Encouraging or Obstructing? Assessing Factors That Impact Faculty Engagement in Undergraduate Research Mentoring

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At colleges and universities around the world, faculty serve a critical role in supporting the well-documented practice of undergraduate research, scholarly and creative activity. Using unique data from an online survey of faculty members ($n = 223$) at three colleges and universities in the United States, we investigate the individual and institutional factors that facilitate or inhibit faculty members' willingness to provide undergraduate students with research opportunities. We focus our quantitative analysis on individual and institutional variables associated with faculty participation. Our work confirms prior qualitative research, indicating the significance of institutional support for faculty engagement in undergraduate research mentoring.

Keywords: faculty, mentoring, faculty development, undergraduate research, higher education

INTRODUCTION

The integration of research and creative activity into the undergraduate collegiate experience has been an international paradigm shift in higher education (Moore and Felten, 2018). Undergraduate research and creative scholarly activities (URSCA) have been well documented in the literature as high impact practices (Gregerman et al., 1998; Hathaway and Nagda, 2002; Lopatto, 2004, 2006; Elgren and Hensel, 2006; Hu et al., 2008; Kuh, 2008, 2015 Healey and Jenkins, 2009) with both faculty and other members of the academy playing key roles in supporting this educational model (Behar-Horenstein et al., 2010; DeAngelo et al., 2016; Healey and Jenkins, 2018; Moore and Felten, 2018). This paper assesses some of the factors that impact faculty engagement in mentoring undergraduate research and offers a data-informed perspective for those in academic development working to advance undergraduate research at their institutions. Using unique data from across three institutions in the United States, we investigated demographic differences in mentor participation as well as faculty reports of institutional supports for their mentoring efforts.

FACULTY AS MENTORS

At colleges and universities around the world, participation in research and scholarly activity is considered one of the three primary areas of faculty responsibility, the others being teaching and service. Faculty time is often divided into these separate areas, but there are advantages to facilitating overlap among them. Research has shown that engaging students in undergraduate research projects positively benefits a faculty

member's own research and teaching goals (Elgren and Hensel, 2006; Potter et al., 2009; Wilson et al., 2012; Adedokun et al., 2013). Although mentoring undergraduate researchers benefits both faculty and students, it also presents substantial challenges (Bullough and Draper, 2004; Dolan and Johnson, 2010; Marquis et al., 2017). Additionally, the findings from Hattie and Marsh's meta-analysis that explored the relationship between research and teaching suggest that universities should aim to maximize the nexus between them (Hattie and Marsh, 1996). Inquiry-based learning is another paradigm that has been successfully utilized to link research and teaching (Healey, 2005; Justice et al., 2007, 2009; Jenkins and Healey, 2015). The departmental ecosystem plays an important role in student learning and cognitive development. Volkwein and Carbone (1994) asserted that "a combination of strong research and a positive mate appears to make significant contributions both to the academic integration of undergraduate majors and to their intellectual growth and disciplinary skills" (Volkwein and Carbone, 1994). We maintain that there are distinct advantages for engaging in mentoring as a means of improving a faculty member's teaching and research.

Nonetheless, mentoring is often considered "extra-role behavior" and is frequently not a part of the formal reward system for faculty. Using interview data from faculty within the California State University system, DeAngelo et al. (2016) found that institutional norms is a common hindrance to mentoring. The results of a quantitative study of research productivity of faculty at the University of Minnesota Medical School—Twin Cities demonstrated that a faculty member's productivity is related to a combination individual and institutional characteristics, which were primarily under the auspices of administrators (Bland et al., 2005). Across the various institutions in their study, Milem et al. (2000) observed evidence of isomorphism, with research universities demanding more time related to teaching and primarily undergraduate universities demanding that faculty devote more time to research. Another prime finding of their study was the identification of the contradiction between "what we value in higher education and what we reward" in that faculty are often not rewarded for work that specifically improves student outcomes. If a university seeks to build a "mentoring culture," there should be substantial support from administration and targeted efforts to address barriers to that end.

Various studies have also explored the motivating and inhibiting factors related to mentoring the high-impact practice of undergraduate research. Traditional one-on-one mentoring is a time-intensive practice and a limited number of students can be served in this manner (Wei and Woodin, 2011). In their research, Aikens et al. (2016) showed that students who engage both a faculty and post-graduate mentor showed greater outcomes than those who only worked with one mentor. However, the specific aspects of the mentoring relationship that were most beneficial remain understudied. The developing mentoring skills of the post-graduate was another variable that affected student outcomes (Dolan and Johnson, 2010). Hardré et al. (2011) found that perceived departmental support is a critical to faculty motivation to conduct research. In terms of faculty mentoring of undergraduate research, research has

demonstrated that time constraints, funding, and inconsistent valuation are variables that significantly influence level of engagement (Jones and Davis, 2014).

