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Characteristics of Faculty Who Mentor Undergraduates in Research, Scholarship, and Creative Work

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In this article we report on a study that represents the first step in a multi-year, multi-institutional research project, "Faculty Across Career Stages: Building Capacity for Undergraduate Research, Scholarship, and Creative Work," which aims to develop a more comprehensive portrait of faculty mentors of undergraduate researchers. We analyze archival data from two liberal arts colleges and one public research institution. The dataset included demographic information on 198 faculty members who supervised undergraduate researchers in formal experiences between 2009 and 2014. The undergraduate research (UR) included supervised summer and academic-year experiences, but it was defined differently by different institutions, depending on their records. Discipline and faculty rank were important characteristics associated with faculty mentoring of undergraduate researchers, but gender was not. The study highlights a need for mixed-method research to understand better departmental and institutional influences on faculty members' engagement in UR. We believe directors of undergraduate research programs should document faculty mentors' participation according to at least three standard categories—faculty rank, discipline, gender

Introduction

A growing body of research has shed light on the benefits of undergraduate research, scholarship, and creative work for the students who participate in these educational practices (e.g., Lopatto 2010; Osborn and Karukstis 2009; Kuh 2008; Hunter, Laursen and Seymore, 2007; Lopatto 2004). However, less attention has been given to the characteristics of faculty members who make such educational experiences possible. This dearth of data about faculty members is particularly surprising given that one of the distinguishing characteristics of undergraduate research is that students and faculty members are engaged in mentor/mentee relationships, rather than student/teacher relationships (Osborn and Karukstis 2009; Lopatto 2003; Hakim 1998). Faculty members with active research, scholarly, and artistic agendas, along with considerable mentoring expertise, are the foundation of undergraduate research programs. In *Characteristics of Excellence in Undergraduate Research (COEUR),* Rowlett, Blockus, and Larson noted, "A key component to a successful undergraduate research environment is an institutional commitment to a scholarly faculty" (2012, 3). Few research studies have been conducted, though, to understand faculty members who choose to mentor undergraduate researchers and what such an "institutional commitment" might look like through their eyes.

Existing research about faculty mentorship of undergraduate researchers has highlighted the

rewards—both intrinsic and extrinsic—that faculty mentors reap from their work in mentoring undergraduates. For example, Osborn and Karukstis described ways in which mentoring undergraduate researchers benefits faculty, including by "enhancing their teaching and engagement with students, increasing their own research, scholarly, and creative outcomes, integrating scholarship and teaching, and increasing their job satisfaction and personal development" (2009, 46). Osborn and Karukstis' list of benefits, including the status attributed to talented mentors, aligns with earlier work by Koch and Johnson (2000) and Kinnier, Metha, Buki and Rawa (1994). This body of research serves an important exhortatory function, encouraging faculty members to serve as mentors.

Turning to articles that offer advice to faculty members about how to successfully mentor undergraduate researchers provides a sideways glance at some challenges faculty members face. A special section of the June 2004 issue of the *CUR Quarterly* focused on "Creating Time for Research," while the December 2003 issue included eight essays that took up the challenge of staff support for undergraduate research. Calls for the reform of institutional systems of reward and recognition for faculty participation in undergraduate research, particularly as they relate to issues of tenure and promotion, represent another topic of concern faculty members have expressed about working with undergraduate researchers (*CUR Quarterly* Summer 2011; Grobman and Kinkead 2010). Highly successful undergraduate research programs often emphasize the need to provide faculty with professional-development experiences to expand their repertoire of mentoring practices (Flores, Darnell, and Renner 2009; Morris, McConnaughay, and Wolffe 2009; Pyles and Levy 2009). The need to provide training for faculty members to mentor students from underrepresented populations in postsecondary education is particularly acute (Ingram 2009; Scisney-Matlock and Matlock, 2001).

