

VOLUME 3 | ISSUE 1 | SUMMER 2017

OPPORTUNITY MATTERS:
Journal of Access and Opportunity in Education



A Publication of the COE Research, Evaluation, and Data Use Community of Practice
and the Pell Institute for the Study of Opportunity in Higher Education



OPPORTUNITY MATTERS: *Journal of Access and Opportunity in Education*

VOLUME 3 – ISSUE 1 – SUMMER 2017
Table of Contents

i From the Editors: An Introduction to Opportunity Matters, Volume 3, Issue 1

Abraham E. Peña-Talamantes and Mika Yamashita, *Editors-in-Chief*

ARTICLES

1 A Qualitative Approach to Researching Self-Efficacy Perception of McNair Scholars

Tremayne O. Waller and Hill L. Wolfe

This article describes an effort to assess how participants of the Ronald E. McNair Post-Baccalaureate Achievement Program, known colloquially as the “McNair Scholars Program,” at an Ivy League university understand their self-efficacy and relationship with mentors. The study focuses on the following broad research questions: How did students in the McNair Scholars Program perceive their academic self-efficacy, research self-efficacy and social self-efficacy as a result of their overall participation in the program? Furthermore, how does faculty mentoring within the program enhance these three areas of self-efficacy? The data are based on two cohorts of seniors in the McNair Scholars Program. We used a qualitative analysis tool, ATLAS.ti, to review open-ended responses and to identify themes to better understand the perceived notions of the participants in our study. With our findings, we attempted to illuminate the extensive range of backgrounds and life experiences that these scholars bring to college.

OUR VOICES

25 Belonging, Staying, Making it Better: Underrepresented Students Create Space for Student Voice in an Educational Opportunity Program

Rebecca G. Kaplan¹ and Ashley Seidel Potvin¹ | ¹Equal Contribution

This paper highlights the importance of centering student voices in the design and implementation of educational opportunity programs, and demonstrates that participatory research methods are a productive and powerful way to do so. We met regularly with a group of students within an educational opportunity program, to discuss tensions they were experiencing and support them in strategizing to address the tensions. Students created a space for student voice and organizing to push their program to incorporate students’ skills and experiences in a way that would value students beyond grades and test scores. The students envisioned the student group as an integral part of programs designed to support and retain underrepresented students in higher education institutions

NARRATIVES & CREATIVE WORKS

37 Making Room and Finding Place: Why I Stayed in STEM

Patricia Hogan

One of the challenges in the STEM fields (particularly in the hard sciences and engineering) has been retaining under-represented groups at the college and university level and later at the career level. In this personal reflection, a woman with both engineering and chemistry degrees describes why she persisted in the STEM fields and why she believes the individual decision to stay is key to changing the face of STEM.

An Introduction to *Opportunity Matters*, Volume 3, Issue 1



Abráham E. Peña-Talamantes* and Mika Yamashita**

Welcome practitioners, scholars, students, and supporters to another edition of *Opportunity Matters*! It has been a year since our last volume was published and there have been several changes in the political and educational sphere since then. Without going into detail on what these changes have been and their potential implications on our programs and goals, we will say this: *it is now, more than ever, of utmost importance that we support educational opportunity programs and the populations which they serve.*

With *Opportunity Matters* we hope to create a space where research, knowledge, and voice can be shared among the community. We hope that the content of these volumes can help interested individuals, policy makers, and other professionals better understand the needs, celebrate in the successes, and contribute to scholarly discussion on the lives, experiences, and issues that plague students from marginalized groups and populations with a need for access and opportunity in education.

We maintain that the primary goal of this journal is to help make research, promising practices, and other creative works more accessible and useful to practitioners in the educational opportunity field. There is a lack of studies that target the experiences of underrepresented students and what strategies may work to help them succeed. Similarly, there is a lack of purely reflective pieces that may help shed light on the individualized narratives of underrepresented students, faculty, staff, and other professionals or individuals within or outside of the educational sphere. At *Opportunity Matters*, we welcome many types of scholarly and reflective work. We believe that while it is important to include open-access to peer reviewed, systematic research, there is much value in reflection, art, poetry and other creative works, as well.

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JOURNAL OVERVIEW AND SUBMISSIONS CATEGORIES

Opportunity Matters serves as a full-fledged peer-reviewed journal where scholars, practitioners, students, parents, and community leaders involved with educational opportunity programs can share their research, reports, ideas, and creative works. As of 2017, we will be publishing one volume per year at the end of the summer. Each volume will be released prior to the Annual Conference of the Council for Opportunity in Education, where it will be presented during the business meeting of the Research, Evaluation, and Data Use Community of Practice. Authors whose pieces are published in an issue may be asked to speak about their work during the COE session to elaborate on their findings, recommendations, and/or experiences. The journal is made available in PDF format, free-of-charge through the Research, Evaluation, and Data Use Community of Practice website and through a dedicated page within The Pell Institute for the Study of Opportunity in Higher Education: http://www.pellinstitute.org/opportunity_matters.shtml

The journal accepts submissions in three difference categories: Articles, Our Voices, and Narratives & Creative Works. We have included these three types of submissions because we believe that alongside original scholarly work on the issues our students face and how to better position our programs to ensure continued funding, we should also be privy to the actual experiences of the individuals connected to our programs, whether good or bad. To get a holistic understanding of our programs and our students, we need to understand them from many angles. It is our hope that this structure will help us do just that. The following paragraphs describe each category and some general guidelines for submission.

Articles

For those interested in submitting research articles, the following are areas of interest for the journal:

1. The demographic profile and needs of students served by educational opportunity programs, especially targeted populations or subgroups (e.g., immigrant students, out-of-school youth, racial/ethnic minority males, rural students)
2. Factors (e.g., academic, social, economic) that influence college access and success for low-income, first generation college students, as well as, veterans and students with disabilities
3. Programs and practices that improve college attendance and completion rates for underrepresented populations
4. Methods used to evaluate the effectiveness and outcomes of educational opportunity programs
5. The impact of federal and state policy on education opportunity and the delivery of services to target populations
6. The process, practice, and benefits (as well as challenges) of developing and sustaining partnerships between school districts and institutions of higher education as they relate to issues of access and opportunity

Submissions in this category would involve rigorous, innovative, and critical scholarship that aligns with the mission of the journal. We welcome all modes of inquiry including quantitative, qualitative, and mixed methods, as well as, conceptual review papers that are integrative and timely.

Our Voices

The “Our Voices” category was designed to showcase the work of scholars, practitioners, community leaders, parents, and students who have important knowledge, research, or tools that may be useful to those interested in issues of access and opportunity. These submissions would primarily entail descriptions, data-driven research reports and case studies, or critical reflections with a theoretical framework. This section would also serve to include the communication of evaluation methods or the reporting of strategies that work for individual programs and ways in which these may be applied in other contexts, as well as, letters and reactions to policies/actions, and position papers. Solicited commentaries and interviews with specialists and important figures who have made an impact in the field or in your local community, as well as the evaluation of materials that may be of importance to other practitioners and students in educational opportunity programs will also be considered. Personal reflections and narratives without a theoretical basis will not be included in this category. We see this category as the section of our journal that allows us to share our practices and report their success, and/or a place to obtain knowledge that may help us better make sense of the issues plaguing our programs and our students. In other words, a section on “promising practices” for the community.

Narratives & Creative Works

This last category includes both personal narratives and creative works. This is because traditionally speaking, these types of content do not make it onto academic journals. Given the nature of educational opportunity programs, we feel that this is a very important component to the story we have to tell. Like success stories in typical newsletters and reports, these works allow us to better understand: (a) the climate of our programs; (b) how individuals served and affected by our programs may feel; and (c) the kinds of non-scholarly works that our participants and practitioners produce. Thus, this category will serve to showcase alternative forms of expression from our community, alumni, current students, teachers, parents, practitioners, and/or anyone else involved with educational opportunity programs. These may include, but are not limited to, narratives, confessionals, short stories, artwork, drama, humor, poetry, or other creative work. Submissions that are not narratives or personal reflections should include a short reflection or description of how the work is relevant to the focus of the journal.

VOLUME 3, ISSUE 1

In the pages that follow you will find three pieces that make up Volume 3, Issue 1 of *Opportunity Matters: Journal of Access and Opportunity in Education*. We thank the authors for their contributions and reflections and hope that the larger educational opportunity programs community will be able to take valuable information from these works.

In the **Articles** section, Waller and Wolfe explore the relationships between faculty mentoring and three types of self-efficacy: academic, research, and social. Using a qualitative approach and two McNair Scholars cohorts, several themes are identified that point to the importance of mentoring and students' perceptions of self-efficacy across these domains. The study argues that mentorship opportunities are instrumental to the development of self-efficacy for low-income, first-generation, and underrepresented students; the authors provide some recommendations for McNair hosting institutions to take advantage of these findings.

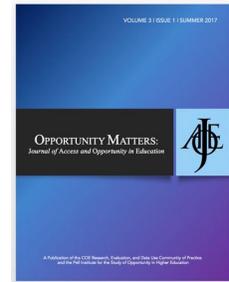
In **Our Voices**, Kaplan and Potvin speak about their experiences working with students in an educational opportunity program. They posit that using participatory research methods and allowing students to have a voice in the development and implementation of educational opportunity programs can make a major impact in the students' success. Given the program they examine is within the engineering field, their recommendations speak to both institutions and researchers about ways in which programming and frameworks can best support marginalized student populations. They hope that future work may speak to issues of retention and student experience for underrepresented student populations in higher education.

In the final section, **Narratives & Creative Works**, Hogan reflects on her journey through the STEM field as a first-generation, low-income, female in chemistry and engineering. An important and timely piece, this narrative captures the inner struggle that many of our students face when entering the natural and physical sciences. It speaks to the power of persistence as the key to changing the face of STEM, from a white-male dominated field to a more inclusive and open one with diversity of thought and experiences. Hogan reminds us that our actions today are instrumental in carving out a path for others like ourselves in the years to come.

These articles allow us to better understand the needs of our students and help us understand how we can be more intentional about creating spaces that are inclusive and supportive. Whether it is by listening to their experiences, pushing them to persist through the challenging times, or allowing them to connect to others with similar experience on campus, there are many ways in which we can help our students and colleagues navigate the college experience and reach their goals. Thank you, again, to all the reviewers, authors, supporters, and editorial board members for your time, feedback, and revisions that made *Volume 3* possible. We hope you enjoy this issue of *Opportunity Matters*, and encourage others to submit their work.