Other researchers have focused on defining and exploring the "mentor variable" (Eagan et al., 2011; Baker et al., 2015; Johnson et al., 2015). By analyzing data from the Higher Education Research Institute's Faculty Survey, Eagan et al. (2011) found that faculty with external funding who worked in the life sciences were most likely to mentor undergraduates. They also observed that faculty at liberal arts or historically-black colleges are more likely to mentor undergraduates than their peer faculty at research universities and those that regard their work as valued are more willing to participate (Eagan et al., 2011). Recognizing the need to examine these issues from the faculty perspective, Baker et al. (2015) conducted focus groups of faculty and administrators from five diverse universities and Brew and Mantai (2017) interviewed 20 academics at one Australian university. The qualitative results from these studies were consistent with previously published findings (Jones and Davis, 2014), but the small sample sizes resulted in insufficient power to resolve inconsistencies with prior quantitative research. The research presented in the current study offers a larger sample to more thoroughly explore these issues.

THEORETICAL FRAMEWORK

When considering the larger institutional context in which faculty engagement takes place, our work was informed by the Model of Faculty Research Productivity advanced by Bland et al. (2005), which posits that high faculty productivity is achieved when well-prepared individuals work in a supportive institutional environment with leaders who use an assertive, participative style of leadership. The model further identifies the specific individual, environmental, and leadership factors that have been shown to optimize faculty productivity. Recognizing Bland's empirical precedent, Stupnisky et al. (2019) explored faculty motivation through the lens of self-determination theory. Their work, as well as that of Carli et al. (2019), explores how individual and contextual factors correlate with research excellence. Yates (2018) build on Bland's research in the medical school setting by exploring the prioritization of research in veterinary schools. A productive research organization takes advantage of the resources, rewards, instrumental support, and mentoring available at the institution. Adding to these institutional factors are individual characteristics of faculty members, such as motivation, training, expertise, and leadership ability. Relying on the Bland model and the assertion that institutional characteristics are at the center of the "productive research organization" (ibid, p. 233), the current study investigates the extent to which the availability of a supportive institutional mentoring environment influences faculty members' engagement in mentoring undergraduate students. In this work, we move beyond the current approach to understanding faculty research productivity in terms of the quality and quantity of the articles, books, grants, awards, and other individual accomplishments of faculty members. We

believe that faculty members' own mentoring behaviors represent an important aspect of research productivity as it encourages proximal relationships between faculty and students and, for many students, the beginning of their own journeys as scholars.

THE PRESENT STUDY

Without faculty to mentor students, undergraduate research experiences as a high-impact practice would not be possible. Many previous studies have focused on the experiences of undergraduate student researchers themselves. However, more recent investigations have begun to identify the factors that shape faculty participation as research mentors (Eagan et al., 2011; Jones and Davis, 2014; Jenkins and Healey, 2015; Aikens et al., 2016; Brew and Mantai, 2017). As the research literature investigating faculty mentoring of undergraduate researchers expands, there is a growing need to understand the extent to which faculty members' decisions to engage in mentoring are shaped by individual characteristics vs. characteristics of the institutions where faculty members (and students) are located. This study places faculty members into institutional contexts and to ask two important questions: (1) What individual demographic factors are correlated with faculty participation as undergraduate research mentors? and (2) How does perceived institutional support shape mentoring participation?

METHODS
Participants and Procedure
The study sample draws from the Pathways to Undergraduate Research Experiences (PURE) multi-institutional study faculty survey (Morrison et al., 2018). Conceived by a collaborative group of faculty and administrators, a survey was developed to assess and understand the factors that potentially influence how faculty members participate in UR experiences across diverse institutional contexts. Approval from the three participating universities' Human Subjects Review Boards was granted for this research.

All faculty members at each of the three institutions were recruited via email to complete an online questionnaire via SurveyMonkey (SurveyMonkey, 2018) in Spring 2015. A total of 276 faculty members (total population = 1372, response rate 20.1%) completed the questionnaire. Additional information regarding this instrument and qualitative evaluation of the responses has been previously reported (Morrison et al., 2018). Due to non-responses on key items, our working sample is 223. Demographic characteristics (race and gender) of the faculty in the study sample are comparable to the general faculty population from which the sample was drawn; however, more than double the faculty in the study sample are tenured compared to the larger faculty population (72.5% in sample compared to 38% in population).