The limited body of research about the characteristics of faculty members who mentor undergraduate researchers has been comprised of studies at single institutions, such as the work of Potter, Abrams, Townson, and Williams (2009), who surveyed faculty participants in undergraduate research at the University of New Hampshire, or Buddie and Collins (2011), who studied faculty at a state university in Georgia. Studies that explore faculty participation in undergraduate research across multiple institutions and diverse institutional types would enrich knowledge of the factors that may affect faculty engagement and experiences as undergraduate-research mentors.

The long-term objective of the research project outlined above is to determine faculty members' perceptions of institutional support and challenges as they make decisions about mentoring undergraduate researchers. Before this objective can be met, however, it is important to have a more nuanced understanding of trends in faculty participation in undergraduate research, including faculty rank and career stage, disciplinary affiliations, and institutional types.

We advanced our understanding of faculty participation in undergraduate research, scholarship, and creative work by examining archival datasets from three institutions over a five-year period. The research question that guided our exploration of the datasets was: What is the profile of faculty members who mentor student experiences in undergraduate research, scholarship, and creative work?

Method and Analysis

We examined archival faculty data from summer 2009 through spring 2014 using a "convenience" sampling technique to collect records from some of the authors' institutions. Archival records of 198 faculty members were obtained from two liberal arts colleges (LAC1 and LAC2) and one public research university (PublicU). LAC1 is located in the northwestern part of the United States. Only information on faculty members in the College of Arts and Sciences ($N = 128$) at LAC1 was available for our analysis. Undergraduate enrollment was about 1,700 in fall 2014, and there were a total of 338 faculty members at the institution. LAC2 is located in a suburban area in the Midwest. Student enrollment was about 1,300 in fall 2014, and there were 108 faculty members. PublicU is in an urban area in the Midwest that enrolled about 8,660 undergraduates in fall 2013, and employed just under 1,200 part- and full-time faculty members.

Each institution provided the department, gender, and rank of each faculty member, as well as the academic year(s) of participation in UR between 2009 and 2014. The sample ultimately included records of 198 faculty UR mentors, including 31 from LAC1, 82 from LAC2, and 85 from PublicU.

LAC1 defined a mentor of an undergraduate researcher as a faculty member who participated in a formal summer research program with undergraduates, with modest stipends for faculty members. LAC2 defined mentoring as faculty supervision of students in a summer research experience. PublicU defined mentoring a student in UR as faculty supervision of an undergraduate who presented work at the university's annual undergraduate research symposium, which was held in the final weeks of the spring semester.

The departments of faculty UR mentors were organized into six divisions to simplify the statistical analysis: applied fields (architecture, education, and engineering), fine arts, humanities, natural science, physical science, and social science. Health-related departments (N=4) and mathematics (N=6) were included in the natural-science division. The small numbers of faculty members in the applied fields resulted in their being treated as one category. The divisions were dummy coded into five variables, with social sciences as the referent category, for logistic regression calculations. Seven faculty members were promoted to associate professor and two to full professor during the period under study; these faculty members were assigned their higher ranks in the analysis.

Frequencies, percentiles, and chi-squared and logistic regression equations were calculated to answer the research question. The variables were categorical variables. Faculty participation in UR in an academic year (yes or no) was the dependent variable. The independent variables were rank, gender, division (dummy coded into five variables), and institution (dummy coded into two variables). Logistic regression is appropriate to determine the likelihood of a categorical dependent variable based on the categorical independent variables.

Results

The archival records included 107 men, 83 women, and 8 people whose gender was not reported. Two-thirds of the faculty members were tenured or on the tenure track. About 24 percent of the sample were assistant professors (N=47), 30 percent were associate professors (N=61), and 26

percent were full professors (*N*=52). The remaining faculty members held titles such as adjunct, instructor, visiting professor, research professor, or administrator; six records were missing a rank. The latter, non-tenured titles were collapsed into a non-tenure track (NTT) category (*N*=32). Half of the faculty members were in the natural sciences (*N*=54) or social sciences (*N*=53), with humanities (*N*=35) and the physical sciences (*N*=28) having the next largest number of faculty mentors. The fewest faculty mentors were in the fine arts (*N*=13) or the applied fields (*N*=15) of architecture, education, or engineering. See Table 1 for a summary of this demographic information across the three institutions.

