

FEATURE ARTICLE

Helping Students From the McNair Scholars Program Enroll in Graduate School: A Multilevel Modeling Examination

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ABSTRACT

Due to structural educational inequity, students who are first-generation, low-income, and certain students of color have lower graduate degree attainment compared to their peers. One national program, the Ronald E. McNair Post-Baccalaureate Achievement Program, serves students from these groups to increase the number of students from these backgrounds who enroll in graduate school and obtain a doctoral degree. This study utilized federal data to examine graduate school enrollment rates for students from this program and understand variation among programs in students enrolling in graduate school. Results indicate that program funding and length of time funded do not statistically and significantly relate to graduate enrollment rates. Additionally, the program works better to help students who were able to graduate with an undergraduate degree. The article concludes with practical implications for those in higher education and limitations of the study.

Keywords: graduate education, enrollment, McNair Scholars Program, multilevel model

In the United States, increasing levels of education have been found to relate to important life outcomes such as employment, higher earnings, and intellectual fulfillment (Chamorro-Premuzic, 2020; Rosenberg, 2020). However, due to structural inequality such as classism and racism, multiple groups of students do not have the same opportunities to obtain these advanced levels of education. “First-generation students”, students whose parents “had not attended college,” are half as likely as their counterparts to enroll in doctoral programs (Cataldi et al., 2018, p. 1). Students from low-income households are also less likely to enroll in graduate school compared to students from high-income households (Baum & Steele, 2017). Graduate enrollment rates also differ by race and ethnicity. White and Asian students who have completed their bachelor’s degrees are more likely to enroll and complete an advanced degree than students of color from other racial/ethnic groups (e.g., Black, Hispanic) (Baum &

Steele, 2017). Given the current inequalities among groups of students, examining programs that work to decrease these gaps in graduate school education remains important.

One program that works to help students from marginalized and underrepresented groups enroll in graduate school and attain doctoral degrees is the Ronald E. McNair Postbaccalaureate Achievement Program, also called the McNair Scholars Program (MSP). This program is a federally funded grant awarded to institutions of postsecondary education to work with students who are highly motivated and come from underserved groups to attain their PhDs (United States Department of Education [USDOE], 2021). Each program selects a cohort of students from first-generation, low-income,

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and/or racially minoritized backgrounds and provides selective programming to help students prepare for and attend graduate school. As of the 2015 fiscal year, 151 institutions were serving 4,293 students at a cost of over \$50 million in spending by the federal government (USDOE, 2021, Awards section); for this reason, the program is important for study. As such, this report examines the likelihood of graduate school enrollment of students from the MSP to determine how well this program works to serve these marginalized students.

Literature Review

MSP Background

The United States federal government began fighting the “war on poverty” in the 1960s (p. 573, Bowden & Belfield, 2015). From the inception of the Higher Education Act (HEA) of 1965, institutions could financially assist full-time students with “exceptional financial need” who “show[ed] evidence of academic or creative promise” and would not be able to attend the institution without the funds. This resulted in the creation of the first TRIO program for this purpose. Each reauthorization of the HEA has allowed lawmakers to adapt the legislation to meet new national demands (Wolanin, 2002). For instance, within the next decade, TRIO programs served special populations, such as returning adults, veterans, or students who were “disadvantaged” (students from low-income households), or focused on specific needs, such as helping students prepare for college entrance, apply for and obtain federal financial aid, or complete their college degree (USDOE, 2014, para 1). A later HEA reauthorization included a change to not only support these groups of students into undergraduate education but also into graduate education. This change led to the birth of the MSP as an extension of existing TRIO programs. The MSP formally began in 1986 and was then named to honor Ronald E. McNair, an African American astronaut who believed in supporting students from underrepresented backgrounds but who tragically died in the Challenger explosion that year (Dervarics, 1994). Since then, the MSP has been available as a federal grant for which institutions can apply in order to support students from first generation, low-income, and racially or ethnically marginalized communities (e.g., Black, Latinx) obtain a doctoral degree. As such, TRIO programs provide student assistance into and through undergraduate and graduate education.