A Qualitative Approach to Researching Self-Efficacy Perception of McNair Scholars

Tremayne O. Waller* and Hill L. Wolfe



Abstract: *This article describes an effort to assess how participants of the Ronald E. McNair Post-Baccalaureate Achievement Program, known colloquially as the “McNair Scholars Program,” at an Ivy League university understand their self-efficacy and relationship with mentors. The study focuses on the following broad research questions: How did students in the McNair Scholars Program perceive their academic self-efficacy, research self-efficacy and social self-efficacy as a result of their overall participation in the program? Furthermore, how does faculty mentoring within the program enhance these three areas of self-efficacy? The data are based on two cohorts of seniors in the McNair Scholars Program. We used a qualitative analysis tool, ATLAS.ti, to review open-ended responses and to identify themes to better understand the perceived notions of the participants in our study. With our findings, we attempted to illuminate the extensive range of backgrounds and life experiences that these scholars bring to college.*

Keywords: Self-Efficacy, Faculty Mentoring, Undergraduate Research, Survey, Academic Opportunities

Increasing the preparedness of first-generation, low-income and/or underrepresented undergraduate students so that they can enter PhD programs and emerge with a terminal degree remains an elusive, but highly important, goal for undergraduate institutions (Ehrenberg et al., 2014). Research indicates these three groups have a difficult time transitioning from undergraduate to graduate school, and, in particular, meeting the significantly higher expectancies of a graduate program. Some of the known hindrances include a lack of information, unrealistic expectations, and a reduced sense of self-efficacy (Kim & Sax, 2009). Included in a growing list of interventions to help students overcome these roadblocks to a graduate degree is faculty mentoring. Both anecdotal evidence and

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research findings point to the importance of faculty mentors in building and strengthening the supportive infrastructure for undergraduate, particularly those from marginalized groups in preparation for a PhD program (Kuh & Hu, 2001).

Faculty mentors can play an essential role in encouraging and readying undergraduates to tackle the rigors of graduate education. In particular, frequent and engaging faculty mentoring goes a long way toward enhancing the self-efficacy of college students. Germane to this report is the fact that faculty mentoring appears to be essential for students who belong to underrepresented or at-risk groups in that faculty mentoring can both plant the seeds for attaining an advanced degree, as well as nurture the growth of that goal in specific ways. In short, faculty mentors have the ability to shape and raise expectations for first-generation, low-income, and underrepresented college students with respect to graduate education and careers that they might never have considered in light of their socioeconomic and/or ethnic background (Pascarella & Terenzini, 2005).

This paper will address the relationship between faculty mentoring and student self-efficacy via a case study of the Ronald E. McNair Post-Baccalaureate Achievement Program. Specifically, it will investigate how participants of the McNair Scholars Program (hereafter called MSP) understand their self-efficacy and relationship with mentors in three areas: academic self-efficacy, research self-efficacy and social self-efficacy. The first section of this article describes the McNair Scholars Program and its components. The second section defines these three areas of self-efficacy and how faculty mentorship impacts them. The third section, which is the Methods section, details the metrics used to assess the effectiveness of the McNair Scholars Program in terms of its impact on self-efficacy, and the final section presents the discussion and conclusions.

McNair Scholars Program

To augment the number of underrepresented students entering PhD programs in all fields—and thus increase the diversity the faculty of colleges and universities across the nation—the U.S. Congress passed legislation to create the MSP in the mid-1980s. The program is named for Ronald E. McNair, who was one of first three African Americans accepted into the NASA space program. In 1986, McNair and his six crew members died in an explosion aboard the space shuttle Challenger. In his memory, the U.S. Department of Education provides grants to colleges and universities for programmatic activities targeted at low-income, first-generation college students to encourage their subsequent enrollment in graduate studies.

In 2012, a McNair Scholars Program was established at Ivy League Institution where the program we studied was hosted under the umbrella of the Office of Academic Diversity Initiatives (OADI) to address the needs of underrepresented and low-income minority students. The impetus for pursuing the establishment of the program at this university can be credited in part to a number of highly capable and ambitious graduate students who were former McNair Scholars at their undergraduate institution. Given the breadth of research opportunities already offered to undergraduates, the OADI believed that the MSP could be effectively supported within existing structures and through the commitment of dedicated faculty in a number of departments, especially those in STEM fields (Waller, Smith, Lumumba-Kasongo, & Lupa, 2014).

The program supports a total of approximately 30 undergraduates in any given year, with new students recruited annually through a rigorous application process organized by program staff, in collaboration with faculty and university administrators. Upon applying to the MSP, students are expected to submit the demographic and financial information needed the program and to complete several essays and a committee interview with faculty, staff and graduate students about their interest in the program and their future goals. Students must submit two letters of recommendations (one must be from a faculty member). The program's activities are multifaceted and include (but are not limited to) summer internships; seminars; academic counseling; one-on-one faculty mentoring; the opportunity to engage in mentored research opportunities and present results at local, regional, and national meetings; and targeted assistance in identifying graduate education programs, which includes help in completing application requirements and identifying/securing funding for graduate school (US Department of Education, 2016). These broad areas have the potential to greatly impact a student's self-efficacy, and thus improve their chances of success in PhD programs (Waller et al., 2014).

LITERATURE REVIEW AND DEFINITIONS

In supporting the program's goal of readying students from underrepresented segments of society for success in graduate programs, the MSP takes deliberate steps to enhance the self-efficacy of students through research opportunities and other scholarly activities (University of Central Florida, 2016). This topic of self-efficacy has intrigued researchers for decades. Nearly forty years ago, Bandura (1977) defined self-efficacy as a person's belief in his or her ability to succeed in specific situations; specifically, it is "the conviction that one can successfully execute the behavior required to produce the outcomes" (p.79). For self-efficacy to take root, a student must perceive any given challenge as an opportunity for growth and development rather than as an insurmountable obstacle. Bandura asserted that self-efficacy in the academic setting can be examined along three constructs: academic self-efficacy, research self-efficacy and social self-efficacy.

To illuminate the experiences of undergraduate students in MSP around the country and how it is serving their goal of attending graduate school, Williams (2004) utilizes Bandura's theory of self-efficacy to explain motivation. In designing and executing his study, Williams (2004) relies on Bandura's definition of perceived self-efficacy as "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (Bandura, 1994, p. 71). Bandura grounded his theory in a social cognitive framework; namely, that self-efficacy beliefs determine how people feel, think, motivate themselves, and behave. Such beliefs are capable of producing diverse effects, from crippling to empowering, via four major processes: cognitive, motivational, affective, and selection processes. A strong sense of self-efficacy enhances human accomplishment and personal well-being in many ways; for example, people who believe strongly in their personal capabilities are far more likely to view a difficult task as something to be mastered rather than as a personal threat to be avoided. This type of positive outlook is also likely to increase and sustain interest in a task, regardless of its difficulty (Bandura, 1994).

Williams (2004) compares the pre- and post-programmatic experiences of African American students in MSP, and thus the program's impact, based upon the students' measured levels of academic

self-efficacy, research self-efficacy, and social self-efficacy, which the MSP takes deliberate measures to develop through programming activities and mentoring systems. It should be noted that several other research studies have evaluated the MSP with respect to these three measures of self-efficacy (Forester, Kahn, & Hesson-McInnis, 2004; Unrau, & Beck, 2005). These earlier studies generally assessed self-efficacy in relation to programmatic interventions at the undergraduate level. Drawing upon these studies, we will assess the effectiveness of the MSP according to these three metrics.

Academic Self-Efficacy

Researchers agree that academic self-efficacy refers to a person's belief or conviction that he or she can successfully tackle an academic task, thereby attaining one or more specific educational goals. As such, this facet of self-efficacy is related to academic motivation and performance (Bandura, 1997; Eccles & Wigfield, 2002). Similarly, other scholars have investigated academic self-efficacy in terms of a student's ability to organize, execute, and regulate his or her academic performance (McGrew, 2008; Zimmerman, 1995). Studies demonstrate that students who participate in academic programs with greater confidence tend to perform better than their peers who feel less confident about their ability to attain an academic goal. Not surprisingly, students with high levels of academic self-efficacy are more likely to persist to graduation. In support of this relationship, Willison and Gibson (2011) examine the transition experiences of 22 McNair Scholars into graduate school in order to identify factors that influenced their persistence and matriculation. Their qualitative results obtained from interviews reveal that the academic self-efficacy of these students is not solely related to a genetic predisposition toward confidence. Rather, their results reveal five major themes that contributed to enhancing this facet of their self-efficacy: (a) the students are academically prepared for graduate school, (b) the students have created a supportive web among fellow-students, (c) these students are adept at time management, (d) they all feel at home and accepted in their academic setting, and (e) they are cognizant of staying "financially fit."

Research Self-Efficacy

Research self-efficacy can be thought of as one's confidence in one's ability to perform a specific research project or task successfully (Bieschke, 2006; Forester et al., 2004). Students with high levels of research self-efficacy are associated with successful execution of research (Forester, 2004).

Self-efficacy is essential for students who are conducting research, since it involves designing a study (either solely or in collaboration with faculty and/or peers), conducting research in the laboratory, library, or in the field, analyzing data; writing a persuasive and thorough research report, and presenting results in a public forum (Unrau & Beck, 2005). Researchers have described the many pluses for students with higher levels of research self-efficacy. Kahn (2001), for example, confirms a positive association between research self-efficacy and research productivity. Graduate students with high levels of confidence in their ability to identify and research an idea, to carry out a well-design research project, analyze data, and compile a written summary, and to present research results are more likely to continue their involvement in research after receiving the doctorate degree (Bishop, Bieschke & Garcia,

1993). Conversely, Bieschke, Bishop & Garcia (1993) demonstrate that lower levels of research self-efficacy may explain why some graduate students lack an interest in research-related activities. In a study examining the specific programmatic components of the MSP, Ishiyama and Hopkins (2003) compare the retention, graduation and graduate school placement rates of McNair Scholars with a control group to assess for differences. The researchers determined that the two most impactful programmatic components of the MSP are mentoring and research experience (Ishiyama & Hopkins, 2003).

Social Self-Efficacy

Students have varying perceptions of their ability to successfully interact with others. Those on the upper spectrum of self-perceived social ability have an edge. As defined by Williams (2004), social self-efficacy pertains to one's confidence in seeking social support, utilizing social networks, and achieving greater social mobility. Social self-efficacy, which is linked to the ability to initiate and maintain interpersonal relationships, is strongly associated with greater personal well-being (Smith & Betz, 2000).

Supportive relationships are essential for developing one's social self-efficacy and adjusting to college whether at the undergraduate or graduate level. Indeed, research shows that strong social networks contribute to student satisfaction, persistence, and the benefits that students gain from their college experience in terms of enduring friendships and professional opportunities (Kuh et al. 2005; Pascarella & Terenzini 2005). Research also indicates that self-efficacy expectations are linked to improved academic performance in college freshman (Ferrari & Parker, 1992) and the ability to decide on a career path with greater confidence (Tuck, Rolf, & Adair, 1995).

