Journal of Agricultural Education, 62(2), 27-38
https://doi.org/10.5032/jae.2021.02027

Broadening Participation in Agricultural Sciences through a STEM Intervention Program

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Abstract

The purpose of this study was to examine the perspectives of underrepresented minority students (URM) from several historically Black land-grant universities and minority-serving institutions (MSIs) who attended a STEM intervention program at a predominately White research-intensive university. Guided by expectancy-value motivation and self-efficacy, participants were asked various questions regarding changes in their perspectives of psychosocial and instrumental support and changes in their self-efficacy after participating in the STEM intervention program. Data were collected from participants (n = 80) who attended several historically Black colleges and universities (HBCUs). Findings provide essential insight into motivational, mentoring, and social cognitive experiences that can bolster the recruitment and retention of URM students into predominantly White institutions (PWI) STEM graduate programs.

Keywords: agricultural sciences; STEM intervention program; HBCUs; land grant universities; self-efficacy; motivation

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Introduction

Due to an increasing population, agricultural sciences are becoming more vital to the well-being of every citizen. Some of today's agricultural challenges include food security/insecurity, urban green space development, sustainable energy, and public health. Because these agricultural issues are national and global, it is imperative to tackle the problem from a culturally and socially diverse lens. However, the educational pipeline's demographics into agricultural sciences graduate programs do not match the nation's demographics or world (Warren, & Alston, 2007; Westbrook & Alston, 2007). More importantly, recruiting and retaining underrepresented minority (URM) students in agricultural sciences programs is one of the most challenging problems facing many academic institutions (Warren, & Alston, 2007; Westbrook & Alston, 2007).

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Attrition at the graduate level is a more significant problem for URM students pursuing agricultural sciences degrees in general (Sowell et al., 2015). Obstacles that cause attrition rates to increase for URM include lack of psychosocial and instrumental support and a lack of meaningful mentorship (Westbrook & Alston, 2007; Sowell et al., 2015). Most notably, academic and social integration have been identified as key factors contributing to student persistence in agricultural sciences graduate programs (Westbrook & Alston, 2007; Sowell et al., 2015). Activities specifically related to academic and social integration include psychosocial and instrumental mechanisms, peer-group and faculty-student interactions, student perception of faculty concern for students' success, and institutional commitment (Westbrook & Alston, 2007; MacLachlan, 2006). Such activities are associated with student-centeredness, including building academic and personal relationships with students and community building, building academic and social support communities on- and off-campus, and collaborative partnerships that include cross-institutional department and campus relationships. These are critical elements of effective STEM intervention programs (Clark, 2017; Rincon & George-Jackson, 2016; Dyer-Barr, 2014).

STEM Intervention Programs

To address the historical underrepresentation of minority students who enter agricultural sciences graduate programs, STEM intervention programs that specifically address broadening participation have emerged on college campuses across the country (Clark, 2017; Rincon & George-Jackson, 2016). STEM intervention programs can foster psychosocial support and instrumental support, which are critical components of many recruitment efforts of URM students in agricultural sciences graduate programs (Bodden, 2014; Dixon-Reeves, 2003). Such programs help address feelings of loneliness and lack of community by creating an environment where supportive faculty and peers are easily identified (Gardner, 2008; Golde, 2005). STEM intervention programs also shape and raise expectations of academic and professional careers for URM students. Simply, the guidance and support provided through such programs can enhance the overall graduate education experience (National Academies Press, 2011). This is especially true for URM students who face barriers when attending a predominately White, research-intensive university (Bodden, 2014).

STEM intervention programs range from living-learning communities, summer research programs, pre-college programs, bridge/transition programs, visitation programs, and first-year experience programs (George-Jackson & Rincon, 2012; Rincon & George-Jackson, 2016; Clark, 2017). STEM intervention programs on predominantly White campuses can mean the difference between degree persistence and attrition for URM students pursuing agricultural sciences graduate degrees. This is especially true for African American students who are completing an undergraduate degree at historically Black colleges and universities (HBCUs) and aspiring to matriculate into an agricultural sciences graduate program at a predominately White institution (PWI).

