Doctoral Advisors and Their Protégés

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BACKGROUND

Mentoring is pervasive, popular, and resource intensive. Zuckerman (1977) found that having a mentor was a critical feature in the training of talented scientists who became Nobel Prize winners. The National Science Foundation annually confers a Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring and provides awardees a $10,000 grant. Mentoring is the foundation of the American doctoral experience. Yet, remarkably little is known about mentoring, including what it means to mentor someone or how the process of mentoring works.

What is known is that mentors provide two types of support, psychosocial and career. Psychological support involves listening, building confidence, and providing encouragement. Career support involves providing challenging assignments, access to the mentor network of individuals, and professional advice. However, it is not know how these two types of support influence each other or mentoring outcomes.

It is also known that mentoring is associated with certain protégé benefits. In the business and organizational management literature employees who report having a mentor are significantly better compensated (Dreher & Cox, 1996), promoted more often (Roche, 1979), and more satisfied with their jobs and careers (Allen et al., 2004; Mobley, Jaret, Marsh, & Lim, 1994; Underhill, 2006), than employees who do not report having a mentor. However, the effect sizes in this literature are small (Allen et al., 2004). Similarly, studies of doctoral students have found that students who report having mentors also report significantly more publications and are more satisfied with their program than non-mentored students (Cronan-Hillix, Gensheimer, Cronan-Hillix, & Davidson, 1986; Nettles & Millett,

2006; Tenenbaum, Crosby, & Gliner, 2001); these effects are also small.

The presence of significant, but small effects, suggests that conditions should be examined that might influence the effect of mentoring on doctoral student outcomes (Frazier, Tix, & Barron, 2004).

PURPOSE

This study investigated the effect of two types of mentoring support on doctoral success, as measured by five doctoral student outcomes. In addition, student discipline, citizenship (since a large percentage of doctoral students are international), and identity were examined for their influence between the two types of mentoring support, psychosocial and career, on the measures of doctoral success. The five doctoral outcomes were satisfaction with advisor, having an intellectual property event, number of publications, number of presentations, and progress on degree milestones. The study also explored the presence of mentoring networks.

METHODS

Sample

Doctoral students across disciplines from two, large research universities in the South and Southwestern United States participated in this study. Over 600 students completed a 10-20 minute online survey, however only 477 subjects had sufficient data to be included in the analysis.

Variables

There were five independent variables. Two of

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these variables (psychosocial and career) measured mentoring support from the advisor. Psychosocial mentoring support and career mentoring support were estimated by a shortened version of the 14-item Advisor Working Alliance Inventory (Schlosser & Gelso, 2001). This inventory listed 14 behaviors that characterize mentoring activities, for example, "My advisor has invited me to be a responsible collaborator in his/her own work." The third variable was discipline, which was collapsed into six areas: engineering, education, science, math, social science, and humanities. Discipline was dummy-coded with engineering as the referent discipline. The fourth variable, identity commitment, was measured by the 24-item Objective Measure of Ego Identity Status (Adams, 1998). Finally, citizenship was self-reported by the respondents as United States, Permanent Resident or International.

There were five dependent variables that measured doctoral student success: satisfaction with doctoral advisor, productivity (intellectual property events, publications, and presentations), and degree progress (see Table 1).

1. Satisfaction with advisor was measured with one 5-item Likert scale. Individuals reported how many intellectual property events, presentations, and publications they had.
2. Intellectual Property Events is a categorical yes/no variable; 39 individuals responded with a yes.
3. Number of publications is a continuous variable that was estimated by summing the number of publications (including in press) that the individual reported having with faculty as co-authors, in refereed journals, and in published proceedings.
4. Number of presentations was calculated by summing the number of local, national, and international conference presentations the student reported having given.
5. Progress toward degree was calculated from respondents' answers to seven questions about achieving common degree milestones, such as 'Classes and coursework' and "Advancement to candidacy."

Respondents indicated if the milestone was a requirement of their program, and if they had completed that milestone or not. A modified Guttman scale was used to assign a score to each individual, since some milestones indicate that the candidate has completed all the previous items. If the milestone was not required by the individual's program then he or she was given credit for accomplishing that in the Guttman scale.

Table 1.

Dependent Variables: Means, Standard Deviations, and Pearson Correlations

Variable	Mean	S.D.	1	2	3	4	5
1. Satisfaction with Advisor	3.81	1.2	—				
2. Intellectual Property Events	0.08	0.3	0	—			
3. Publications	1.66	3.1	.14**	.28***	—		
4. Presentations	4.63	4.8	.12**	.09*	.32***	—	
5. Progress	5.2	1.7	.09*	0.1	.21***	.25***	—

*p<.05, **p<.01, ***p<.001

There were two covariates, number of semesters since beginning the program and number of semesters of undergraduate research. A definition of mentoring was presented and then individuals were asked to report how many people on and off the faculty they considered to be a mentor. This last item measured how many people might be in a student's mentoring network.