Institutional Contexts
Three institutions, hereafter referred to as R3, M3, and A&S, participated in the study. All schools are located in the United States and each are described, in brief, below. We used the Carnegie Classification (Center for Postsecondary Research Indiana University School of Education, 2019) and the Common Data Set from 2014 to 2015 (Common Data Set Initiative, 2019) to corroborate our characterizations of the institutions.

R3 is private doctoral university in the Midwest region. This university has a Moderate Research Activity Carnegie classification, a smaller student enrollment ($\sim$10,000), and an 86.6% admissions rate. R3 is also primarily residential, majority undergraduate and considered to be balanced in arts & sciences/professions. During the 2014–2015 academic year, the total number of instructional faculty was 332 (31% non-white, 46% women, and 54% men).

M3 is a public Master's College with a medium student population ($\sim$7,400) that is very high in undergraduate enrollment. Located in the northeast, this school is balanced in the arts & sciences/professions, has a 49% admissions rate and low transfer rate. The total number of instructional faculty during 2014–2015 was 820 (14% non-white, 52% women, and 48% men).

A&S is a private, small ($\sim$1,700) baccalaureate college. As an arts and sciences focused university, A&S is also highly residential, has a 64.5% admission rate and very low transfer rate. This university is located in the mid-south region. The total number of instructional faculty during 2014-2015 was 220 (11% non-white, 41% women, and 59% men).

Measures
The survey instrument built on previously published work (Jones and Davis, 2014) and has been described in another publication (Morrison et al., 2018). In addition to collecting basic demographic information such as gender, race, and rank, the questionnaire asked faculty members to report on their research and scholarly activities, to include mentoring URSCA, and institutional environment. The mentoring and institutional measures are described below.

Mentoring
Faculty member engagement in mentoring URSCA was included as a dichotomous variable (1 = currently or have previously included undergraduates in their scholarly activity, 0 = have not and do not plan to include undergraduates in their scholarly activity).

Institutional Support
Our interest in institutional variation extends beyond whether there are differences in participation across institutions. To capture variation in perceived institutional support for mentoring undergraduates, we averaged responses to the following four items that asked faculty members whether they agreed or disagreed (Cronbach's $\alpha = 0.78$): "Faculty are encouraged to submit grants that involve undergraduate students"; "Undergraduates in my college/school have opportunities to communicate the results of their research or creative activities"; "My dean and administrators support faculty efforts to involve undergraduates in scholarly work"; and "Involving undergraduates in student scholarship is valued for tenure and promotion decisions." Higher values reflect perceiving more institutional support for mentoring

TABLE 1 | Descriptive statistics ($N = 223$).

Variable	Mean (SD) or %
Mentored Undergraduates (1 = yes)	79.1
Female (1 = yes)	53.2
Non-white (1 = yes)	7.5
Tenured (1 = yes)	72.5
Institution	
R3	36.4
M3	36.0
A&S	27.6
Perceived Institutional Support	2.78 (.71)

undergraduate researchers. These items are based on prior qualitative research, which has shown that institutional support for mentoring undergraduate researchers is indicated by recognition of this work in promotion and tenure, student incentives in the form of funding opportunities, and student opportunities for writing, research, and presentation/dissemination (Baker et al., 2015).

Statistical Analysis

Descriptive statistics for the study variables are reported in **Table 1**. Faculty demographic characteristics included gender, race, and tenure status. Given the nature of the sample, faculty gender was included as a dummy variable ($1 =$ female, $0 =$ male), with men as the reference category in the logistic regression analysis. Race was included as a dummy variable [$1 =$ non-White, $0 =$ White (non-Hispanic)], with white (non-Hispanic) as the reference category in the logistic regression analysis. Tenure status was included as a dummy variable ($1 =$ tenured, $0 =$ tenure-track), with tenured faculty members as the reference category in our logistic regression analysis. Given the categorical nature of the data, we performed a fixed-effects logistic regression analyses to predict the likelihood of a faculty member being involved in mentoring UR students. By performing fixed-effects logistic regression, we control for the unmeasured similarities across faculty members within each of the institutions included in this study (Allison, 2009). In this analysis, institutional support and faculty demographic characteristics, including gender, race, and tenure status were included as the predictor variables. For these analyses, we report odds ratios and the Nagelkerke R-squared, which is analogous to the R-square in a linear regression model (Norusis, 1997). Through these analyses, we considered the unmeasured characteristics of the three institutions that may shape faculty member participation.