Summary

By examining the academic self-efficacy, research self-efficacy, and social self-efficacy of a selected group of McNair Scholars, this study is expected to elucidate the ways that these three areas contribute to advancing underrepresented students to a successful graduate school experience and a PhD. The data from the assessment of these areas may help faculty, administrators and program managers in identifying scholars' strengths and weaknesses with respect to these three areas, thereby facilitating the graduate school process.

METHODS

Although several published reports demonstrate the positive impact of the McNair Scholars Program universities hosting the program, the vast majority of these findings are supported through quantitative research that documents factors such as matriculation and acceptance into graduate programs (Lam et al. 2003; Parker, 2003; Thomas, 1994). By contrast, few studies employ qualitative methodologies to analyze and gain an in-depth understanding of the phenomenology behind the success of the McNair Scholar Program. In support of a qualitative approach, theorists Denzin and

Lincoln (2011) note that qualitative research has the ability to “isolate target populations” and “show the immediate effects of certain programs on such groups” (p. 15). Given these advantages, we designed this study to shed light on some of these immediate effects and benefits of participating in the MSP.

The question that governed the design, data collection, and analysis of this study is the following: *How do students in the MSP perceive their academic self-efficacy, research self-efficacy, and social self-efficacy based on their faculty mentoring relationship?* This focus on faculty mentoring as a potentially important variable stems from a recent study by Lam, Ugweje, Mawasha and Srivatsan (2003), who also investigated success-related variables in connection with the MSP. Their findings support the role and enthusiasm of faculty mentors as a significant predictor of success in the program.

Data Collection

Each year approximately 15 students are chosen to participate in the MSP during the Fall semester of their junior year. In September of the following year (their senior year), each student is asked to complete a survey assessing his or her experiences as a McNair Scholars during the prior year (junior year). This open-response survey was first developed by the PI in Spring, 2013 and it is based on a review of related qualitative-based literature specific to the MSP. It features a list of carefully structured questions to encourage program participants to provide as much detailed feedback about the program as possible (see Appendix A). In addition to requesting information that we anticipated would corroborate anecdotal evidence supporting the benefits of the program, we also collected data on aspects of the program that posed challenges and unfavorable outcomes for students. Specifically, the survey is intended to provide rich data about the program in four principal areas: (1) if and how targeted supports (i.e., faculty mentor meetings, research projects) contributed to the goals of the MSP; (2) their assessment of how program participation impacted their skills, confidence, and self-efficacy attitudes; (3) how and in what ways program participation contributed to their academic and research capabilities; and (4) an overall assessment of the strengths, shortcomings, and areas for possible improvement of the MSP.

As detailed in the next section, this survey (Appendix A) canvassed the opinions and viewpoints of MSP participants from the 2013 and 2014 cohorts. The findings detailed in this study will incorporate direct quotes to demonstrate the variety of unique viewpoints and experiences from respondents.

Sample

Participants in this study are drawn from the 2013 and 2014 cohorts accepted and inducted into the MSP. As shown in Table 1.1, a total of 27 McNair Scholars took part in this investigation: 13 individuals from 2013 and 14 individuals from 2014. (Only one person from each cohort did not contribute). Due to the goals of the grant, the high rate of participation in this study sample is representative of the cohort and is also closely aligned with national demographics for underrepresented minorities, females, those with low income and first generation status for students participating in the MSP. Demographic information for these 27 individuals include their pseudonym

name, eligible first-generation status, eligible low-income status, underrepresented minority, sex identification, and whether they were a STEM major while taking part in the program.

Table 1.1 | Survey Respondents and Characteristics

Pseudonym	Eligible First Generation	Eligible Low Income	Underrepresented Minority*	Sex	College Major Category**
2013 COHORT					
Tan	N	Y	Minority	F	STEM
Estelle	Y	N	Minority	F	Non-STEM
Patricia	Y	Y	Minority	F	Non-STEM
Hydra	Y	N	Not Minority	F	STEM
Austen	Y	Y	Minority	M	STEM
Aditia	Y	Y	Minority	M	STEM
Ahmir	Y	Y	Minority	U	STEM
Landon	Y	Y	Minority	M	STEM
Rachel	Y	Y	Minority	F	STEM
Ricardo	Y	Y	Minority	F	STEM
Tatiana	Y	Y	Minority	F	STEM
Riat	Y	N	Minority	M	STEM
2014 COHORT					
Venessa	Y	Y	Minority	F	STEM
Marianne	Y	N	Minority	F	STEM
Hayley	Y	Y	No Response	F	STEM
Yolanda	Y	Y	Minority	F	STEM
Insley	Y	Y	Minority	F	Non-STEM
Grace	N	N	Minority	F	STEM
Britt	Y	Y	Minority	F	Non-STEM
Nathan	Y	Y	No Response	M	Non-STEM
Timothy	Y	Y	Not Minority	M	STEM
Anslee	Y	Y	Minority	F	STEM
Rian	Y	Y	Minority	F	STEM
Cory	Y	Y	Minority	F	STEM
Ann	Y	Y	Minority	F	STEM
Ogder	Y	Y	No Response	M	STEM
Michelle	Y	Y	Minority	F	Non-STEM

Note: Pseudonyms were created through a free online name generator.

* Underrepresented Minority is defined as Blacks or African Americans, Hispanics or Latinos, American Indians or Alaska Natives, and Asian or Islander.

**College Major Category is defined as any declared major in the science, technology, engineering, or math (STEM) fields OR declared major outside of these four fields of study (non-STEM).

Recall that the aim of the MSP is to reduce socioeconomic disadvantage disparities in the enrollment and retention of first-generation, low-income and/or underrepresented undergraduate students in graduate school programs. Thus, similar to the demographic makeup of McNair Scholars at other institutions, the vast majority of program participants represent a combination of underrepresented minorities, female, low-income and first-generation students. Although it is important to understand the complex interplay of multi-sectionality and intersectionality when assessing programmatic impacts based on specific demographic characteristics, the scholars did not present sufficient differentiation for us to examine and evaluate any observed differences between scholars in majority or dominant social categories versus those were not. In addition, due to the limited sample size, non-binary demographics of underrepresented minorities race/ethnicity and college major were converted to a binary format to protect the anonymity of participants.

Data Analysis

Two researchers carried out the coding and analysis of qualitative data collected from 27 survey respondents by using Atlas-ti. We developed a method for organizing individual responses in order to capture emerging themes that signaled programmatic aspects of the MSP that participants found to be successful. The decision to use coding measures was derived from prior qualitative evaluations of the MSP. For example, in her study of the undergraduate MSP experience, Ford (2011) used coded categories “by highlighting sections of interview data and writing a word that represented a particular category in the margins” (p. 90). Since our research questions were concerning the connections between self-efficacy and the undergraduate experience, we used three categories of self-efficacy from prior evaluative studies, most appropriately including Williams’ (2004) study of McNair Scholars. This data analysis was executed in two phases. During the first phase, we organized the response to the open ended question provided by each survey respondent into one or more of the three aforementioned categories of self-perception: academic self-efficacy, research self-efficacy, and social self-efficacy. During the second phase, we identified sub-categories based upon the types of support that participants signaled as being supportive and important. We used a parallel coding approach. After we code individually, we met to evaluate the initial round of coding, which resulted in several modifications to subsequent coding iterations (Appendix B).

Although the survey questions are based upon our review of prior research and literature, including case studies and evaluations of programs pertaining to diversity and inclusion in higher education, we adopted a grounded-theory approach in our analysis of survey responses when we created sub-categories to capture supportive and important support. (Glaser & Strauss, 1967). The review of participant responses involved several carefully designed steps. First, as recommended by the grounded theory approach, we both made individual notes for each survey response, which led to the development of emerging themes that corresponded to programmatic components supporting the success goals of the MSP. Second, we departed from the grounded-theory approach by first identifying theory-based themes pertaining to academic self-efficacy, research self-efficacy, and social self-efficacy. Finally, we returned to a grounded-theory approach by identifying sub-categories from the dataset based on the types of support participants had received.

Although these theory-based and pre-determined codes were used, the analytical sub-categories were derived completely from data and not from predetermined hypotheses (Glaser & Strauss, 1967). The aim of this additional data categorization enabled us to use grounded-theory to (1) more narrowly identify success components of the program, (2) validate our interpretations of the data through clustering themes, and (3) expand our interpretations by providing additional categorical coding descriptions and investigating self-efficacy from varying perspectives. For example, when students discussed the social impact of the MSP, they often discussed receiving consistent encouragement from their peers. We later nested this description of data under “Support system within the program.”

Stake (1995) indicated direct interpretation, establishing patterns, and developing naturalistic generalizations as perspectives on interpreting qualitative data. For increased accuracy, we identified categories using actual verbiage from participants. Initially, we identified over 50 sub-categories through the first round of coding. In order to bridge more connections among patterns identified through analysis, we organized the data into more inclusive brackets of 2 to 3 sub-categories under each definition of self-efficacy. In summary, the three areas of self-efficacy were linked to a number of recurring themes, as follows:

Academic self-efficacy:

1. Faculty advice for navigating ambiguities in academics
2. Opportunities for developing critical thinking and analysis skills

Research self-efficacy:

1. Research-orientated guidance from faculty mentors
2. Exposure to research opportunities
3. Opportunities to communicate research

Social self-efficacy:

1. Holistic care from faculty mentor
2. Support system within program

In addition, by using a thematic approach to our analysis of participant responses, we were able to develop recurring themes based on programmatic aspects that appeared to be “causally related” or “at minimum describes and organizes the possible observations” to developing these three types of self-efficacy (Boyatzis, 1998, p. 4). Boyatzis (1998) asserted that this type of thematic analysis is flexible and “may be a list of themes, a complex model with themes, indicators, and qualifications that are causally related; or something in between these two forms” (p. 4). For example, with the question “What changes can you see in your skills since your research experience?”, the notion of skills-building through “opportunities to communicate research” was found repeated in questions specifically asking about research experience. A more detailed account of the themes and accompanying definitions according to the three types of self-efficacies are listed in Table 1.2.

