but well-designed experiences that engage students in the doing of research yield additional outcomes such as increased research self-efficacy.

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