Agricultural Sciences Workforce

Agricultural sciences occupations are projected to grow about 23% from 2020 to 2029, faster than the average for all occupations (U.S. Department of Labor, 2020). A recent report initiated by the U.S. Department of Agriculture's National Institute of Food and Agriculture (NIFA) and Purdue University showed a strong demand (61% of the annual job supply pool) for students across America who are studying agricultural sciences (Fernandez et al., 2020). This same report indicated that for the food and agriculture sector to fully address the U.S., diversity and inclusiveness are imperative for the future workforce.

Theoretical Framework

This study was guided by expectancy-value theory (Eccles et al., 1983; Wigfield & Cambria, 2010). Expectancy-value theory postulates that academic and career-related choices are influenced by subjective task value and self-efficacy for graduate school success. Simply, students' self-efficacy to

perform well on a task is associated with their expectancy-value beliefs (Doménech-Betoret et al., 2017). Research indicates that expectancy-value influences academic and career choices and have been used to explain the underrepresentation of women and minorities in STEM programs (Wang & Degol, 2013). Further, individuals with high STEM self-efficacy typically perform better and persist longer in STEM disciplines than those with relatively lower STEM self-efficacy (Britner & Pajares, 2006; Pajares, 2005). Proactive steps to heighten student's STEM self-efficacy are recommended in efforts to expand diversity in agricultural sciences programs (MacPhee et al., 2013).

Expectancy-value theory is one of the most comprehensive frameworks used for studying the psychosocial and instrumental factors underlying individual differences in academic motivation and career choice (Eccles & Wigfield, 2002; Wang & Degol, 2013). Expectancy-value beliefs are closely related to achievement outcomes of chosen activities. Expectancy-value theorists argue that individuals' task choice, persistence, and performance can be explained by their beliefs of available psychosocial and instrumental support, which contributes to beliefs about how well one will do on an activity and the extent to which one values the activity (Eccles et al., 1983; Eccles & Wigfield, 2002). Eccles et al. (1983) outlined four components of value: attainment, intrinsic, utility, and cost. *Attainment value,* defined as the personal importance of doing well on a task (Eccles & Wigfield, 2002). *Intrinsic value* is the enjoyment an individual receives from performing the activity or the individual's interest in the subject (Eccles & Wigfield, 2002). *Utility value* is determined by how well a task relates to current and future goals (Eccles &Wigfield, 2002). *Cost value* is conceptualized in terms of the negative aspects of engaging in the task, such as the amount of effort needed to succeed and the lost opportunities that result from making one choice rather than the other (Eccles & Wigfield, 2002).

In this study, we examine three of Eccles et al. (1983) outlined four components of value: attainment, intrinsic, and utility. Cost value was not examined as there were no apparent negative costs directly associated with the task of attending the STEM intervention program (e.g., participants' expenses were paid by grants or other sources of funding). Accordingly, we examined the change in student's perspectives after participating in the STEM intervention program. We also examined students' self-efficacy changes to attend an agricultural sciences graduate program at a PWI.

Purpose and Objective

The purpose of this study was to describe participants' perspectives of psychosocial and instrumental support and graduate school self-efficacy before and after attending a STEM intervention program on a predominately White campus. The following objectives guided this study.

1. Describe differences in students' perspectives of psychosocial support before and after attending a STEM intervention program.
2. Describe differences in students' perspectives of instrumental support before and after attending a STEM intervention program.
3. Describe differences in students' graduate school self-efficacy before and after attending a STEM intervention program.

Context of the Study

STEM Intervention Program

The Mentoring@Purdue Summer Scholars' Program (M@P-SSP) is an outgrowth of a larger STEM intervention program. M@P, established in the Fall 2012 semester, focused on increasing the number of URM students receiving graduate-level agricultural sciences degrees such as agricultural sciences and communications, forestry & natural resources, agricultural and biological engineering, animal sciences, food science, and more. M@P-SSP, located on Purdue University's campus, a predominantly White research-intensive university, is in its sixth year of hosting a pre-graduate school visitation program. Students from several HBCUs pursuing a baccalaureate degree in various agricultural sciences participated in a five-day real-world immersion experience held on Purdue's