RESULTS

A description of the faculty in the study sample are shown in **Table 1**. Participants were distributed almost equally across the three institutions. Over 79% of the faculty surveyed engage undergraduates in scholarly activity. The faculty members in the sample were overwhelmingly white (92.5%) and tenured (72.5%); slightly more women than men participated in the study (53.2

TABLE 2 | Zero-order correlations for analytic variables.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Mentored Undergraduates (1 = yes)							
(2) Female (1 = yes)	−0.023						
(3) Non-white (1 = yes)	−0.048	−0.041					
(4) Tenured (1 = yes)	0.016	−0.073	0.005				
(5) R3	−0.130*	0.028	−0.045	0.013			
(6) M3	0.107	0.095	0.047	−0.049	−0.609*		
(7) A&S	0.044	−0.160*	0.005	0.027	−0.433*	−0.429*	
(8) Perceived Institutional Support	0.241*	−0.068	−0.186*	0.025	−0.206	0.050	−0.016

$N = 223$. *$p < 0.05$ (two-tailed tests).

TABLE 3 | Fixed effects regression coefficients predicting likelihood of mentoring undergraduates across three institutions.

Variable	B	Wald χ^2	Exp(B)
Female (1 = yes)	0.005	0.000	1.002
Non-white (1 = yes)	0.002	0.000	1.002
Tenured (1 = yes)	0.018	0.002	1.019
Institution			
R3	0.179	0.118	1.195
M3	−0.593	1.5464	0.553
A&S	(reference)	(reference)	(reference)
Perceived institutional support	0.768*	9.533	2.157
Constant	−0.389	0.127	0.677
Model χ^2		15.004*	
−2 Log likelihood		191.996	
Nagelkerke R^2		0.109	

$N = 223$. *$p < 0.05$ (two-tailed tests).

vs. 46.8%). **Table 2** presents the zero-order correlations among the analytic variables. Higher levels of perceived institutional support were found correlate with faculty members reporting they had mentored undergraduates. Additionally, faculty at the R3 institution were significantly less likely to report having mentored undergraduates. The only other significant correlation to note is that non-white faculty members reported having lower levels of perceived institutional support than did white faculty members. **Table 3** reports the results of the multivariate analysis. This analysis demonstrated that perceived institutional support was the only characteristic that predicted the likelihood of mentoring an undergraduate.

Faculty members who reported greater levels of perceived institutional support were significantly more likely to be involved in mentoring undergraduates, even after controlling for sociodemographic characteristics. After accounting for gender,

race, rank, and institution, greater perceived institutional support was associated with higher odds of participating in URSCA mentoring; the odds of currently or previously including undergraduates in their scholarly activity was 2.157 times higher. It is also important to note that no sociodemographic characteristics were significantly related to participation in undergraduate research mentoring, and there were no differences by institution.

DISCUSSION

Extensive evidence suggests that institutional context, including college or university type, mission, size, faculty research requirements, and pressures for accountability from interested constituents shapes faculty workload (Hattie and Marsh, 1996; Wright et al., 2004; Terosky and Gonzales, 2016). Faculty workload predicts burnout and the time that faculty invests in various work-related activities (Lackritz, 2004) and, in particular, has been shown to reduce faculty interest in mentoring undergraduate students (Johnson, 2002; Prince et al., 2007) or make the development of high-quality faculty-student mentoring relationships more challenging (Johnson, 2015).

Strong faculty mentoring relationships are an essential element of a high-quality URSCA experience (Lopatto, 2003; Healey and Jenkins, 2009; Behling et al., 2015). Mentoring undergraduate researchers, especially outside the confines of a formal course, is typically not considered a part of a faculty member's work requirements. However, as studies have begun to document, a substantial number of faculty across institutional types choose to mentor undergraduates in the creation of authentic scholarly and creative activities (Baker et al., 2015; Morales et al., 2016). The current study integrates research focusing on individual characteristics (Lackritz, 2004) with those examining institutional factors (Lunsford et al., 2016) to simultaneously examine factors that may predict faculty's propensity to mentor undergraduate researchers.