Table 1.2 | Themes and Definitions

THEME	THEME DEFINED
ACADEMIC SELF-EFFICACY	
Advice on navigating ambiguities in academics from a faculty mentor	This classification refers to receiving advice from a faculty mentor on navigating uncertain circumstances with academics. Learning the “tricks of the trade” are vital to enhancing the self-confidence of scholars and being successful in academic pursuits.
Opportunities for developing critical thinking and analysis skills	This classification refers to being presented with opportunities for critical thinking and analysis skill-building to assist in achieving at a more elevated level in an academic subject, which in turn develops academic attentiveness and focus. Becoming aware of skill-building leads to greater self-confidence (Posselt & Black, 2012).
RESEARCH SELF-EFFICACY	
Research-orientated guidance from a faculty mentor	This classification refers to gaining confidence and skills in conducting and navigating research-related tasks from specific research advice from a faculty mentor.
Exposure to research opportunities	This classification refers to feeling motivated to conduct research from opportunities where scholars are presented, encouraged and occasionally required to conduct research.
Opportunities to communicate research	This classification refers to skill-building through opportunities to communicate research. In this process, scholars “gain skills and experiences leading to new forms of external recognition, which, combined, lead to changes in how they see themselves” (Posselt & Black, 2012, p. 36).
SOCIAL SELF-EFFICACY	
Holistic care from a faculty mentor	This classification refers to the consideration of needs of scholars beyond research, academic and professional endeavors. Taking social and mental needs into account develops competency in these areas, which enable scholars to be more healthy and successful students.
Support system within program	This classification refers to the personal growth through close and collective interaction with other scholars with similar backgrounds and academic aspirations. This classification is also known as the “cohort effect” (Posselt & Black, 2012).

FINDINGS

The data analysis process we utilized for this investigation is grounded in the expectation that survey data would elucidate the ways that academic/research/social self-efficacy developed among McNair Scholars. In other words, we are interested in how self-efficacy is constructed and eventually internalized via the experiential descriptions that the scholars provided. The challenge in interpreting the data is that some support was systematically built within the MSP, other experiences students described was derived from informal channels not explicitly integrated into the curriculum of the MSP. For example, through the MSP, scholars are required to communicate their research findings to various audiences, but are not necessarily expected to have their social needs met from interacting with other McNair Scholars or their faculty mentors.

Nonetheless, our identified themes (see Table 1.2) of support fit within the predefined categories of academic, research, and social self-efficacy under Bandura's (1994) umbrella definition of perceived self-efficacy as "people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (p.71). As detailed in the following sections, the discussed themes embody the co-curricular support needed to accomplish the central goal of the MSP in developing a sustainable framework to "increase graduate degree awards for students from underrepresented segments of society" (University of Central Florida, 2016).

Academic Self-Efficacy

In addition to discussing the benefits of the research-related advice they received from faculty, most students also discussed the importance of faculty advice in navigating the ambiguities of the day-to-day academic landscape. Indeed, participation in the MSP had a marked impact on the academic self-efficacy of students, which is vital for subsequent success in graduate school. Almost all survey respondents noted how it increased their academic self-confidence. This marked academic growth was met with phrases of conviction and confidence such as "I feel more comfortable asserting and defending my arguments" and "I am now able to trust my intellectuality and know that it is valid." Several participants spoke of the importance of engaging with a faculty expert. Timothy mentioned that his faculty mentor helped him to "hone in on a specific topic," while Aditia noted that "Having a faculty mentor (especially in your research area) is a great help in understanding just what you need to do to be successful in your field."

In addition to targeted academic advice, several students viewed their faculty mentor as the go-to person for more generalized help. Tanya encapsulated the importance of the faculty-scholar relationship in the following quote, in which she also alludes to the significance of the role-modeling component:

It matters because she is who I can ask for advice in multiple situations when it comes to my academic life. I appreciate her perspective since she was capable of making it large in my field of study and is clearly succeeding in a way that I would also like to do.

Similarly, when asked why the faculty-mentor relationship matters, Austen added that “It allows me to have someone in academia who I can always go to when I need help.” Importantly, over one third of respondents specifically stated that they believe their faculty mentors give them advice that is “honest,” “genuine,” or a synonym of being reliable and trustworthy. This finding is important since the MSP make it a priority for scholars to connect with faculty mentors from their field; thus, scholars learn directly from the source how to succeed in their field of study in graduate school. Estelle remarked: “One could just Google the answers to their questions instead, without getting a genuine, realistic account of what to expect in grad school.”

Over one third of respondents also believed that their involvement in the MSP increased their critical thinking and analysis skills, both of which are vital for the successful completion of a terminal degree. Indeed, research shows that developing the academic identity and skills of McNair Scholars leads to greater self-confidence and thus the likelihood of success in graduate school (Posselt & Black, 2012). As Ahmir summarized, “I think the MSP increased my analytic, problem solving, and critical thinking skills... I am more considerate of the practical implications of my research.”

Research Self-Efficacy

Without exception, McNair Scholars in both cohorts discussed the significance of research-orientated guidance from faculty mentors, actual opportunities to conduct research, and having the chance to present and communicate their own research findings and results. Faculty mentors in the MSP are well aware of the importance of advising students on appropriate and productive ways of designing and carrying out research projects. We require faculty mentors to participate in MSP mentoring training sponsored by the Center for Teaching. Several participants who reflected on the advice they were given indicated that it increased their belief in their ability to spearhead their own research endeavors. Participants noted how direction from faculty mentors helped them understand the research process in much greater detail, which would prepare them for similar pursuits in graduate school. For example, Aditia, a first-generation and low-income student, discussed how the holistic approach to research he received through faculty interactions and MSP required advising and workshops would be beneficial as a graduate student:

My faculty mentor has been able to direct me specifically towards my research, whereas the McNair program focuses more on the logistic aspect of graduate school. In tandem with McNair, it's given me a well-rounded approach to what I need to do prior to pursuing my doctorate degree.

Similarly, Timothy detailed the benefits of conducting guided research as a McNair Scholar:

I feel that having a faculty mentor throughout the McNair research experience is vital aspect to the program in that it allows the scholars the opportunity to develop a close relationship with an expert in his/her respective field, much like the relationships fostered as a doctoral candidate. Furthermore, it provides the scholars with a line of communication to someone who has already had many of the experiences that the scholars may have questions or concerns about.

Furthermore, apart from simply following advice from faculty, engaging with faculty in a research project produced other positive spinoff effects. Britt put it succinctly: “Having access to faculty mentors has bumped up my confidence.” Similarly, Ahmir described not feeling afraid to network with faculty when in need of support: “I am a more confident student and researcher. I am not afraid to put my name out there and engage faculty about my needs and concerns.” In a similar statement, Riat described an important lesson learned from the opportunity to conduct research and how the importance of persistence boosted his self- confidence:

My confidence has increased because I realized I did not have to be perfect. That has been the number one confidence booster. Not everything will go as planned and that’s perfectly ok. I messed up so much in the lab, but that did not matter as long as I tried again and did not give up.

Riat also noted some additional benefits of having been a McNair Scholar: “The MSP has assisted me in getting a summer REU,(The Research Experiences for Undergraduates program, which supports active research participation by undergraduate students in any of the areas of research.) This furthered my career interest in agricultural plant sciences by letting me intern at a research company and seeing firsthand the careers represented there.”

In addition to speaking about confidence and skills-building when describing their research experiences as Scholars, participants also used words such as “fun” and “exciting.” Ann, a first-generation and low-income student, detailed how exposure to the nuances of engaging in research also increased her enjoyment of the process, as well as boosted her confidence about pursuing graduate studies:

It confirms my decision to go to a grad school. I enjoy planning experiments and troubleshooting failures even though it gets depressing at times. However, the sense of accomplishment of a successful experience and the thought that my project has the potential impact to [my field] is very exciting.

Additionally, several participants pointed out the importance of communicating their research findings through oral presentations at academic conferences as a confidence-building process. For example, Austen noted how his participation in the MSP boosted his critical writing and public-speaking skills:

I feel the greatest skill that I am gaining as a result of the MSP is the ability to communicate. Through the writings I have done for the program and the presentation I gave at a conference, I feel that I have become a more confident public speaker and academic writer.

Similarly, Anslee indicated that her research-related experiences as a McNair Scholar enhanced her self-efficacy skills with respect to communication and being about to conduct research in the future: “I am able to communicate more efficiently and clearly. It makes me feel that I am a lot closer to being able to develop my own research project.”

Social Self-Efficacy

The MSP is structurally designed to support students in all areas of their undergraduate experience. And indeed, many participants attributed a general growth in their roles as students and scholars as a result of the holistic encouragement from their faculty mentors, which extended beyond academic and research-oriented guidance. In other words, the MSP's less formal programmatic focus takes the social and psychological/emotional needs of the student into consideration as a way to enhance the student's overall academic experience. This component is supported by research, which concurs that social support and feeling connected with faculty can improve retention in higher education for a variety of reasons (Lotkowski, Robbins, & Noeth, 2004). For example, enhancing social support builds efficacy in individuals, which can lead to a greater propensity to set higher goals and be more deliberate and confident in approaching and achieving those goals (Williams, 2004).

While all students are at risk for any number of non-academic challenges, the fact that McNair Scholars tend to be first-generation, low-income and/or underrepresented students means that they may face some additional hurdles as undergraduates. Thus, the informal social support that faculty mentoring provides may be invaluable. Consider the example of Michelle, who spoke to this issue:

As a first generation student I can't find this type of support anywhere else. Unfortunately, my parents don't really understand what a PhD entails so I feel that this provides extra guidance where my home support might be lacking.

Other McNair scholars spoke about instances when their faculty mentors aided them in meeting more personal needs. Nathan shared: "My faculty mentor has supported me financially and emotionally. When I lost my cousin, my faculty mentor invited me over his house. He treats me fair as a student, but he also treats me as an individual that matters and has purpose." Similarly, Estelle, a minority and first-generation student, revealed:

I am always uplifted by visiting with my faculty mentor, because it is so obvious to me that she cares not only about my academic/research progress, but about my mental, emotional, and physical well-being as well. I feel completely comfortable disclosing matters to her.

Considering that most McNair Scholars are first-generation students who are navigating higher education and pursuing graduate education for the first time, the importance of a supportive relationship with a faculty mentor who can also serve as a role model cannot be overemphasized. Ricardo was unambiguous in describing the importance of this relationship:

It brings me the support and comfort I need. Her encouragement means the world to me. Having struggled so much my first few years doubting myself and not knowing what to do or look up to as a first-generation student [in my field of study], this relationship has brought back to me hope and the enthusiasm I needed to keep going.

Among the 27 students who provided feedback about their experiences with McNair Scholarship Program Ricardo was perhaps the most enthusiastic about the benefits of having a faculty mentor: “You have someone who can talk to you and has the best experience in what you want to do. I don't think anyone else other than my mentor who's walked the path I want to follow could give as good advice as hers.”