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During the five-year period, while 198 faculty members participated in UR as mentors at the three institutions studied, during any one academic year from 34 percent to 44 percent of the 198 were actually engaged in mentoring undergraduate researchers (see Table 2). The participation rate was consistent at each institution over the five years. We conducted the rest of our analyses to understand factors related to the faculty members' engagement in UR.

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Five logistic regression equations were computed for each academic year, in which division, rank, gender, and institution were regressed on mentoring (yes or no) a student in UR. In two of the five years the logistic regression equations were significant only for academic divisions. In 2009-10 faculty members in the natural sciences (four times as likely) and the physical sciences (five times as likely) were significantly more likely to mentor a student in UR than were faculty members in the social sciences (χ^2 (185) = 216.62, p = .01). In 2012-13 faculty members in the physical sciences were four times as likely to mentor a student in UR than were faculty members in the social sciences (χ^2 (185) = 230.23, p = .05).

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There was variability by academic rank in the percentage of faculty members participating over the five years (see Figure 1). Chi-square calculations showed that participation in UR was significantly different by rank during the first three years under study: 2009-10, χ^2 (4, 198) = 9.14, p = .06; 2010-11, χ^2 (4, 198) = 12.79, p = .01; and 2011-12 3, χ^2 (4, 198) = 14.34, p = .006 (see Figure 2). Associate professors participated more in UR during these three years and participated at a similar rate across all five years under study. Assistant and full professors appeared to move in and out of UR mentoring over the five years under study, but in 2013-14 they outperformed the associate professors. We examined non-tenured faculty members' participation in mentoring separately and found an average of 9 of the 32 such faculty members

participated in UR in any one year, with a low of 6 such faculty members in 2009-10 and a high of 13 faculty members in 2011-12.

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There were no statistically significant differences in faculty mentoring of undergraduate researchers by gender. However, there was a trend of female faculty members' participating in UR more frequently than their male peers (in four of the five years under investigation). Institution, entered as a control variable, was significant only in the fourth year of the study, when faculty at LAC2 were almost 3.7 times as likely to mentor a student researcher than faculty at the other two institutions (χ^2 (184) = 229.67, $p < .01$).

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Discussion

A strength of this study was the use of institutional definitions of UR to understand trends in faculty participation in undergraduate research and scholarly and creative work. Undergraduate research included supervised summer and academic-year experiences. Inviting institutional researchers and undergraduate research directors at three institutions to report rates of faculty participation in UR mentoring at their institutions allowed us learn how institutions are defining and documenting such participation. These data allowed us to generate findings that add to the literature on faculty mentoring of undergraduate researchers in four areas.

First, discipline matters. This finding suggests that colleges and universities have not institutionalized UR across all their departments and colleges. Our dataset included faculty members who had participated in UR at least once over a five-year period. Of these faculty members, those in the natural and physical sciences were more likely to have participated in UR than those in applied fields, fine and performing arts, humanities, and social sciences in two of the years under study. Could this difference be related to teaching loads in these disciplines? Fairweather and Beach's (2002) findings suggest that they might be. These authors reported that faculty members in fine arts, business, and education published less. At the same time, faculty in arts and humanities spend more time on teaching (53 percent of time) than their peers in natural sciences (32 percent of time). We need to understand more about how disciplinary influences shape the motivation of faculty in various fields to engage in UR, such as the perceived value of mentoring undergraduates' work, resource availability and recognition for such efforts, and prior models or expectations involving this component of faculty work. It seems there is a need for institutions to place more emphasis on creative and scholarly work in designing student research experiences.