Data Analysis

The interaction of psychosocial and career support was examined for an effect on the dependent variables. In addition, the interaction of both of these mentoring variables with discipline, identity, and citizenship was also considered for any effect on the dependent variables.

Logistic regression was used to estimate the interaction effect of discipline, citizenship, and identity with the two mentoring variables on the satisfaction with advisor and presence of intellectual property events. Negative binomial regression was used to predict number of publications and presentations. Ordinary linear regression was used to estimate degree progress. Descriptive analysis was conducted on the number of other mentors students reported. Exploratory

regressions were computed on the 14 mentor behaviors that comprised the two mentor factors to determine what behaviors had the most influence on doctoral outcomes.

FINDINGS

Mentoring Prevalence and Networks

Mentoring is a common experience that graduate students deem important. Over half of the sample agreed or strongly agreed that their major advisor was a mentor to them. Eight-six percent of the individuals reported one or more mentor(s), in addition to their advisor. Despite the prevalence of mentoring, twenty percent of the students did not consider their advisor to be a mentor, which is surprising given the importance of the advisor relationship in completing a PhD. However, most of these students found mentors elsewhere. There were remarkably few students, 16 out of 477, who did not consider their advisor to be a mentor and reported no other mentor. Two-thirds of the sample indicated that mentoring contributed to their success as a graduate student. Most mentoring research focuses on one mentor-protégé relationship, yet doctoral students appear engaged in several such relationships at a time.

Undergraduate Research

One of the surprising findings was the importance of undergraduate research. Individuals who reported more semesters of undergraduate research reported significantly more intellectual property events, more conference presentations, and faster progress on degree milestones; but they reported significantly less satisfaction with their advisor. This last relationship is unexpected. However, it might be that doctoral students with more exposure to faculty, through undergraduate research, might have higher expectations of faculty and are therefore not as satisfied as students with less undergraduate research experience. Undergraduate research was a crude measure of an activity (that could be considered a type of mentoring), which occurred years ago and had robust effects on doctoral outcomes. This study provides evidence that undergraduate research might contribute to graduate student success.

Satisfaction, Publications, and Presentations

Mentoring affects how satisfied students are with their advisor, but it is a synergistic effect. Psychosocial support (rapport) significantly, positively interacted with career support (apprenticeship) in predicting satisfaction with advisor. The interaction was strongest at high levels of psychosocial and career support and explains a large amount of the variance in ratings of satisfaction with advisor (pseudo $R^2 = .43$). This finding is important because previous research has not examined the relationship between psychosocial support and career support on protégé outcomes. None of the other independent variables were significantly related to student satisfaction with advisor.
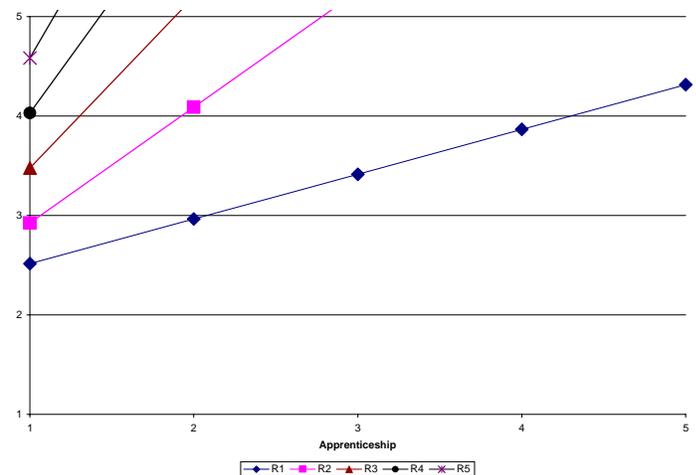

Figure 1. Effect of Apprenticeship, Conditional on Rapport, on Satisfaction with Advisor.