Similarly, Landon spoke about the importance of his social relationship with his faculty mentor in terms of how similar their backgrounds were. The informal interactions he shared with her extended beyond skills building to confidence building:

My faculty mentor provided many of her personal stories and experiences with me and I noticed what a similar path that we have traveled through education and experiences within our [underrepresented] communities and it is encouraging to hear that someone once in my position has made it through to "the other side" and is in a pretty significant role despite life challenges.

A number of students also discussed their personal growth as a result of their close interactions with other McNair Scholars with whom they identified based upon their similar backgrounds, challenges, and academic aspirations. Posselt & Black (2012) referred to these supporting relationships as the “cohort effect,” where “mutual support, role modelling, and deep friendships developed in the group that extended beyond the programme’s structured activities” (p. 38). A number of students specifically referred to being supported by their peers and belonging to a community. When asked to identify the best part of being in the MSP, Hydra stated, “The best part is being a part of a supportive community full of people who have similar aspirations to mine.”

The fact that many McNair Scholars spoke to the importance of the social support received from their faculty mentors and fellow students highlights the significance of this component as a way to enhance social self-efficacy. Indeed, the supportive role of the McNair “family” directly translated to a variety of benefits for scholars. Most notably, through their interactions with faculty and peers, the students were able to contextualize their fears about being successful in academics and research and realize that their uncertainties and self-doubt were not unique to themselves. Hydra summarized these feelings rather succinctly:

Being in the MSP has given me more confidence and boosted my self-esteem. We have discussed the imposter syndrome, and I now truly believe that I deserve my achievements. Also, being able to talk to my fellow scholars has helped me realize they have the same issues I have.

DISCUSSION

This investigation is designed to answer the following research question: *How do students in the MSP perceive their academic self-efficacy, research self-efficacy and social self-efficacy based on their faculty mentoring relationship?* The researchers downloaded the open ended written responses from 27 scholars across two cohort years in order to provide the opportunity to (1) describe how targeted supports (i.e. faculty mentor meetings, research projects) contributed to the goals of the MSP; (2)

describe how the MSP has augmented the academic and research capabilities of participants; (3) reflect on skills-gained and student growth in academic/research/social self-confidence as a result of program participation; and (4) gather feedback from their experiences in order to determine if any programmatic changes are needed to further strengthen the program.

Based on participant feedback, we identified a number of emergent themes that we categorized into the three distinct categories of self-efficacy: academic self-efficacy, research self-efficacy, and social self-efficacy (Williams, 2004). With respect to academic self-efficacy, participants discussed how the advice they received from faculty mentors helped them overcome both general and specific academic challenges, as well as enabled them to develop critical thinking and analysis skills. Faculty mentoring helped bridge academic, research, and social self-efficacy. The participants were able to integrate these areas of self-efficacy on various levels. One level is having regular faculty mentor meetings. These meetings allow one-on-one relationships and foster academic skill building. A second level is the ability to connect outside of the classroom around academic or social issues. The final level is having the ability to take ownership connecting various ideas, research to practical issues. These networking opportunities allowed scholars to expand their communication skills and share their discoveries in research at symposiums, conferences, and social settings. In the category of research self-efficacy, participants routinely pointed to the importance of research-orientated guidance from faculty mentors, exposure to research opportunities, and opportunities to communicate their research findings both in writing and orally. Finally, the McNair Scholars growth in terms of their social self-efficacy is promoted by informal, yet caring, relationships with faculty mentors and their McNair peers. Indeed, the social support of the McNair “family” (to include faculty mentors, program administrators, and fellow Scholars) appears to be of critical importance to the growth of their social self-efficacy.

RECOMMENDATIONS FOR FURTHER RESEARCH

Continuation of Study

This study provides important feedback directly from McNair Scholars about their relationship with their faculty mentor and how the programmatic components of the program have impacted their readiness for graduate school. Based upon our findings, coupled with synthesis from prior research and program evaluations of other McNair Scholar Programs, we suggest two strategies for augmenting the findings from the current investigation. First, the survey utilized in this study could be administered at the other 151 MSP host universities in order to ascertain if the development of the three components of self-efficacy are also being seen McNair scholars around the country. The survey questions were designed to gather participant feedback based on self-efficacy categories used by Williams (2004) and offers the opportunity for open-ended responses. Second, researchers could consider longitudinal study, especially one that canvasses the qualitative input of former McNair Scholars who are graduate students (or in post-graduate positions). Third, a follow-up study should consider constructing and implementing self-efficacy scales as a more quantifiable way to assess the success of the MSP (Bandura, 2006).

Other Considerations

While we consider the input we received from the 27 McNair Scholars who contributed data for this investigation to be illustrative and valuable, at the same time we recognize that small sample size limits the depth of our analysis. For this reason, it would be beneficial (as recommended in the prior section) to examine self-efficacy across more cohorts both at this institution as well as at other institutions across the United States. Such a study could clarify if there are regional differences, or differences stemming from the distinct programmatic components at each institution.

A limited sample size also places tighter parameters on the variety of demographic factors that can be analyzed. As noted, the vast majority of McNair Scholars are a combination of underrepresented minorities, female, low income and first generation students. Increasing the demographic parameters in a sample could augment the possibility of conducting a cross-demographic study, which would allow researchers to examine the complex interplay of different identities when assessing programmatic impacts among specific demographic characteristics. For example, differences among scholars in social categories, such as ethnicity, could facilitate a rich and saturated discourse recognizing where students from different backgrounds may vary in experiences.

Lastly, since this study examines the importance of faculty mentorship in the development of self-efficacy among McNair Scholars from a single perspective (namely, the students), it would be enlightening to also survey faculty mentors for their insights. Indeed, this additional source of feedback could further strengthen the program by identifying any barriers hindering faculty from succeeding in the role a MSP mentor. Additionally, the experiences of faculty mentors with *any* student could contribute to our understanding of how to stimulate and inculcate self-efficacy in undergraduates so that the brass ring of a PhD would never appear to them to be out of reach.

RECOMMENDATIONS FOR PROGRAM IMPLEMENTATION

The findings reported in this study indicate that the formal and informal support systems that McNair Scholars were able to access, primarily through their contact with faculty mentors, are instrumental in the development of these students' academic, research, and social self-efficacy. Based upon our findings and synthesis with prior research and evaluations of other McNair Scholar Programs, we recommend that McNair Scholars Program and host institutions encourage faculty mentors to (1) provide research-oriented guidance to help scholars gain confidence and skills in conducting and navigating research-related tasks; (2) address all aspects of navigating the many ambiguities in undergraduate education; and (3) be receptive to mental, emotional, and social needs that support the general welfare of McNair Scholars since participants revealed the positive impact of having various needs met and receiving holistic care. In the MSP overall, we recommend that host institutions (1) consistently provide opportunities for both conducting and communicating or presenting research since our data reveal opportunities greatly enhance research self-efficacy; (2) take into consideration opportunities for developing and enhancing critical thinking and analysis skills; and (3) maintain a collaborative environment for McNair cohorts to convene and share their experiences, stories, problems, and successes based upon consistent feedback about social self-efficacy achieved through the

“cohort effect” support system (Posselt & Black, 2012). We would recommend the following actions steps:

1. Identify a list of opportunities on and off campus for the scholars to conduct and present their research
2. Identify local and regional conferences for the scholars to present their research
3. Identify a list of on-campus and on-line workshops for scholars to form learning strategies to develop critical thinking skills (i.e. workshops, courses at the institutions, lynda.com, Khan Academy, intellectual/research journal, etc.)
4. Identify books that deal with the various identities that impact scholars and have book discussions/workshops/dinners that are led by faculty mentors, staff and peers (i.e. Journey to the Ph.D.: How to Navigate the Process as African Americans, The First Generation Student Experience, etc.)
5. Identify off-campus venues to allow social gatherings and discussions about the journey to the PhD with faculty, staff and students (i.e. Barnes and Nobles, Starbucks, etc.)
6. Identify opportunities for faculty to train students on specific research-related tasks in a particular field and assist faculty with research projects in a particular field

CONCLUSION

In summary, the fact that the MSP exists on 151 college campuses across the nation points to the importance of an academic and social “leg-up” for first-generation, low-income and/or underrepresented undergraduate students. While the formal and informal programming efforts associated with the MSP are clearly making a positive impact on the self-efficacy of McNair Scholars, providing a strategy for attaining a graduate degree, we understand that personal growth in self-confidence and resilience is complex and that there are many factors that may be contributing to growth in these essential areas. However, based on our own findings and prior research, we argue (with confidence) that the MSP provides a systematic structure for ensuring success in higher education overall, but especially in preparing an at-risk population for attaining a PhD. As one student stated, “I would like to emphasize that a program such as McNair is very much needed. There are many people who know what they want to do in life, but do not know how to go about accomplishing it. This is when McNair can come in.”

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APPENDIX A

McNair Scholars Program Survey

1. How has the McNair Scholars Program enhanced your career aspirations (i.e. readiness for research/careers, socialization, networking, polishing application for graduate school, research experience, adjustment to graduate school, etc.)?
2. Have you discussed your career aspirations with your faculty mentor? If not, why not? Please elaborate on your response.
3. What type of advice did you receive from your faculty mentor about your career aspirations? Please elaborate.
4. What are the benefits of having a faculty mentor throughout the McNair research experience?
5. Why does the faculty mentor relationship matter?
6. Were there any problems with the faculty mentor relationship (i.e. management, guidelines, and expectations)? Please elaborate.
7. Please explain how your faculty mentor was supportive.
8. What motivated you to participate in the McNair Scholars Program?
9. Did your summer project fit with your research interests? If so, how? If not, why not?
10. What changes can you see in your understanding since your research experience?
11. What changes can you see in your skills since your research experience?
12. What changes can you see in your confidence since your research experience?
13. What changes can you see in your attitude since your research experience?
14. Prior to the McNair Scholars Program, did you conduct research with a faculty mentor? If so, when? How would you describe the experience and why?
15. Did you work with other students or did you work alone on faculty based research projects? What was the experience like? What was the most important/significant about that experience?
16. How did you enhance your skills during the McNair Scholars Program? What skills did you feel were most important for you to gain (i.e. research, lab procedures, literature reviews, communication, and leadership)? Please elaborate.
17. How did the McNair Scholars Program enhance you personally?
18. How did the McNair Scholars Program enhance you professionally (i.e. self-confidence, self-esteem, etc.)?
19. How did the McNair Scholars Program enhance your intellect (i.e. subject matter, problem solving, critical thinking, practical application, challenges, and support, etc.)?
20. How did the McNair Scholars Program change your approach to learning (i.e. shift from passive to active learners, or learning to work independently)?
21. What was the best part of the experience?
22. What was the worst part of the experience?
23. Is there anything else I should be asking you?
24. Of everything we have discussed, what would you like to emphasize?