campus. The M@P-SSP is a STEM intervention program that utilizes interactive workshops to enhance students' psychosocial and instrumental knowledge and skills and help them overcome and navigate barriers they face in higher education. Workshops also were to enhance students' awareness of psychosocial and instrumental support available at a PWI. Workshops addressing instrumental support included completing a competitive graduate school application, requesting letters of recommendation, obtaining internal and external funding, and creating and maintaining a résumé/curriculum. Workshops supporting psychosocial development and awareness included participation in workshops on mental and physical wellness as a graduate student, visits to campus research facilities, meetings with potential faculty research advisors, and engagement with currently enrolled graduate students. Students also engaged in culturally relevant activities with campus community affinity organizations such as cultural centers.

Methods and Procedures

Participants

Over the past six years, the M@P-SSP hosted over 100 HBCU undergraduate students from 11 HBCUs to have the opportunity to engage with faculty and students, explore research opportunities, and consider graduate study at Purdue University.

This study included 80 students who participated in the M@P-SSP during 2017, 2018, and 2019. The number of participants in our study would allow the researcher to address this study's objectives and represent a "slice of life" sample of the population (Oliver & Hinkle, 1981). Participants were selected to attend the M@P-SSP through an application process that demonstrated applicants' academic and research accomplishments and future educational goals. Participants were also provided a scholarship to attend M@P-SSP that covered the cost of travel, hotel accommodations, and meals. Upon acceptance of the scholarship, students gave consent to complete pre- and post-M@P-SSP questionnaires.

Among the participants, 54 (67%) were women, and 26 (33%) were men. Sixty-nine participants were African American/Black, one participant was Asian, one participant was Hispanic/Latinx, three participants were Multiracial, three participants were White/Caucasian, and three participants selected other for ethnicity. Thirty participants were interested in pursuing a master's degree, 38 were interested in pursuing a doctoral degree, and 12 were interested in veterinary medicine. Participants engaged with 11 academic departments within the College of Agriculture, including Animal Sciences, Agricultural Economics, Agronomy, Animal Sciences, Agricultural Sciences Education and Communication, Biochemistry, Botany and Plant Pathology, Ecological Sciences and Engineering, Entomology, Food Science, and Horticultural & Landscape Architecture. Students also engaged with the College of Veterinary Medicine and the Department of Nutrition, located in the College of Health & Human Sciences. Through seminars and workshops, students also had the opportunity to engage with the Dean of the College of Agriculture, the Dean of the Graduate School, the Office of Agricultural Research, the Alliance for Graduate Education and the Professoriate, the Office of Multicultural Programs, the Center for Career Opportunities, and Purdue's Wellness Programs.

Questionnaire Development

Upon reviewing the literature, no previously established questionnaire was available for this study to address the research objectives. Following the basic principles of survey design and development (Likert, 1932; Oppenheim, 1992; Spector, 1992), the researchers designed and developed a pre- and post-questionnaire. The questionnaire aligned with the M@P program's objectives and literature on expectancy-value theory (Eccles et al., 1983; Wigfield & Cambria, 2010). The questionnaire included items that measured participants' perspectives of psychosocial support, instrumental support, and graduate school self-efficacy in attending an agricultural sciences graduate program at a research-intensive PWI. Five items comprised the psychosocial support scale, ten items

comprised the instrumental support scale, and eight items comprised the graduate school self-efficacy scale. A 5-point anchored rating scale was used for each item ranging from 1 = Not at all, 2 = A little, 3 = Somewhat, 4 = Mostly, and 5 = Definitely, which indicated the extent to which participants agreed or disagreed with each item of the scale. The instrument was found to be valid by a panel of content experts consisting of two faculty members and two graduate students. They were chosen based on their expertise with survey development, mentoring programs, diversity, equity and inclusion, and STEM intervention programs. Cronbach's α coefficient of internal consistency scores were 0.70 for psychosocial support, 0.78 for instrumental support, and 0.87 for graduate school self-efficacy.