Students

MSPs recruit rising junior or senior undergraduates, so scholars typically join the program for 1–2 years. To be admitted, students must come from a disadvantaged background, demonstrate high achievement (e.g., have good college grades), and exhibit the desire and motivation to obtain a doctoral degree (Renbarger & Beaujean, 2020). *Disadvantaged background* is defined as (a) coming from a low-income family (i.e., family income \leq 150% of the federal poverty level), (b) being a first-generation college attendee, or (c) belonging to a racial/ethnic minority group (Seburn et al., 2005). Two-thirds of each MSP cohort must have first-generation and low-income status; the remaining one-third can be from an underrepresented group (USDOE, 2021, Eligibility section). More recent funding cycles have prioritized grants from institutions that will specifically target students in science, technology, engineering, and mathematics (STEM) areas to alignment with priorities to improve STEM representation nationwide (USDOE, 2020). This underrepresentation in STEM must be documented using national statistics and approved by the federal government but may include students from Black/African American, Hispanic/Latinx, Native American, or Pacific Islander groups.

These groups are targeted because they are at a particular disadvantage for attending graduate school. Students who identify as first-generation often do not have the support or academic preparation necessary for postsecondary education (Engle & Tinto, 2008; Thayer, 2000). Consequently, they are less likely to attend and graduate from college and to enroll in graduate school. Likewise, students from low-income backgrounds are also less likely to graduate from college or attend graduate school, even when accounting for academic ability (Thayer, 2000). While students from the aforementioned racial/ethnic groups have had an increase in graduate degrees in recent decades, they have not completed doctorate degrees at the same rate as their non-racial/ethnic minority peers (Sowell et al., 2015). Thus, providing access to graduate school for marginalized students “represents a critical component in the development of the intellectual capital of the nation” (Gallardo, 2009, p. 64) and is a core goal for MSPs.

Program Activities

MSPs provide activities for their students related to making them competitive for graduate-level research programs. These include providing

opportunities for research, internships, tutors, academic counseling, and faculty mentorship, along with preparing graduate school applications (USDOE, 2021). Programs may also provide other educational and cultural seminars to help students gain a better understanding of what is required to succeed in graduate school. However, there are distinct differences in how programs implement the basic requirements. For example, some programs implement intense summer research opportunities while others allow students to research over the course of the year, providing variability within the overall MSP.

While MSP curriculum was designed prior to the majority of research on what works for marginalized student success, MSP program components have been found to be instrumental for success for what researchers have labeled “underrepresented minority” students in science (Chemers et al., 2011, p. 469). In 2011, Chemers et al. identified “support components” such as research experience, mentoring, and being involved in a community that help lead to improved “psychological processes” (e.g., identity, self-efficacy) that ultimately help students succeed in their future careers (p. 471). Both academic and non-academic factors have been found to be important specifically within other TRIO programs as well (Chaney et al., 1998). Thus, while this study examines only one program dedicated to serving students from marginalized groups, there are implications for other programs that serve this population using these research-based practices.

MSPs and Graduate Enrollment

More extensive reports of MSPs achieving their graduate enrollment goals come from federal reports of the program. These governmental findings were positive concerning student graduate enrollment. From the federal report that used data from 1999–2000 year, 21% of participants were enrolled in a graduate program (Humphrey et al., 2002); however, these authors did not indicate whether this number was significant or abnormally large. Findings from the 2008 federal report, which examined the data from 1989–2000, indicated that McNair participants with their bachelor’s degrees were more likely to attend graduate school (McCoy et al., 2008)

compared to the average enrollment for students from underrepresented backgrounds. Data from 1997–2002 indicated that “the percentage of McNair participants enrolling in graduate school is promising” (Seburn et al., 2005, p. 24). However, these reports do not provide strong conclusions about the program’s effectiveness due to concerns surrounding data quality and the use of a descriptive rather than inferential method. Collectively, these studies seem to suggest that MSPs work, but they do not examine more current longitudinal evidence regarding the program’s goals of graduate enrollment or discuss the variability among students and programs.