APPENDIX B

Coding Structure

Level 1	Level 2	Level 3
1. Research Self- Efficacy		
	1.1.	Faculty Mentor Provided Research-Related Guidance
	1.2.	Exposure to Research Opportunities
	1.3.	Opportunities to Communicate Research
	1.4.	Increase in Confidence: Research
	1.5.	Experience with Research Complexity
	1.6.	Advanced Through Research Process
	1.7.	Enhance in Motivation to Conduct Research or Enthusiasm In Research
	1.8.	Faculty Mentor Provided Research Expectations/ Progress Tracking
2. Academic Self-Efficacy		
	2.1.	Faculty Mentor Provided Advice in Navigating Ambiguity in Academics
	2.2.	Opportunities for Critical Thinking and Analysis
	2.3.	Increase in Academic Attentiveness and Focus
	2.4.	Enhance in Academic Preparation
	2.5.	Adopted More Serious Academic Approach
	2.6.	Increase in Confidence: Academic
	2.7.	Motivated to Explore More Courses
3. Social Self-Efficacy		
	3.1.	Faculty Mentor Provided Holistic Care (Mental, Emotional, Physical, Etc.)
		3.1.a. Individual Attention
		3.1.b. Consistent Encouragement
		3.1.c. Provided Overall Genuine Advice
	3.2.	MSP Provided Sense of Community or Support System
	3.3.	Increase in Confidence: Social or Personal
	3.4.	Enhance Autonomy
	3.5.	Enhance Hope
	3.6.	Enhance Self-Advocacy
	3.7.	Exposure to Different People
4. Hard Skills Gained		
	4.1.	Skills: Active Learning
	4.2.	Skills: Coding
	4.3.	Skills: Critical Analysis
	4.4.	Skills: Networking
	4.5.	Skills: Organization
	4.4.	Skills: Practicing Methodologies
	4.5.	Skills: Problem Solving
	4.6.	Skills: Reading
	4.7.	Skills: Teaching
	4.8.	Skills: Work Ethics
	4.9.	Skills: Writing
	4.10.	Skills: Progress Tracking
5. Constructive Criticism Feedback		
	5.1.	Faculty Mentor Was Busy
	5.2.	Did Not Enjoy Summer Research
	5.3.	Trouble Getting in Touch With F/A
	5.4.	Felt Isolation in Work
	5.5.	Difficulty Adjusting to New Environment

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ACKNOWLEDGEMENTS

This research paper would not be possible without the dedicated participation from each and every student in the Ronald E. McNair Post-Baccalaureate Achievement Program at Cornell University and the steadfast support from staff and faculty that support them.

Belonging, Staying, Making it Better: Underrepresented Students Create Space for Student Voice in an Educational Opportunity Program



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Abstract: *This paper highlights the importance of centering student voices in the design and implementation of educational opportunity programs, and demonstrates that participatory research methods are a productive and powerful way to do so. We met regularly with a group of students within an educational opportunity program, to discuss tensions they were experiencing and support them in strategizing to address the tensions. Students created a space for student voice and organizing to push their program to incorporate students' skills and experiences in a way that would value students beyond grades and test scores. The students envisioned the student group as an integral part of programs designed to support and retain underrepresented students in higher education institutions.*

Keywords: Student Voice, Participatory Approaches, Engineering

The hot room is filled with exhausted new education researchers getting ready to showcase their qualitative studies to a public audience for the first time. Former middle and high school teachers, we are two white women learning how to support teachers to create equitable and democratic educational experiences with their students. We nervously stand by our poster, making small talk and checking the tape for the third time. A burst of energy interrupts the palpable anxiety as five undergraduate Men of Color pile into the room, dressed in ties and slacks. These familiar young men greet us with smiles and handshakes, clearly excited to be here. These students gather around the poster, which displays our research on our participatory work with them, and they laugh as they recognize their words in the quotes. The group becomes quiet as they read through our claims, and Jackson exclaims, "It's perfect, we couldn't have said it any better!" The rest of the guys nod in agreement and Miguel asks, "Will you explain it?" We readily explain our work, and this begins a pattern of the morning - we explain our

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analysis and the students elaborate and answer questions as graduate students, professors, and administrators join us to learn about our partnership.

There is a need for researching and designing programs from a participatory approach in higher education institutions and for research on educational opportunity programs. Students of Color are underrepresented in higher education because they have been historically underserved by and/or excluded from k-20 education institutions (Cooper, 2011; Ladson-Billings & Tate, 1995). Educational opportunity programs are crucial for supporting underrepresented students to attain higher degrees in the face of that historical exclusion. However, if these programs mirror the oppressive structures that have historically excluded Students of Color, they run the risk of continuing to marginalize the students they seek to serve and support (Ladson-Billings & Tate, 1995). Professionals working within these programs must seek out student voice and make it the focal point of the design and implementation of their organizations. Research that illuminates underrepresented student voice can be used to support this process. This is what our study aims to do.

STUDYING SOLUTIONS WITH STUDENTS

In our study, we drew on the principles of participatory action research (PAR): “critical scholarship, multi-generational collectives, [which work] to interrogate conditions of social injustice through social theory with a dedicated commitment to social action” (Fine, 2008, p. 213). We therefore engaged in work with students using a critical lens to understand the structures of their educational opportunity program, the Strive Program (pseudonym), as embedded in larger systems of inequity. We entered this work with the presupposition that expertise is widely distributed and that the wisdom, experiences, and histories of underrepresented students should be centered in the design and structure of programs meant to support them (Strand, Marullo, Cutforth, Stoecker, & Donohue, 2003; Torre, 2009). Throughout this paper, we draw on critical theories to understand students’ interpretations of dilemmas and strategies to improve their educational opportunity program (Ladson-Billings & Tate, 1995; Torre, 2009; Yosso, 2005).

In 2013-2014, we met regularly with a group of first-year students within the Strive Program, an educational opportunity program, to discuss tensions they were experiencing and support them in strategizing to address the tensions. Simultaneously, we (the authors) studied the process. This relationship began through a semester of ethnographic fieldwork situated within a larger research project aimed at studying the Strive Program. During interviews, students had identified the need for voice within the program. Through conversations in our research meetings, we (the authors) realized we had joint interest in learning more about the students’ experiences. As our fieldwork progressed, and we developed relationships with students, we discussed the possibility of working together to explore the tensions the students were experiencing. After four months of ethnographic fieldwork, we shifted our research role to participant observers (Spradley, 1980) as we formed a partnership with the students based on a participatory framework. For the next five months, we met regularly and recorded and transcribed our conversations.

The participants included seven freshmen; all were Students of Color. Two students, Carlos and Miguel, facilitated our meetings and acted as leaders in this partnership, and we conducted interviews with them. The students had an active goal - to start a student group that would serve as a space for student voice and organizing within the program. Students used us as a sounding board to articulate their feelings about the program and the goals of the student group. We (the authors) studied the discussions on the dilemmas students felt they were facing and the solutions they felt would alleviate these tensions. Our partnership meetings focused on the need for student voice within the program and simultaneously provided opportunities for students to organize, raise and explore concerns, and strengthen community.

THE STRIVE PROGRAM

The Strive Program, located within the College of Engineering in a large university in the western United States, was designed to provide opportunities for students who were underrepresented in the field to go into engineering. Traditionally, white males constitute the majority of the field of engineering (American Society for Engineering Education, 2011). The Strive Program sought to increase participation of females, first generation students, and Students of Color in the College of Engineering and as a result, in the field of engineering. The program encouraged applications from students who attended high schools that did not offer the prerequisite coursework for application to the College of Engineering. To this end, the program invited applicants who had not been accepted into the College of Engineering to apply to Strive in order to pursue an undergraduate degree in engineering through a five-year route. Students in the Strive Program received a small scholarship each year, intended to make up for the cost of the additional fifth year of the program.

The five-year route included programmatic supports. Students in the Strive Program were required to take particular classes, some which were strictly Strive classes, and some which were integrated with other first-year students. An administrator of the Strive Program taught a leadership class for Strive students only. In addition, students also took a critical-thinking humanities course with the honors engineering students. The program required that all Strive students live a community dormitory for their first two years. Students in the program were encouraged to access the college's resource center for additional resources, such as study groups and tutoring. Additionally, second-year students served as mentors to the incoming students. Administrators and mentors met with the first-year students in small groups periodically throughout the semester to check in with them and offer support. In the year of our study, 31 students were enrolled as first-year students in the Strive Program.

DILEMMAS STUDENTS FACED IN THE STRIVE PROGRAM

Students experienced dilemmas within the structure of the Strive Program, based on rigid grade requirements and a one-size-fits-all approach, causing them to retake classes, costing them time, money, and morale.

Rigid Structure and Requirements

Though the Strive Program was designed to support underrepresented students, the grade requirements were stricter than the requirements for the rest of the College of Engineering. By admitting marginalized students who were originally denied admission into the College of Engineering, the Strive Program acknowledged that students were not initially accepted to the school due to systemic inequities (i.e. attending schools with high teacher turnover, failing ratings, no advanced classes offered). Still, the program maintained unnecessary and demoralizing requirements for the students to remain in the program once they were accepted. The program required that students earn a minimum grade of a B- in each class (as opposed to the minimum grade requirements for the rest of the College of Engineering, a C- for prerequisite classes, or D- for all other classes), and the students had to retake the class if they failed to do so. Despite how talented, motivated, and hardworking these students were, many students had to retake courses during second semester because of the grade requirements which cost them time, money, and morale. Miguel confided in us the pressures that came with these grade requirements and revealed the damage to his self-esteem:

I feel like, the time I actually broke out crying was December. Because I had been working really hard to get the grades for Strive, and I had failed all my tests. Which was really hard for me. And when I got my final grade, [starts crying] I failed them both. I failed physics and I failed math, and it was just really hard. I felt frustrated; I just didn't feel like I was enough after that. (Miguel)

Despite Miguel's account, he did not actually fail his courses by university standards but rather he did not receive the Strive Program required B-. Within our partnership, we were able to discuss this frustration with the students and support them in making sense of how this could inform the changes they proposed to the program administration.

The academic requirements not only lowered students' morale and shook their sense of belonging in the Strive community, but also pushed students out. At least four students left the program throughout that academic year:

Brad already left ... if you don't get a B- in math or science you have to retake. He enrolled himself in Calculus because he wanted to be on track. He felt like he messed up and he learned from it. [The administration] was making him go back and he said no and so he got out. (Miguel)

When students left, this sense of loss was profoundly felt and students discussed it at each of our meetings throughout the semester.