Data Collection and Analysis

Data were collected during the first and last M@P-SSP group meetings. The first M@P-SSP group meeting involved welcoming students to the M@P-SSP, reviewing the program itinerary, collecting IRB consent forms, and completing the pre-assessment questionnaire. The last M@P-SSP meeting involved debriefing students about their experience at M@P-SSP and completing the post-assessment questionnaire.

Data were analyzed using IBM SPSS 23 statistical software. In particular, frequencies, percentages, means, and standard deviations were used to descriptively report the data. Additionally, paired *t*-tests were used to describe differences between pre- and post-assessment scores on measures of psychosocial support, instrumental support, and graduate school self-efficacy. The assumptions of normality were examined for each paired *t*-test.

Findings

Frequency tables indicate the number and percentage of participants' choice for each item comprising each of the three scales. Paired *t*-tests were used to describe differences between pre-assessment and post-assessment scores on scales measuring participants' psychosocial support perspectives, instrumental support, and graduate school self-efficacy before and after attending the M@P-SSP. Overall, findings indicated increases in participants' responses from pre-assessment to post-assessment related to psychosocial support items, *"I felt I connected culturally to students of my ethnicity"* (Pre: 77%; Post: 88.8%) *and "I engaged with other students of my ethnicity"* (Pre: 77.7, Post: 88.8%). A decrease in participants responses was reported for psychosocial support item "I felt that faculty were interested in me as a student" (Pre: 96.3%, Post: 85%). Findings indicated an increase in participants' responses from pre-assessment to post-assessment related to one instrumental support item, *"I learned about student support organizations"* (Pre: 82.5%, Post: 92.5%). Findings indicated an increase in participants' responses from pre-assessment to post-assessment related to self-efficacy items, *"I can get accepted to graduate school at a research-intensive university"* (Pre: 81.3%, Post: 95.1%), *I can get an assistantship or fellowship for graduate school"* (Pre: 78.8%, Post: 95.0%), *"I can find a supportive advisor"* (Pre: 80.0%, Post: 96.3%), and "*I can develop a competitive graduate school application"* (Pre: 77.6%, Post: 96.3%). Tables 1, 2, and 3 show the frequency and percentage of participants' responses for each item comprising each of the three scales.

Table 1

Frequency and Percentage of Participants' Perspectives of Psychosocial Support (n = 80)

Pre-Items	*Not at All f (%)*	*A Little f (%)*	*Somewhat f (%)*	*Mostly f (%)*	*Definitely f (%)*
My expectations for the M@P SSP are that I...					
1. ...be respected by the faculty.	2 (2.5)	0	7 (8.8)	6 (7.5)	65 (81.3)
2. ...feel valued as a prospective student.	0	1 (1.3)	3 (3.8)	6 (7.5)	70 (87.5)
3. ...feel that faculty are interested in me as a future student.	0	0	3 (3.8)	7 (8.8)	70 (87.5)
4. ...connect culturally to students of my ethnicity.	3 (3.8)	4 (5.0)	11(13.8)	17 (21.3)	45 (56.3)
5. ...engage with other students of my ethnicity.	3 (3.8)	4 (5.0)	11(13.8)	17 (21.3)	45 (56.4)
Post-Items					
M@P SSP met my expectations in the following ways...					
1. ...I felt respected by the faculty.	0	0	3 (3.8)	8 (10.0)	69 (86.3)
2. ...I felt that I was valued as a student.	0	0	4 (5.0)	14 (17.5)	62 (77.5)
3. ...I felt the faculty were interested in me as a student.	1 (1.3)	0	11 (13.8)	18 (22.5)	50 (62.5)
4. ...I felt I connected culturally to students of my ethnicity.	2 (2.5)	0	7 (8.8)	12 (15.0)	59 (73.8)
5. ...I engaged with other students of my ethnicity.	1 (1.3)	3 (3.8)	5 (6.3)	11 (13.8)	60 (75.0)

Note. Pre- and post-assessment of participants' perspectives of psychosocial support consisted of five items on a 5-point scale ranging from 1 = Not at all, 2 = A little, 3 = Somewhat, 4 = Mostly, and 5 = Definitely.