For example, research in the arts is better described as creative inquiry, rather than researching a hypothesis. Mentoring undergraduates in creative inquiry involves reflection on the creative process (Burton 2004; Coady and Nelson 2013). Scholars in the arts seek aesthetic truths not

only through traditional processes of synthesizing and creating, but also through such reflection (Lavender 2006). We have conducted focus groups with faculty members to understand better their participation in UR. Preliminary analyses of the focus groups in stage two of our study suggests that senior capstone projects may warrant being considered as UR, especially by faculty in the arts and humanities. This supports the findings of an internal report conducted by LAC1, which revealed that all faculty members in the arts and humanities considered senior capstone projects as involving mentoring students in UR.

Second, rank was important in some years. What might encourage early-career faculty members to participate, or alternatively, prevent participation by faculty members in the assistant professor ranks? Similarly, what might be causing the fluctuation in full professors' rates of participation in UR? There is an assumption that only tenured or tenure-track faculty members are engaged in these important activities, yet we found that faculty members not on the tenure track were also engaged in UR. Given the increasing number of faculty members who are in the non-tenure-track positions, more attention may be needed regarding how to support them in undergraduate coursework or summer experiences related to UR—particularly in the teaching-intensive disciplines such as the fine and performing arts and humanities. PublicU had doctoral programs and LAC1 is a comprehensive institution with masters and some doctoral programs. Thus, it is possible that assistant professors at those institutions were focused on publishing with graduate students rather than engaging in undergraduate research.

Third, gender was not a significant factor. This finding was surprising, given that research suggests that men demonstrate more research productivity than women (Bellas and Toutkoushian 1999; Sax, Hagedorn, Arredondo, and Dicrisi III 2002), and thus may provide more such opportunities for undergraduates. In this study, gender was not significantly related to supervising undergraduates in UR. In fact, the trend was for women to participate more than men in four of the five years of the study. Supervising students is a complex component of faculty work; while male faculty members have reported higher levels of research productivity, female faculty members are often more likely to engage in teaching, service, and advising. Further research is needed to better understand these dynamics and their outcomes for faculty success and satisfaction, as well as for effective undergraduate research experiences.

Fourth, there is a need to develop common metrics of faculty engagement in UR. We had considerable difficulty obtaining our data, even though we sought to identify what our institutions collected regularly. There were also no institutional reports on these important faculty behaviors. Further, we were unable to obtain datasets from two institutions from which we had hoped to obtain them, even though the directors of undergraduate research at the institutions requested the information from their institutional-data offices. We propose that directors of undergraduate research programs begin to categorize UR activities as (1) credit-bearing fall or spring courses, (2) summer programs with and without credit-bearing courses, and (3) programs carrying no credit but with stipends for students. Beginning to standardize reporting would enable institutions to understand better who is engaging with undergraduate researchers, and it may highlight how the institutions could better encourage faculty to mentor students in UR. Moreover, such common metrics would help professional organizations and other inter-institutional bodies develop programming and support mechanisms for faculty across institutions.

Conclusion

It is important to acknowledge some limitations in our conclusions. Institutions define UR differently, and it is possible that these definitions may influence which faculty participate in mentoring during the summer or during the academic year. Also, our data may be affected by faculty who became administrators or took a position at another institution during the course of our study. These job changes were not captured in our dataset and may have led to our under-reporting faculty participation in UR if a faculty member was not present on the campus during all five years that we studied. Only two institutional types were included in this study, and we only were able to obtain participation data, rather than detailed information about how much time faculty members spent mentoring undergraduates or how many students they supervised over multiple semesters.

This study does advance scholarly and practice-related work on UR, however, by identifying characteristics of faculty members who mentor students in these activities. Data from the three institutions we sampled allowed us to study faculty rates of participation by academic division, rank, and gender. Findings suggest that there is an opportunity to learn more about how to encourage faculty in disciplines other than the natural and physical sciences to engage in UR. In addition, faculty members did not consistently participate in mentoring UR. Additional research that explores the motivations behind faculty engagement in UR, looking at institutional and individual characteristics, would be helpful in informing efforts to increase the capacity of faculty members to participate in this important component of undergraduate education, across institutional types and disciplinary boundaries.