Students expressed feelings of frustration about not having a process to appeal individual cases; they discussed the desire to have a say in their future: "It's *our* future; it's what we want to do. I think we should have a bigger say in what we do and what we take. We're in college now. We're paying for classes" (Ophelia).

One-size-fits-all Approach

Students were all enrolled in the same remedial courses, in spite of their test scores or high school experiences. This one-size-fits-all approach led to students who had a stronger academic background to feel limited. The students pointed out that taking unnecessary courses put a financial burden on their families; tuition was costly, and the students needed to progress in as timely a manner as possible. Many of the remedial classes students were required to take in their first year did not count toward their degree, which added additional financial stress. Jackson explained:

Amanda dropped because she was way smart and way ahead. She could have easily been in calc last semester and [the administrator] would not allow it. She wanted to take classes without having to take the intro classes... She didn't have to go through all the intermediate steps that we have to go through and I think she felt that way too. She made straight A's and [the administrator] would not let her go [...]

The emphasis on grades and rigid requirements contributed to students feeling as if they were a statistic within the program, rather than individual people. Students explained that this also contributed to several of their peers leaving the program. The one-size-fits-all requirements of the program were experienced as barriers rather than supports. Students believed that increasing a sense of community would allow them to address the structural dilemmas that they faced. Carlos explained that with community, "You feel like you belong, and you're willing to stay and make it better."

BELONGING

Students conceptualized a complex definition of community, which included an awareness of inequitable positioning of individuals within structures, a belief that members of a community must take action to improve the community, and an understanding that community was imperative for people with non-dominant identities to succeed in institutions.

Community as a Collective of Cultural Brokers

Community was central to the students' discussions. Their definition of community involved having a sense of belonging, not just on an individual level, but on a collective level, "It's not about me, me, me, me. It's about we and us. It's about we and us. It's all of us" (Carlos). The students described the "community sense" as "we/us," in which community members are interconnected in their willingness to help one another and to share resources and knowledge. Miguel explained, "I feel like that's pretty much what a sense of community is, helping each other, and looking for the best of yourself and others, and then I feel like it's just a matter of help and prosperity within the community."

Additionally, students' understanding of community involved sharing knowledge and resources. Students often identified cultural brokers, people who shared information concerning how to successfully navigate systems in order to gain access to higher education (Cooper, 2011).

Simultaneously, students believed it was their duty to work as cultural brokers themselves, passing on the information to others from their community: “I would see these amazing students and they'd do these amazing things but they weren't sharing. But that's kinda what made me mad. Or not mad, but like inspired to do that” (Carlos). Sharing was central to students’ identities as community members and provided them tools to skillfully maneuver within power structures.

Without a Sense of Belonging

The students’ experiences in the Strive Program were in tension with their understanding of community. While students approached community from a “we/us” perspective, the students felt that the program treated all students as a homogenous group without individual needs, yet singled students out based on grades. An important component of community for students was giving back, but the rigid structure and grade requirements offered few opportunities and limited time for students to engage in service. Students believed a foundational component of community involved sharing knowledge, but there was no space or vehicle for students to support each other in their experiences and share this information with the administration. Students’ ideas around community embodied a critical perspective focused on changing the future and understanding and addressing positioning within structures. However, as is often the case in educational opportunity programs for marginalized students, students did not have an avenue to participate in the development and improvement of their program.

STAYING

The students believed that improving community was imperative for people with non-dominant identities, and that membership in a community involves taking action to improve it. Carlos described how attending college is changing the future for himself, his family, his high school, and his neighborhood,

In our communities, with full minorities, they don't go to college. We're trailblazers, we're setting that new trail and we're expanding our roots to our community. Cause I knew when I went to college, when I came here, I wasn't just affecting my family and changing my family's future. I know I'm changing Montgomery's future and I'm going to work toward that and I'm going to do it and I want to. (Carlos)

Students articulated a belief that productive community members view themselves as actors in their own history and as a result understood that their actions could affect change within the Strive community.

Not every student entered the group’s discussions with this understanding of community already formed. For instance, two of the students, both of whom had met all Strive requirements, expressed their opinions that the grade requirements in the Strive Program were not too strict, and suggested that students just needed to work harder. These two students did not enter the program with a critical perspective, but our group participated in conversations that challenged this kind of

meritocratic thinking. Our meetings served to deepen understanding of systemic inequities in education through dialogue.

Supporting Students to Stay

The students' critical perspective of community also included an awareness of positioning within structures. Miguel asserted, "Everybody says college is the place where you find yourself and I feel like not many people are getting to find themselves in this kind of positioning, circumstances that we're in." Students wanted to feel supported by the community; they wanted space to develop as individuals to make their community better. This concept of making the community better added a critical perspective to the idea of giving back, and it broadened the concept of community to encompass marginalized communities at large. Carlos described the message of one cultural broker whose words stuck with him, a public speaker who discussed the importance of returning to one's community after achieving success: "...you can't really improve your community if you don't go back and help it. And that's what [the public speaker] emphasized, he's like, you have to be present there ... I really wanted to do that as well." The critical aspect of students' definition of community emphasized doing something with one's success because they realized that success was not just their own. For example, Carlos' personal future goals included using the success of an engineering career to establish scholarships and pathways for students from his and other marginalized communities, as well as returning to his own neighborhood to teach.

Without a Way to Give Back

As it was, students did not feel like the Strive Program was structured in a way where they were positioned as active community members who could give back to the program and support future students. They wanted to feel ownership and agency within the program. Students expressed a desire to push on the structure of the Strive Program in order to open up an avenue for their voice and concept of community: "We are going to be together for the next 5 years. It's really about coming together and having that community sense. Because we're really going to need that for us and to make the program better" (Carlos).

MAKING IT BETTER

As our partnership progressed, students began to envision creating a space for student voice within the program in order to directly address structural dilemmas. The students articulated four main goals: to create a space for students to talk about issues within the program, to develop a vehicle to bring concerns and ideas to the administration, to organize opportunities for student bonding, and to serve as a national model for other educational opportunity programs.

Goal 1: A Space for Students to Talk about Programmatic Dilemmas

Students wanted a space to "spill [their] guts out" (Carlos) to one another, without adult presence. The students felt that with a space to describe their experiences within the program as new

college students and as marginalized students on a predominantly white campus, they could support one another and increase their sense of belonging. Bassam explained, “I like seeing diversity. I like seeing Strive kids. It’s not like I have anything against the majority, but I like to see that we have a presence on campus.” Students acknowledged that a positive aspect of the Strive Program was that it brought together Students of Color, but felt that they needed more opportunities to talk together about their experiences. Students wanted to improve upon the structures that already existed and create a stronger sense of belonging through acknowledging their collective positioning as non-dominant students on campus.

Goal 2: A Vehicle to Bring Concerns and Ideas to the Administration

Students identified other structures, such as programs within their high schools, which valued student voice. Miguel explained,

In our district, we had focus groups to see what we wanted to change. In our school we [students] ran it. Students opened up when the teacher left. We could talk to the younger students and relate to them and then advocate for them to the principal. Then the principal could say “yes” to this and this and this, maybe “no” to that...

Students felt it was important to constructively address concerns as a group, rather than allow individuals to complain or feel frustrated in small groups or on their own. Students wanted to address these tensions in a respectful and effective way, in order to increase their sense of belonging and improve experiences. They were not hoping to dismantle parts of the structure of the program, but rather to open dialogue between students and administration to work towards the common goal of retaining and graduating students. They wanted to have a voice in decisions that affected their lives. Students hoped that the group would function as a vehicle to reciprocally share knowledge and ideas with the administration. In doing so, the students wanted to alter the power dynamics within the program, position themselves as experts in their own lives (Kirshner, 2010), and change the landscape for future community members.

Goal 3: Opportunities for Student Bonding

The students felt that they started the program feeling a sense of pride through intentional team-building activities during the two-week summer program. However, once classes started the students felt a shift in the program’s priorities and messages, and all team-building activities ceased. The students no longer felt valued as individuals with histories, cultures, families, talents, interests, and skills; rather the only way they felt valued by the program was through academic achievement. The students wanted to plan social events, field trips, and team-building opportunities.

The importance of building community was apparent in our meetings, when students referred to Strive as a family. For example, when the students invited the rest of their cohort to a meeting to discuss this space for student voice, Damian suggested calling it a “family meeting.” Calling Strive a

family revealed how students understood community. Students wanted to plan the bonding events themselves, so that they could give back to their Strive community and create opportunities to share personal knowledge beyond the academic world. The students understood the importance of bonding to increase their sense of belonging on the predominantly white campus, in a way that would be crucial to their success.

Goal 4: A National Model

The students envisioned this student group as an integral part of programs designed to support underrepresented students in higher education institutions, and therefore understood their work a potential model for the nation. Carlos described his vision, “Say this works. [The administration] sees it works. Strive improves and the [retention and graduation] numbers go higher or whatever. Then on a national level they see this and they’re like okay, we need a student group like this.” The students felt that a space for student voice would allow similar programs to incorporate students’ skills and experiences in a genuine way that would value the whole student, beyond grades and test scores, which would result in increased retention. Situating the student group as a potential model for the nation aligned with the students’ critical conception of community, as they viewed it as a way to address systemic inequities in higher education.

IMPLICATIONS

Implications for Educational Opportunity Programs

The Strive Program hoped to serve as a model for other universities to address underrepresentation of women and Students of Color in the field of engineering. The students envisioned the student group as an integral part of programs designed to support underrepresented students in higher education institutions, and therefore understood their work as a potential model for the nation. They felt that a space for student voice would allow programs to incorporate students’ skills and experiences in a genuine way that would value the whole student, beyond grades and test scores, which would increase retention. Through our partnership many of their goals came to life as we created a space to talk about issues and support one another. At the conclusion of the semester, the students conducted a meeting with approximately 20-25 Strive students, around 80% of the cohort, where they began to design the format for the student group they envisioned throughout the partnership. The stakes were high for student achievement and the success of the program; students needed to have a space to communicate their needs, support one another, and develop community in order to succeed and complete the program.

When universities design programs meant to support underrepresented students, it is important to make an explicit effort to disrupt deficit thinking (Castro, 2012) and value students’ cultural wealth (Yosso, 2005). Deficit thinking involves educators, administrators, and policymakers placing blame on individual students when they do not fulfill academic expectations, rather than considering the current system and historical context that produced the conditions that prevented the student from succeeding

(Castro, 2012). Yosso describes a model of community cultural wealth, meant to disrupt the common idea of “cultural capital” put forth by Bourdieu (1989). Yosso’s model offers a framework to understand the variety of strengths Students of Color bring with them from their homes, communities, and previous experiences into school settings. If educational opportunity programs staff recognize these strengths in ways that match or surpass the usual recognition of cultural capital, students will benefit.