Table 2

Frequency and Percentage of Participants' Perspectives of Instrumental Support (n = 80)

Pre-Items	*Not at All f (%)*	*A Little f (%)*	*Somewhat f (%)*	*Mostly f (%)*	*Definitely f (%)*
While attending the M@P SSP, I want to...					
1. ...learn about research opportunities.	1 (1.3)	1 (1.3)	1 (1.3)	10 (12.5)	67 (83.8)
2. ...learn how to navigate the graduate school admissions process.	0	1 (1.3)	3 (3.8)	5 (6.3)	71 (88.8)
3. ...learn about student support organizations.	0	1 (1.3)	13 (16.3)	12 (15.0)	54 (67.5)

Table 2

Frequency and Percentage of Participants' Perspectives of Instrumental Support (n = 80), Continued…

4. ...learn about funding opportunities.	0	0	1 (1.3)	5 (6.3)	74 (92.5)
5. ...learn about graduate programs in the College of Agriculture.	0	0	1 (1.3)	5 (6.3)	74 (92.5)
6. ...learn about professional development opportunities.	0	1 (1.3)	2 (2.5)	9 (11.3)	68 (85.0)
7. ...increase my confidence to apply for graduate school.	0	0	8 (10.0)	13 (16.3)	59 (73.8)
8. ...increase my interest in applying for graduate school.	0	2 (2.5)	7 (8.8)	21 (26.3)	50 (62.5)
9...better prepare me to apply for graduate school.	1 (1.3)	0	4 (5.0)	11 (13.8)	64 (80.0)
10. ...increase my chances of getting admitted to graduate school.	1 (1.3)	0	5 (6.3)	14 (17.5)	60 (75.0)
Post-Items					
During the M@P SSP...					
1. ...I learned about research opportunities.	0	1 (1.3)	10 (12.5)	18 (22.5)	51 (63.8)
2. ...I learned how to navigate the graduate school admissions process.	0	1 (1.3)	5 (6.3)	26 (32.5)	48 (60)
3. ...I learned about student support organizations.	2 (2.5)	0	4 (5.0)	12 (15.0)	62 (77.5)
4. ...I learned about funding opportunities.	0	0	2 (2.5)	13 (16.3)	65 (81.3)
5. ...I learned about graduate programs in the College of Agriculture.	0	0	2 (2.5)	13 (16.3)	65 (81.3)
6. ...I learned about professional development opportunities.	1 (1.3)	0	14 (17.5)	14 (17.5)	51 (63.8)
7. ...increased my confidence to apply for graduate school.	0	0	6 (7.5)	16 (20.0)	58 (72.5)
8. ...increased my interest in applying for graduate school.	1 (1.3)	1 (1.3)	4 (5.0)	17 (21.3)	57 (71.3)
9. ...better prepared me to apply for graduate school.	0	0	3 (3.8)	13 (16.3)	64 (80.0)
10. ...increased my chances of getting admitted to graduate school.	0	0	6 (7.5)	20 (25.0)	54 (67.5)

Note. Pre- and post-assessment of participants' perspectives of instrumental support consisted of ten items on a 5-point scale ranging from 1 = Not at all, 2 = A little, 3 = Somewhat, 4 = Mostly, and 5 = Definitely.

Table 3

Frequency and Percentage of Participants' Perspectives of Self-Efficacy Support (n = 80)