The large majority of data on the utility of the MSP come from qualitative studies. In a review of the qualitative literature on the MSP, Renbarger (2020) found that research on the program was almost exclusively positive. In line with the theoretical model by Chemers et al. (2011), students felt efficacious in doing research and found a community of scholars who were like them to whom they could turn to for support. Besides providing social and psychological benefits, the students believed the program also prepared them academically by helping students create graduate application materials and study for entrance exams. Yet without examining graduate enrollment numbers, it remains unclear whether the MSP achieves its goal of increasing graduate enrollment for marginalized populations. By examining the few quantitative studies in a meta-analysis, Renbarger and Beaujean (2020) found that the MSP participants were six times more likely to enroll in graduate school compared to demographically similar peers. Given the researchers could only find a handful of quantitative studies and that few utilized large, representative samples, they stated that more quantitative work is warranted to understand the success (or lack of) for the overall program.

Because students can apply for MSPs during their sophomore or junior year, there are presumed risks that students enroll in the MSP but do not finish their bachelor’s degrees. Compared to students whose parents did attend college and those from affluent households, first-generation students and students from lower socioeconomic groups are less likely to persist and complete their

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bachelor’s degrees (Cataldi et al., 2018). Due to federal reporting requirements, MSPs must report all participant outcomes. Thus, students can be reported as MSP participants even though they did not complete their bachelor’s degree, potentially lowering the success rate of the program because these students will not be enrolling in graduate school without this undergraduate degree. Comparing the outcomes of the overall MSP group may not be accurate if including a subset of participants with unique circumstances and are important to examine separately. Finally, because programs can begin serving students or lose funding with each year (through institutional changes) or program cycles (every 5 years), MSPs vary in terms of important aspects such as established directors and programming. They also apply for, and thus receive, different amounts of funding due to factors such as the number of enrolled students and amount of support from the institution where each MSP is located. It is possible that there could be differences in MSPs’ ability to serve students and help them enroll in graduate school but examining MSP tenure and funding has not yet been investigated.

Therefore, the purpose of this study was to utilize multilevel modeling to first determine how well the MSPs help underrepresented students enroll in graduate school and then examine enrollment only for students who were able to persist through their undergraduate degrees. This extends what is known about sub-populations of the MSP program (undergraduate completers) and the overall program in terms of graduate school enrollment. Specifically, the research questions were:

1. What are the odds that McNair participants enroll in graduate school?
2. What are the odds that McNair participants enroll in graduate school when only considering students who attain a bachelor’s degree?

Method

Data

Each year, the USDOE posts data files from funded MSPs. We merged all available MSP grantee files and their associated performance files by institution. This resulted in data for the 2003–2010 cohorts. The data files included individual program data on MSP student graduate enrollment and persistence within graduate programs, along with aggregate data for all programs. Information included in these performance reports can be found in Figure 1. To understand graduate enrollment overall, we utilized the number of students within each MSP

who enrolled in graduate school. To extend this analysis and examine different sub-populations of MSP participants, we then compared students who did and did not graduate with their bachelor’s degrees. Creating this distinction between the two student groups allowed us to see what graduate enrollment was like for students who were prepared for the experience and decrease the amount of noise by assuming the two groups of students were alike.

Figure 1
Cohort Information Provided in Federal Performance Reports

Award number
Institution name
Institution state
Number of bachelor’s degree recipients
Number of bachelor’s degree recipients enrolling in graduate school
Enrollment rate
Number of bachelor’s degree recipients enrolling in graduate school after 2 years
Number of bachelor’s degree recipients enrolling in graduate school after 3 years
Cumulative graduate school enrollment rate
Number of graduate students in cohort
Number of graduate students persisting
Graduate school persistence rate

Note. Notes were rarely provided and do not exist in all reports.