Interestingly, our results demonstrated that the only factor that was correlated with faculty participation in mentoring undergraduates was perceived institutional support. Our results are consistent with other research that has shown that institutional reward structures that discourage mentoring of undergraduate researchers are less likely than their counterparts to show interest in serving mentors (DeAngelo et al., 2016; Morales et al., 2017). To begin, this finding highlights the importance and value of institutions beyond the overall type, history, mission, and demographic makeup of the student body in shaping faculty workload choices, especially as it relates to mentoring of undergraduate research. Second, our findings seem to suggest that faculty members may differ with regard to how they view see variation in the extent to which there are institutional and structural supports and allocate their time accordingly. College and university administrators may believe that providing undergraduate students with authentic scholarly experiences is important, but faculty will not facilitate those experiences through mentoring students if there is not a demonstrated incentive for doing so, including faculty rewards in

the form of tenure and promotion, positive annual evaluations, and other faculty awards and recognition. Institutions that encourage faculty members to include undergraduates in their work may find that faculty members will respond by increasing their engagement in these activities. Given that we focus on three institutions that themselves are very different from one another, future research should examine the robustness of this finding at a variety of other institutions. Regardless, our results suggest that, without direct and explicit support from department chairs, deans, and other senior-level administrators, faculty members are significantly less likely to mentor undergraduate students.

The sociodemographic characteristics of the faculty did not explain unique variance in faculty's decision to mentor undergraduate researchers, when considered along with faculty perceptions of institutional support for mentoring in this context. We were surprised by this as previous research has found some differences based on gender, race, and tenure status (Davis et al., 2015). It is possible that our lack of findings for these variables in the current study may be the result of selection bias. That is, for the most part, the institutions that were included in or sample emphasized undergraduate education and have strong policies in place for undergraduate research. Accordingly, it could be that the faculty employed by the institutions we sampled were prone to hiring faculty members who are more likely to mentor undergraduates, regardless of their own demographic characteristics. When interpreted in light of the fact that the participating institutions emphasized undergraduate education as part of their core mission, our finding that perceived institutional support was the only predictor of faculty mentoring behavior may be especially important. The faculty members we surveyed, regardless of their gender or race, may have elected to work at institutions that encourage and appropriately reward their work with undergraduates at the institutional level.

CONCLUSIONS

This work contributes to the growing literature on mentoring relationships in undergraduate faculty-student relationships by demonstrating that perceived institutional supports are significantly and substantively influential in shaping faculty members' behavior (Brew and Mantai, 2017). Brew and Jewell argued that "academic developers have a key role in informing institutional policy concerning the integration of research and inquiry" (Brew and Jewell, 2012). Our findings confirm this assertion, revealing that the one statistically significant relationship influencing participation in mentoring is perceived intuitional support.

Individuals may be employed at institutions that center around undergraduate education, but will not themselves engage in high impact practices such as mentoring undergraduate researchers if they do not feel their work is valued by administrators. Institutional actors tasked with shaping the educational experience unique to an institution should be mindful of the need to be explicit in policies and procedures that

support, rather than exploit, faculty in their efforts to mentor undergraduates in research experiences.

An important limitation of our study is the relative lack of racial/ethnic diversity of our sample. Higher education, in general, itself is not as diverse as the students we serve (Nelson, 1996; Orfield, 1999; Ofori-Dankwa and Lane, 2000; Stephens et al., 2012). It is possible that greater diversity of faculty members across the three institutions may have yielded different results. In our data, a high percentage of the faculty surveyed were tenured and participated in URSCA; thus, our study sample may not be representative of a more general faculty population.

As this study is based on questionnaire responses, it is possible that some responses reflect social desirability or other psychological mechanisms that would lead to reduced reliability of responses. This specific limitation would best be addressed through investigation of similar research questions using a multi-method approach, allowing researchers to probe questionnaire responses through qualitative interviews. Further multi-method research could also develop additional items measuring perceived institutional support that could be used to build more robust measurement of this construct, as our four items may not fully encompass all components of this construct. Additional items could yield a nuanced measurement model that could be confirmed, validated, and deployed subsequently in this area of inquiry.

Our findings highlight the embedded nature of undergraduate research within higher education as a social institution: institutional characteristics shape individual behavior. Future research should continue to collect and examine data from multiple institutions simultaneously in order to move beyond institutional-specific contextual practices that cannot be transferred to other institutional settings. Comparative work examining institutional practices that support faculty members will illuminate how higher education can expand opportunities for students to excel and thrive.

Academic leaders have a unique opportunity to shift the paradigm of faculty, who may consider their teaching and research as separate silos, and help them develop as mentors (Shanahan et al., 2015; Healey and Jenkins, 2018). This quantitative study offers confirmation of just how important this work remains, as faculty who do not perceive the support of their institution are less likely to mentor undergraduate scholars.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by George Mason University Institutional Review Board. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

SD and RJ planned the study. DM took the lead in preparing the dataset for analysis. SD and RJ took the lead in writing the manuscript. DM and PG substantially contributed to analyzing and interpreting the results. SD, RJ, DM, and PG contributed to writing the manuscript. All authors contributed to the article and approved the submitted version.

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