Pre-Items	*Not at All f (%)*	*A Little f (%)*	*Somewhat f (%)*	*Mostly f (%)*	*Definitely f (%)*
I am confident in my ability that...					
1. ...I can make good grades in graduate school.	0	0	4 (5.0)	17 (21.3)	59 (73.8)
2. ...I can get accepted to graduate school at a research-intensive university.	0	0	15 (18.8)	17 (21.3)	48 (60.0)
3. ...I can get an assistantship or fellowship for graduate school.	0	2 (2.5)	15 (18.8)	22 (27.5)	41 (51.3)
4. ...I can find a supportive advisor.	0	3 (3.8)	13 (16.3)	22 (27.5)	42 (52.5)
5. ...I can contribute knowledge to a graduate program at a research-intensive university.	0	1 (1.3)	4 (5.0)	22 (27.5)	53 (66.3)
6. ...I can select a graduate program where I will be successful.	0	0	6 (7.5)	22 (27.5)	52 (65.0)
7. ...I can develop an educational plan that will prepare me for graduate school at a research-intensive university.	0	3 (3.8)	10 (12.5)	25 (31.3)	42 (52.5)
8. ...I can develop a competitive graduate school application.	0	3 (3.8)	15 (18.8)	23 (28.8)	39 (48.8)
Post-Items					
After participating in the M@P SSP program, I believe...					
1. ...I can make good grades in graduate school.	0	0	2 (2.5)	21 (26.3)	57 (71.3)
2. ...I can get accepted to graduate school at a research-intensive university.	0	0	4 (5.0)	19 (23.8)	57 (71.3)
3. ...I can get an assistantship or fellowship for graduate school.	0	1 (1.3)	3 (3.8)	22 (27.5)	54 (67.5)
4. ...I can find a supportive advisor.	0	0	3 (3.8)	20 (25.0)	57 (71.3)
5. ...I can contribute knowledge to a graduate program at a research-intensive university.	0	0	4 (5.0)	16 (20.0)	60 (75.0)
6. ...I can select a graduate program where I will be successful.	0	0	2 (2.5)	14 (17.5)	64 (80.0)

Table 3

Frequency and Percentage of Participants' Perspectives of Self-Efficacy Support (n = 80), Continued…

7. ...I can develop an educational plan that will prepare me for graduate school at a research-intensive university.	0	0	7 (8.8)	18 (22.5)	55 (68.8)
8. ...I can develop a competitive graduate school application.	0	0	3 (3.8)	21 (26.3)	56 70.0)

Note. Pre- and post-assessment of participants' perspectives of graduate school self-efficacy consisted of eight items on a 5-point scale ranging from 1 = Not at all, 2 = A little, 3 = Somewhat, 4 = Mostly, and 5 = Definitely.

Objective one, two, and three sought to describe the difference in participants' (n = 80) perspectives of psychosocial support, instrumental support, and graduate school self-efficacy before and after attending the M@P-SSP. The summated means and standard deviations were calculated using IBM SPSS 23 statistical software for participants' responses to assessment items measuring psychosocial support, instrumental support, and graduate school self-efficacy scales. Table 4 displays the pre- and post-summated means and standard deviations along with the paired t-test scores for each of the three constructs measured (i.e., psychosocial support, instrumental support, and graduate school self-efficacy scales).

Table 4

Pre- and Post-Scores for Summated Means, Standard Deviations, and T-test Results

	Pre-M, SD Scores		*Post-M, SD Scores*		*p-Value*
Psychosocial Support	4.54	.62	4.63	.46	.320
Instrumental Support	4.71	.34	4.62	.40	.073
Graduate School Self-Efficacy	4.42	.55	4.67	.41	.001

Note. M = mean, SD = standard deviation, and n = 80.

Results of the paired t-test indicate no significant difference in mean pre- and post-assessment scores for participants' perspectives of psychosocial support (pre-assessment mean = 4.54, SD = .64 and post-assessment mean = 4.63, SD = .46; $t(79) = -1.00$, $p = \geq .05$) and there was no significant difference in mean pre- and post-assessment scores for participants' perspectives of instrumental support (pre-assessment mean = 4.71, SD = .34 and post-assessment mean = 4.62, SD = .40); $t(79) = 1.81$, $p = \geq .05$). However, there was a significant difference in mean pre- and post-assessment mean scores for participants' perspectives of graduate school self-efficacy (pre-assessment mean = 4.42, SD = .55), post-assessment mean = 4.67, SD = .41; $t(79) = 3.45$, $p = \leq .05$. The difference had a medium effect size (d = .52).