Acknowledgement

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Table 1. Faculty Demographics of Mentors of Undergraduate Researchers*

Variable	Number	Percent
Male	107	54
Female	83	42
Unknown	8	4
Division		
Applied	15	8
Fine Arts	13	7
Humanities	35	18
Natural Science	54	27
Physical Science	28	14
Social Science	53	27
Rank		
Assistant	47	24
Associate	61	31
Full	52	26
Non-Tenure Track	32	16
Unknown	6	3

*Mentors for at least one term, between 2009-2014

Table 2. Number and Percentage of Faculty Mentors of Undergraduate Research, by Institution and by Academic Year (Fall, Spring, Summer)

Institution	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014
LAC1	17 (22%)	20 (28%)	13 (18%)	17 (25%)	19 (22%)
LAC2	28 (35%)	27 (38%)	26 (37%)	24 (35%)	36 (41%)
PublicU	34 (43%)	24 (34%)	32 (45%)	27 (40%)	32 (37%)
Total	79	71	71	68	87

Figure 1. Percentage of Faculty Mentors of UR during 2009-2014, by Academic Year (Fall, Summer, Spring) and Division

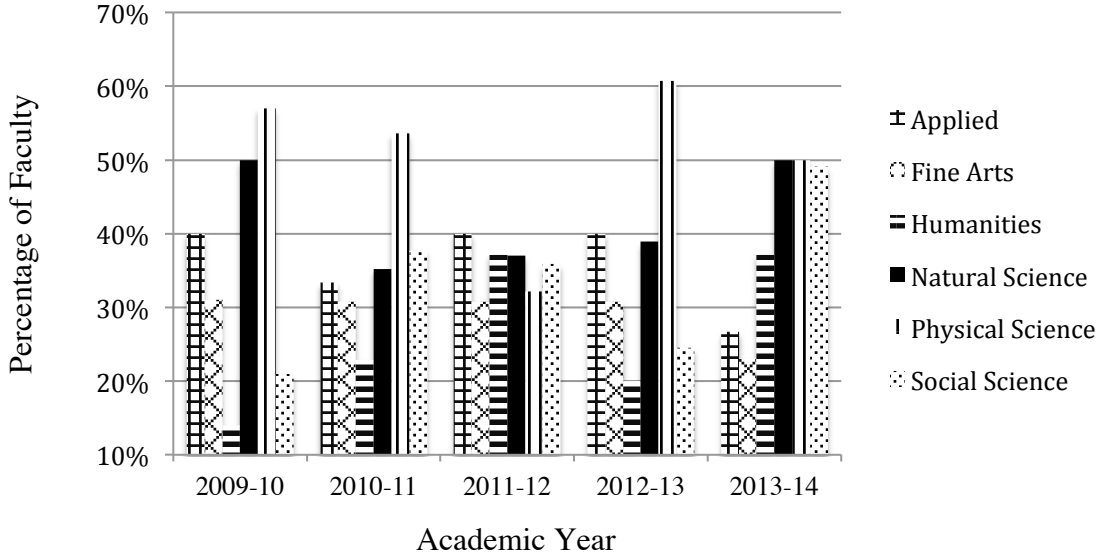


Figure 2. Percentage of Faculty Mentors of UR during 2009-2014, by Academic Year (Fall, Summer, Spring) and Rank