To capture variability among programs, we also included program funding characteristics to examine the degree to which (if any) these related to graduate enrollment rates. Variables were created to indicate the year the institution first received funding and the total number of years of funding that each institution received. The length of time variable for this study was created from these variables to indicate the consecutive number of years the program was federally funded. Institutions are more likely to receive funding for an MSP if an MSP already exists on the campus and has met federal requirements for reporting in the past. As such, programs that have longer lengths of funding likely reflect prior institutional stability that could increase the likelihood of student success. No information was available on student (e.g., race, field), program (e.g., number of staff), or institutional (e.g., public/private) characteristics.

The analytic data set consisted of 223 universities with varying lengths of funding. These represent both private and public

universities from all states. The most frequent length of funding was 8 years (n = 154) followed by 4 years (n = 46) and 2 years (n = 14). Across the 8 years, the average annual award was \$236,784.

Analysis

Based on the purpose of the study, secondary data were analyzed using multilevel modeling in order to appropriately model the longitudinal data structure. MSP participants were nested within institutions to account for the similarity between participants within the same MSP. A multilevel model was fit to each of the outcome variables of graduate enrollment within three years using year and amount of funding awarded as predictor variables. The number of students who enrolled in graduate school differed by university because there were different numbers of students at each university in any given year. Thus, in order to create a comparable metric for a graduate enrollment outcome variable, we transformed the outcome variable to odds of enrolling in graduate school for each year at each university. For Model 1 the odds were based on number of students in the program, and for Model 2, the odds were based on the number of students who had graduated. For example, the odds for Model 2 were computed as:

$$\frac{\text{Students enrolled within 3 years of year } t}{\text{Students who graduated in year } t} \bigg/ 1 - \left(\frac{\text{Students enrolled within 3 years of year } t}{\text{Students who graduated in year } t} \right)$$

It should be noted that the amount of funding is a time-varying covariate, given that it changes across time. For instance, a university may not receive as much funding for years when fewer students were in the program. The intercepts, time, and amount of funding were treated as random effects, and the covariance matrix of random effects was unstructured. The estimated model can be expressed:

Level 1 Model: $Y_{ti} = \pi_{0i} + \pi_{1i}a_{ti} + e_{ti}, e_{ti} \sim N(0, \sigma^2)$

Level 2 Model: $\pi_{0i} = \beta_{00} + r_{0i}, r_{0i} \sim N(0, \tau_{00})$

$\pi_{1i} = \beta_{10} + \beta_{11}X_i + r_{1i}, r_{1i} \sim N(0, \tau_{10})$

Mixed Model: $Y_{ti} = \beta_{00} + r_{0i} + \beta_{10}a_{ti} + \beta_{11}a_{ti}X_i + r_{1i}a_{ti} + e_{ti}$

where Y_{ti} is the odds of enrolling in graduate school within 3 years of year t from university i , a_{ti} is the indicator for year t , and X_i is the amount of funding

for university i . Models were fit using the SAS PROC MIXED command using restricted maximum likelihood estimation (SAS, 2003).

Results

Model 1 – Odds of Enrolling in Graduate School

Table 1 presents the model parameters for predicting the odds of enrolling in graduate school. The intercept of the model ($\hat{\beta}_{00}=0.8$ [SE = 0.39]) indicates that in the first year of funding for a random institution, the odds of students enrolling in a graduate program was 0.8. In other words, on average, participants were slightly less likely to enroll in graduate school than not. The fixed effects of time and amount of funding were not statistically different from zero, which suggests the odds of enrolling in graduate school were not strongly impacted by changes in time or funding amount. That said, the variance of time was considerable ($\hat{\tau}_{10}=0.62$). This indicates that there was fluctuation in the strength of the relationship between time and odds of enrolling in graduate school. The variance in the intercepts ($\hat{\tau}_{00}$) was 9.5, and the residual variance of time ($\hat{\sigma}^2$) was 4.9. Thus, there was considerable variability between institutions.