Additionally, educational opportunity programs should intentionally plan opportunities for students to support one another. Tatum (2003) asserted, “Predominantly White colleges concerned about attracting and keeping [underrepresented] students need to take seriously the psychological toll extracted from [underrepresented students] and the critical role that cultural space can play” (p.80). It is important to center student voice in racial justice work so that students have space to tell their stories and draw on their histories (Ladson-Billings & Tate, 1995). This has important consequences for students, as underrepresented students are often silenced in our current higher educational system:

The “voice” component of critical race theory provides a way to communicate the experience and realities of the oppressed, a first step on the road to justice ... one of the tragedies of education is the way in which the dialogue of [underrepresented students] has been silenced. (Ladson-Billings and Tate, 1995, p. 58)

The establishment of a student group offers a potential way for underrepresented students to advocate for themselves within institutions of higher education. Furthermore, program administrators and staff should collaborate with students to design programmatic structures to value students’ cultural wealth. Through this kind of collaboration, programs can begin to embody that value.

Implications for Colleges of Engineering

Beyond educational opportunity programs, which already serve to increase equity and diversity within higher education, Colleges of Engineering should change norms and structures that keep underrepresented students out of the field. For example, admissions requirements that include advanced coursework not offered in every high school function to prevent underrepresented students from becoming engineers. Policies that impact students who do manage admittance must also be considered; when bell curves are used for student grades, requiring a certain amount of students to fail a course, the costs of failing can be insurmountable. Engineers require skills and knowledge beyond traditional math and science content, therefore university programs should find ways to value and further develop these skills in their future engineers. If Colleges of Engineering are committed to equity and diversity, they must rethink gatekeeping policies that sort, push out, and ignore students’ cultural wealth.

Implications for Researchers

Participatory approaches to research which privilege participants’ cultural wealth have the potential to develop authentic and meaningful solutions to issues that impact participants’ lives. Our

participatory approach provided another opportunity for students to advocate for themselves and for researchers to advocate on their behalf. An additional benefit of the participatory approach was how our influence as two positive adults privileging the students' assets and positioning them as experts had an impact on the students' self-esteem and potentially their trajectory and retention in the program. This was evident in the students' responses, when they were asked how the partnership had impacted their academic achievement. Jackson explained that before Carlos approached him to join the project, he felt "over it and isolated," within the Strive Program. He credited his involvement with the student group as the reason he felt reconnected and supported in the program, and the reason he developed a positive outlook about the program. Miguel also described the importance of the student group in his academic achievement; he felt that having the opportunity to use his skills and experiences to do something positive for his community allowed him to regain self-esteem and feel reinvigorated in his academic career. Future research could look at involvement in groups that privilege underrepresented students' voices and the impact on achievement, confidence, and self-worth. While this project seeks to contribute to the developing understanding of the potential impact of participatory work with underrepresented students in higher education, more research is needed in order to support the retention and experience of students.

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ACKNOWLEDGEMENTS

First and foremost, we would like to thank the Strive students for inviting us into their space and sharing their concerns, hopes, and goals with us. We would like to acknowledge Kevin O’Connor, the Principal Investigator for the broader research initiative in which our study took place, for his guidance and wisdom. Additionally, we would like to thank the wonderful professors/mentors who supported us in both the research and writing processes, including Margaret Eisenhart, Susan Jurow, Ben Kirshner, and Jennie Whitcomb. Finally, we would like to acknowledge the editors and reviewers of *Opportunity Matters*.

Making Room and Finding Place: Why I Stayed in STEM

Patricia Hogan*



Abstract: *One of the challenges in the STEM fields (particularly in the hard sciences and engineering) has been retaining under-represented groups at the college and university level and later at the career level. In this personal reflection, a woman with both engineering and chemistry degrees describes why she persisted in the STEM fields and why she believes the individual decision to stay is key to changing the face of STEM.*

Keywords: STEM, Engineering, Under-represented Groups, Persistence, Culture

I was at a conference recently, and as I was waiting for my turn to speak, I started mentally calculating the time I had spent in my STEM career. The number of years seemed wrong; I stared at the ceiling—can't be right. I flipped over a flier and wrote the calculation out. The value was sound and amazing to me: 44 years. I never had any intention to enter science growing up; I hadn't even considered the possibility. Yet two engineering degrees, two science degrees, and 44 years of experience later, here I was speaking on increasing diversity in engineering, specifically increasing the participation of women in the engineering enterprise. But here's the kicker: I have been having this same conversation about women in engineering—and in the hard sciences—since I was 17 years old. Maybe I am impatient, but 44 years seems ample time to move the needle.

What is the problem? Why is diversifying parts of STEM so challenging? At this point, the academic in me should start citing studies about pre-college programming, recruitment efforts, special retention programs, career mentoring—all well and good, but in some sense, I think this is part of the problem. We view groups not currently participating in STEM as monolithic entities, as if women and people of color all have similar needs based on their group association. We do this because primarily we view the STEM enterprise as monolithic. The words *scientist* and *engineer* invoke classic caricatures in our minds, which are invariably white and male.

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It is true that, traditionally, the STEM enterprise in the US has been driven by the ideas and behavior of white males, and the conservative values of STEM have been narrowly and wrongly (I would argue) described as being steeped in scientific neutrality, logic, and intellectual fairness. Among STEM traditionalists, the entry of a person into STEM is an easy process: if you have the requisite talent (which is usually viewed as fixed), the inherent intellectual fairness of STEM will allow you to succeed. If you cannot succeed, then the flaw is yours, not that of STEM. In the traditionalist's mind, STEM is pure because unbiased knowledge is pure. The purity of knowledge is an important construct. It removes STEM from the taint of humanity and, particularly, the taint of the individual.

However, STEM is not solely a body of knowledge; STEM is also a culture. People who are different, like me, have the same choices as anyone entering a new culture: either learn the language, assimilate, and participate or continue to speak your native tongue, stay on the periphery, and spectate. The challenge for someone breaking into this dynamic is that as individuals who are outside of the norms of this culture (women, people of color, and other under-represented groups) can feel compromised by pursuing their real interest in STEM. Beyond basic questions of concerning ability (Am I smart enough? Can I do this?)—which are common among students—other serious questions emerge about sense of place and belonging for those under-represented. Do they have to modify their value system to participate? Do they have to ignore or suppress their cultural background to fit in? Are their perspectives going to be valued? Do they have to suppress their opinions to minimize conflict? These cultural pressures are real and add an additional layer of complexity to already complex fields of study. Anyone who has participated in engineering or hard science education, for example, will tell you that mastering the material is a grueling process. Obtaining an undergraduate degree has been described to me as a “death march” or “getting hit by a fire hose on a daily basis.” Those comments were made by white males. Think about trying to master that level of material while simultaneously attempting to prove that you have a right to be present. It is not in any way surprising to me that under-represented groups leave STEM or even refuse to enter the field although capable.

However, leaving STEM is not the answer for under-represented groups. If we really want the STEM culture to shift, many of us are going to have to take one for the team. We need to be focused and directed, to search for mentors, to look for every opportunity and milk each one for all its worth—we should carve the path forward to real change. If we want a voice in what scientific questions get asked and answered and what technologies are developed, we should have a real seat at the STEM table as part of the STEM enterprise—as insiders.

Did I ever want to leave? Yes. More than once. The first time was when I was still an undergraduate. At one point in my junior year in 1975, I was going to leave engineering. I was tired of seeing the amazement on people's faces when I said I was a chemical engineering student. I recall telling someone I would expect a similar expression of astonishment if someone's dog started talking to them. I was tired of being told I didn't have a sense of humor when I would get smacked in the buttocks with a yardstick while I was trying to take measurements in lab or when I had a wet mark because someone hooked a lab water bottle in the back of my pants and squeezed. I was really tired of being asked by students and faculty alike whether I had found my husband yet—when was I going to leave anyway? Wouldn't I be better off on the other side of campus? I took a semester off to think about another

major. I thought long and hard. I was interested in engineering, but that wasn't the deciding factor. One thought kept recurring: "If you leave now, you will make it so much harder for the next female engineering student." I went back and finished. I subsequently went on to get another engineering degree and two science degrees. I have worked in private industry, consulting, and higher education. I have run science and engineering programs, did a stint as an assistant dean, and currently run a new multi-disciplinary science department at a university.

I would so like to be able to say that everything was so much better as I made my way in my career after I left school. But there were challenges in every decade. On my first engineering job when I was 23 years old, an entry-level male engineer who was hired at the same time I was stopped by my cubicle purportedly to say hello. On his way out, he turned and said, "Oh and it doesn't bother me if your starting salary is higher than mine, because you will never go anywhere in this company." Later in my career, an older male engineer confided to me that the fact that women could do engineering "ruined" engineering for him—it meant that you really didn't have to be smart to be an engineer and engineering must not be that challenging. In my mid-career (20 years in STEM), a male employee I *hired*—I was his boss!—told me that I needed to dress in a "more feminine way." I could go on, but what would be the point? I—and you—cannot let comments or attitudes like these change our direction: we are making the path so that others can follow. When I stayed for myself and those coming after, I found many good mentors of all sorts, men and women who helped me find my way. There are reasonable, talented people of good will who helped me move forward, and I am so grateful to have met them. You can find your mentors too.

Staying in STEM positioned me to be able encourage and mentor students of all types. I employ student projects that were never open to me during my own engineering education, like service learning, K-12 mentoring, Photovoice, and *PechaKucha*, to help students articulate their values and the meanings they ascribe to their learning. I value my students as the fantastic individuals they are. Is there room in my programs for someone different? The answer is yes. I have the authority to say yes for one reason: I made the decision to stay and to deal with the hardships and revel in the victories of participating in STEM.

As far as persistence in STEM goes, I have no statistical relevance. I am an N of 1. I am anecdote. I am also an individual who values herself, her lineage, and her point of view. Staying in STEM and making it my professional home has been challenging for me at points, and although I am an individual, I represent a multitude—not a monolithic one—but a wonderful kaleidoscope of individuals that I have had the honor of meeting, working with, and mentoring in my career. I revel in their successes as if they were my own. Forty-four years is a long time for an individual change but less so for a culture. Do you want to move the needle on STEM participation for your group? I have one word of advice: **stay**.

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ACKNOWLEDGEMENTS

I would like to acknowledge and express my gratitude to the many men and women who have supported me as I have moved through my STEM career and to my students who have helped shape me as a teacher and a person.

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