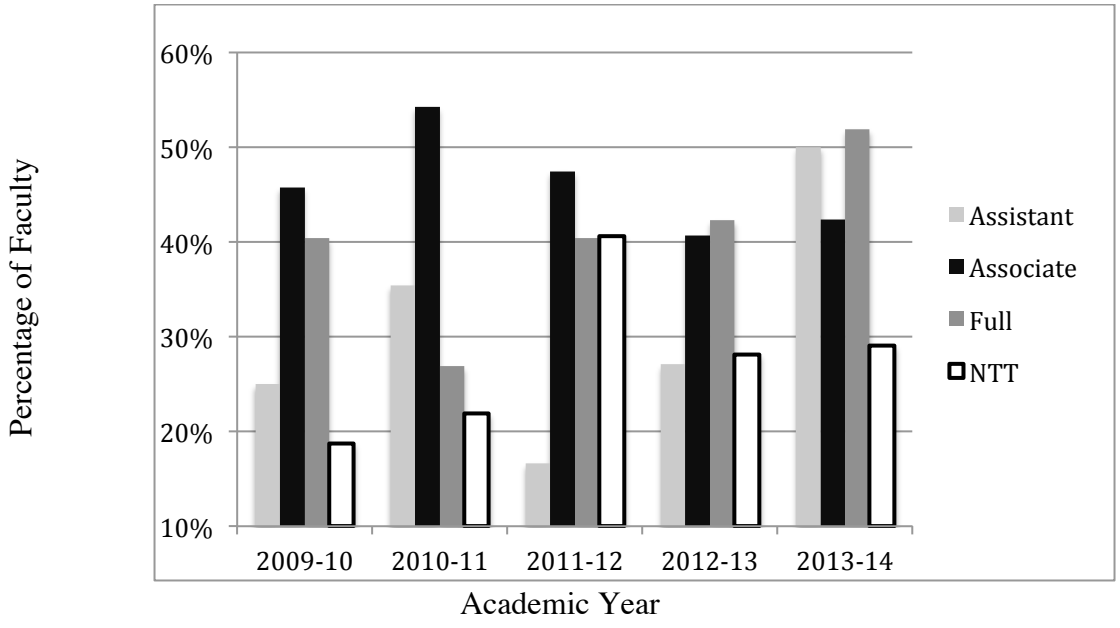
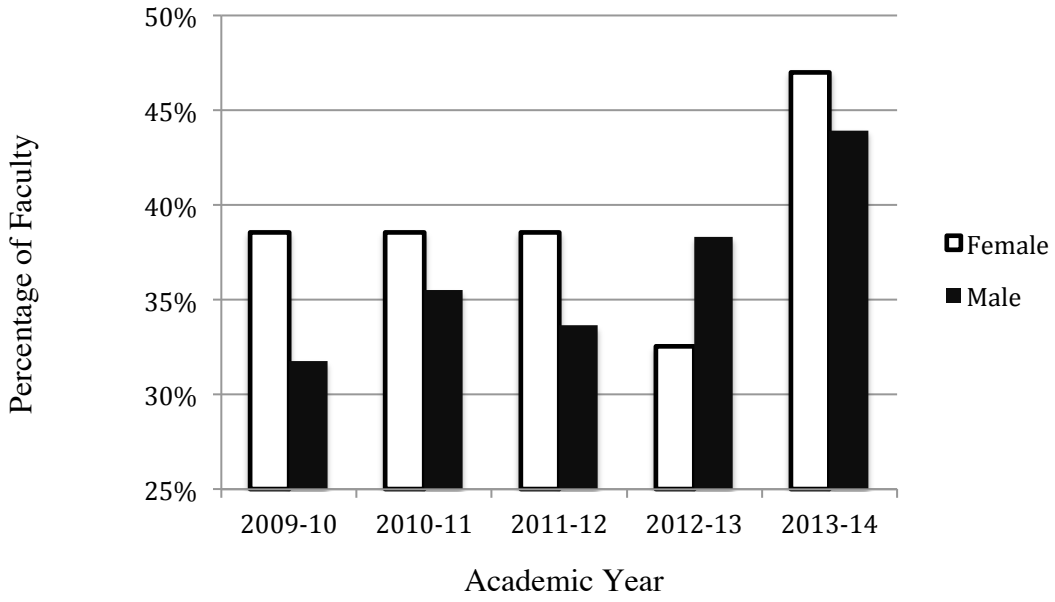


Figure 3. Percentage of Tenured or Tenure-Track Faculty Mentors of UR, 2009-2014 by Academic Year (Fall, Summer, Spring) and Gender



Keywords: mentoring, undergraduate research, faculty rank, discipline, gender