Model 2 – Odds of Enrolling in Graduate School Conditioned on Undergraduate Completion

Table 1 includes the model parameters for predicting the odds of enrolling in graduate school among students who completed undergraduate degrees. The model intercept ($\hat{\beta}_{00}=12.2$ [SE = 2.48]) indicates that in the first year of funding for a randomly chosen institution, the probability of students enrolling in a graduate program among students who completed undergraduate degrees was much higher than the probability of not enrolling. The fixed effects of time indicated that the odds of enrolling increased slightly but was not statistically different from zero. The relationship with the amount of funding was -0.00003 ($\hat{\beta}_{11}$, SE = 0.00001), which is the expected change in odds of enrolling in graduate school for a one-dollar difference in funding. This coefficient is more meaningful when multiplied by \$10,000 (-0.3), given that award amounts ranged from \$140,000 to \$367,750. Regardless of amount, the coefficient shows that funding

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may be slightly negatively associated with odds of enrolling in graduate school. The variance of time ($\hat{\sigma}_{10}^2=0.26$) was less than that in the first model and indicated that there was some fluctuation in the strength of the relationship between time and odds of enrolling in graduate school.

Table 1
Parameter Estimates From Multilevel Regression Models

Model 1					
Effect	Estimate	SE	df	CI95 Lower	CI95 Upper
Fixed effects					
Intercept	0.80	0.39	222	0.04	1.56
Time	-0.03	0.06	1127	-0.15	0.09
Award	0.00	0.00	1127	0.00	0.00
Random effects					
Intercept		9.47			
Time		0.62			
Covariance		-2.49			
Residual		4.90			
Model 2					
Effect	Estimate	SE	df	CI95 Lower	CI95 Upper
Fixed effect					
Intercept	12.18	2.48	222	7.32	17.04
Time	0.08	0.09	1105	-0.10	0.26
Award	-0.00	0.00	1105	0.00	0.00
Random effects					
Intercept		11.84			
Time		0.26			
Covariance		-1.48			
Residual		38.73			

Discussion

The McNair Scholars Program (MSP), a federal TRIO program, is designed to increase graduate school enrollment of populations who are marginalized. However, despite being decades old and costing millions of dollars each year, little research has been done to evaluate the effectiveness of TRIO programs (Bowden & Belfield, 2015). To fill this gap, this study examined the likelihood of graduate school enrollment over time of MSP participants who belonged to populations who are marginalized.

This study provides evidence that participants in the McNair Scholars program have high odds of enrolling in graduate school, yet this effect varies by institution. These results are consistent with other TRIO studies that found that campuses implement programs for marginalized students in different ways to adapt to their own contexts (Bowden & Belfield, 2015) as well as the most recent MSP research (e.g., Renbarger, 2019; Renbarger & Beaujean, 2020) that indicates MSPs benefit participants yet add nuance to the field regarding programmatic factors that relate to student success.

Time does seem to impact a program’s ability to help students enroll in graduate school. Some universities in this sample had 8 years of funding, whereas some only had 2 years of funding. Those with a foundation to build upon appear to do better than newer programs, suggesting that evaluations of programs should continue to consider program experience when making continuation or elimination decisions. Little research of this phenomenon, specifically at the institutional level, was found in the literature. Nonetheless, results here do align with recent research that suggests that faculty members in science who had previously won funding were likely to have twice as much funding 8 years later compared to those who did not win initial funding (Bol et al., 2018). The study researchers found that this could be because those who were not initially funded do not continue to apply for grants; therefore, initial funders continue to win funding because they are more likely to attempt in later funding cycles. Countering the Bol et al. (2018), a more recent study found the opposite: that funding did not predict success for faculty members (Prasad et al., 2020). In studying the long-term success for NIH awardees, their study found that awardees were likely to regress to the funding mean, illustrating that prior funding performance did not then relate to later funding success, and thus institutional support (e.g., mentoring) must be considered in determining later faculty success. While their study examined faculty members and not programs, they emphasized that institutional programming is important and that funding does not automatically beget more funding.