Discussion

This study is one of very few that have examined differences in HBCU students' perspectives before and after attending a STEM intervention program at a research-intensive PWI. The M@P-SSP's focus is on increasing the number of URM students receiving graduate-level agricultural sciences degrees. Participants of this study were primarily upperclassmen (i.e., juniors and seniors). Most participants had committed to applying to a STEM graduate school program. Our findings suggest that

a STEM intervention program such as the M@P-SSP may positively help students graduate school self-efficacy. These findings support Doménech-Betoret et al. (2017), who postulated that students' self-efficacy to perform well on a task (e.g., applying to graduate school) is associated with their expectancy-value beliefs. Expectancy-value theorists (Eccles et al., 1983; Wigfield & Cambria, 2010) argued that task choice, persistence, and performance could be explained by one's beliefs of available psychosocial and instrumental support.

Participants' perspectives on psychosocial support indicated a slight increase between pre-assessment and post-assessment scores. These findings could suggest a difference between participants' expectations for the M@P-SSP and their actual experiences while attending the M@P-SSP. For example, in some cases, participants could not make connections with potential faculty advisors or students in their areas of expertise due to the time of year that the M@P-SSP is held, thereby resulting in a difference in expectations. This finding is also not surprising due to the time of year (summer) that participants were on Purdue's campus. During the summer, many faculty members, staff, and graduate students are away from campus, which means in some cases, participants may not have been matched with a faculty member that might serve as a potential advisor or developed a peer relationship.

Participants' perspectives of instrumental support indicated a slight decrease between pre-assessment and post-assessment scores. These findings may be related to the difference in expectations and experiences participants had while attending the M@P-SSP. Further, this difference could be based on the perception that the more the participants learned about research opportunities, the application process, and funding opportunities, the more they realized they needed to know more information. Similar to the adage, the more one knows, the more they realize they don't know as much as they wished they did.

Participants' perspectives of graduate school self-efficacy indicated a significant increase in pre-assessment and post-assessment scores. These findings support literature that suggests that students' perspectives of psychosocial support and instrumental support contribute to students' self-efficacy (Doménech-Betoret et al., 2017). Simply, students' self-efficacy to perform well on a task is associated with their expectancy-value beliefs of psychosocial support and instrumental support (Doménech-Betoret et al., 2017).

Finally, this study's findings demonstrate that URM students interested in graduate school can benefit from a short-term on-campus immersive experience such as a STEM intervention program at a research-intensive PWI. A pre-graduate STEM intervention program like the M@P-SSP can provide students with immersive experiences to make connections between their interests in agriculture, graduate school, and their future careers, thereby fostering graduate school self-efficacy. Furthermore, it is essential to develop students' self-efficacy, which impacts learning experiences and overall motivation (Ding, 2015), particularly for underrepresented students in the agricultural sciences (Stout et al., 2011). Vicarious experiences and verbal persuasion from familiar models can also play an important role in building URM students' self-efficacy to pursue graduate degrees at research-intensive PWIs.

Implications

This study has implications for PWIs because it provides insight into specific motivational, mentoring resources, and social cognitive experiences that can bolster the recruitment and retention of URM students into graduate programs, specifically agricultural sciences graduate programs. PWIs should consider offering workshops to provide URM students with mastery experiences to navigate the graduate school application process and network with potential faculty advisors and current peer graduate students. Mentoring resources in the form of coaching and modeling can also help prospective graduate students make more informed graduate school decisions, especially when expectancy-value beliefs are closely related to achievement outcomes of chosen activities (Eccles & Wigfield, 2002; Wang & Degol, 2013).

Recommendations

We recommend future research explore the following areas: 1) factors influencing URM students' decisions about attending graduate school, and 2) factors influencing students' self-efficacy to attend graduate school. For example, to better understand factors influencing URM students' decisions about attending a graduate program at a research-intensive PWI, a qualitative study could examine participants' perspectives related to a sense of belonging. Students' sense of belonging, along with academic achievement, have been cited as essential in student recruitment and retention (Tino, 2017)) and their task choice, persistence, and performance (Eccles et al., 1983; Eccles & Wigfield, 2002). Lastly, future research could examine participants' self-efficacy to apply to agricultural graduate programs due to participating in a graduate recruitment program similar to the M@P-SSP. Students' self-efficacy to perform well on a task is associated with their expectancy-value beliefs (Doménech-Betoret et al., 2017). The suggested future studies may collectively provide further insight into the influence of STEM intervention programs on URM students' intention to apply to agricultural graduate programs at PWIs.

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