According to Prasad et al. (2020), for universities who apply for an MSP for their campus, the grant writers must detail how the MSP exists within the current university structures and will be supported by them. Thus, even though not directly evident in the data, the

length of funding may speak to the grant writers' participation and desire to see the program or the institution's support of the program and thus may contribute to its success. Future researchers should study these potential links as determinants of MSP success.

Unsurprisingly, this effect does seem to be limited to MSP students who graduate with a bachelor's degree. By explicitly taking out students who would not be able to enroll in graduate study, this study provides a clearer picture of MSP success. As previously mentioned, students from these marginalized groups are less likely to persist and graduate with their undergraduate degree (Cataldi et al., 2018), thanks to factors such as the cost of higher education (Banerjee, 2018). As such, lower graduation rates are not a surprise. However, the purpose of MSPs is to help students prepare for *graduate* school, not undergraduate degree attainment. Because it is mandatory that a student graduates with a bachelor's degree before being admitted to graduate school, universities must make it a priority to serving students beyond just increasing their access to the institution (Budd, 2016); the program may need to address additional institutional and structural barriers that these students face (i.e., financial concerns, lack of college preparation) (Remenick, 2019). Other TRIO programs, such as the Student Support Services, help retain students disadvantaged by their previous educational experiences within the institution and could be integrated for eligible students to provide graduation supports outside of MSPs that focus on graduate school (Chaney et al., 1998).

Limitations

There were limitations related to program data and inconsistencies in funding. The data from the Department of Education website included limited information about each institutional program. For instance, there is no information regarding student characteristics that relate to the objectives of the program (i.e., race/ethnicity, first-generation status) nor to characteristics that are known to predict success in postsecondary education, such as grade point average or financial support. Besides student

information, there was little information about programs such as MSP director experience, length of program, program activities, or university support for the program. This limited our ability to provide a more nuanced examination of how and why the program might help certain student groups succeed or why increased funding was not significantly meaningful statistically. The data also included many typographical errors with institutional names and affiliations, making it difficult to clean or incorporate other data sources. Finally, many programs gained and lost federal program funding during the time period from this data. No notes indicated why programs lost funding; this could be due to the performance of the program or to something unrelated, such as a university mandate.

Instruction and
teacher-student
interaction
filtered through
time and
technology is
replete with
challenges.

Implications

These results have implications for governmental stakeholders and university program leaders. Examining data from such a long period of time and finding positive results about participants' entry into graduate school is promising. However, policymakers should not use results to simply fund the program. As seen here, more money does not necessarily result in higher graduate enrollment, but this may be because institutions that receive more money typically serve more students and therefore may have less time to dedicate to each student. Whether program directors admit students who may need to focus on graduating with their bachelor's degree or students do not receive enough support in the program is unclear. Therefore,

when policymakers fund the program, they should ensure that MSP directors continue to prioritize funding programs with potential for quality rather than quantity. Given that time does predict greater graduate enrollment numbers (to a small degree), funders should balance funding new programs with supporting existing programs, even if existing programs may not currently perform at high levels. Finally, policymakers can support these students by funding MSP office staff to allow program officials to clean, de-identify, and release data for additional evaluations of program success.

Results from both models have implications for MSP directors as well as leaders of programs similar to the MSP. Since

some participants do not graduate with their bachelor's degree as seniors in the program, as seen in the differences between models one (with non-completers) and two (with completers only), directors can consider likelihood of degree completion when admitting new students. For eligible sophomores who may have difficulty graduating with an increased MSP load, directors may encourage students to focus on coursework and apply again in their junior year. For students already within the program, directors may need to incorporate supports during the program to help students succeed within the MSP and graduate. Alternatively, program directors could seek out tailored supports that already exist at that university for marginalized groups (Banerjee, 2018) and make formal connections with those programs to avoid overextending program staff or diluting program offerings dedicated specifically to graduate school success.

Disclosure Statement

No potential conflict of interest was reported by the authors.

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