The number of publications was significantly influenced by discipline and the two mentoring factors, psychosocial and career support (pseudo $R^2 = .12$). However, the two types of mentoring support displayed different patterns of influence depending on the student's discipline. Students in the social sciences and humanities, who received more psychosocial support (rapport), published less than engineers, who received more psychosocial support (apprenticeship). Conversely, individuals in social sciences, humanities, and education who received more career support (apprenticeship) were found to publish more, whereas career support (apprenticeship) had no influence on the publication rate of engineering students.
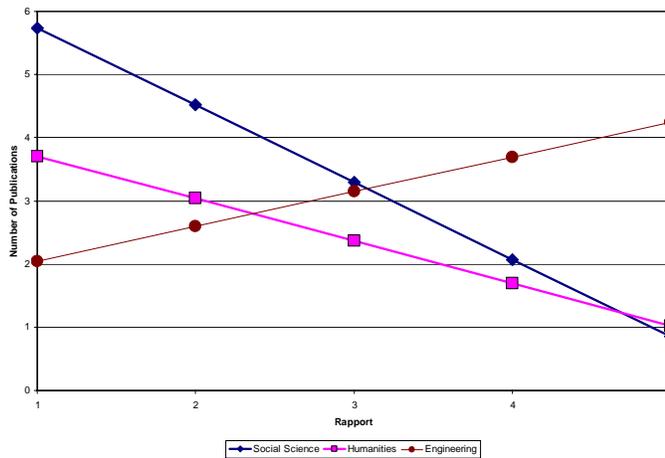
Figure 2. Effect of Rapport, Conditional on Discipline, on Number of Publications.
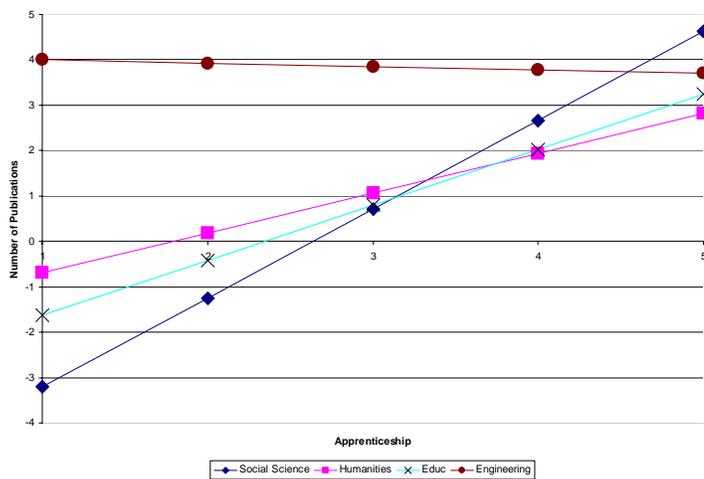

Figure 3. Effect of Apprenticeship, Conditional on Discipline, on Number of Publications.

Mentoring matters when conference presentation rates for doctoral students are considered. Students who received more career support (apprenticeship) had increased odds of presenting at conferences, even after discipline was considered. However, the effect size is quite small ($R^2 = .03$). Clearly, there are additional variables to be considered that influence presenting at conferences.

Degree Progress and Intellectual Property Events

Mentoring had a similar influence on progress on degree milestones as it did on intellectual property events.. Students in the sciences made significantly more progress toward degree milestones than students in engineering (pseudo $R^2 = .25$). The introduction of

discipline eliminated the influence of mentoring on progress toward degree and intellectual property events The amount of variance explained for intellectual property events (pseudo $R^2 = .16$) is in the medium effect size range, but discipline appeared responsible for the effect. Individuals in engineering reported significantly more intellectual property events than students in other disciplines.

Citizenship and Identity

Two of the independent variables, citizenship and identity status, did not significantly influence mentoring but are worthy of mention. The analysis did not reveal citizenship to be significantly related to the doctoral student outcomes. However, a review of the data suggests citizenship and discipline are confounded. Over 60% of the engineering students in this study were international students. Foreign students are estimated to comprise from 25 – 40% of doctoral students in American programs. More study is needed in disciplines with large numbers of international students to tease out mentoring effects on protégés who are foreign-born. This is important because mentoring efforts targeted in disciplines with significant foreign-born populations may not have the same effects for U.S. versus international citizens.

Identity status, or how committed and motivated a person is to develop his or her sense of self, did not prove to be an important variable in this study. This might have been because of the low-reliabilities for two subscales of the instrument used in this study. Having a higher commitment status, Identity Achieved, was significantly related to being more satisfied with an advisor, and having a lower commitment status, Moratorium, was significantly related to publishing less. Both of these findings were in the expected direction. Psychosocial theory, upon which most mentoring research is based, suggests that identity is an important factor in being receptive to mentoring relationships. More work is needed in this area.

Important Mentoring Behaviors

A post hoc analysis was conducted to determine which of the 14 mentor-like behaviors might have the most influence on doctoral student outcomes. Collaboration and encouragement of professional activities were significantly, positively related to at least three of the five outcome measures. Some of the behaviors, such as recognizing areas of improvement, welcoming input, and establishing a timetable, had a negative effect.

Feeling respected by their advisor was significantly, positively related to satisfaction with advisor and intellectual property events, but was significantly, negatively associated with presentations. This study provides a first step toward identifying the specific mentor-like behaviors that influence protégé outcomes. Identification of these behaviors might assist mentoring programs to target relevant behaviors.

RECOMMENDATIONS

There are five practical implications of this research on mentoring and talent development for doctoral education.

- Individuals appear to be embedded in a **network of mentors**. Graduate programs might benefit by providing supporting for new students to connect with multiple people in addition to the major advisor.

- There is some evidence that **doctoral students benefit from career support emphasizing collaboration** and **the building of professional networks**. Graduate deans might wish to encourage those advising behaviors.

- The findings suggest that **career support**, not psychosocial support, **has the greatest positive effect on student productivity**. This finding is supported by case studies on exceptional talent that found career and professional guidance to be more important than emotional support (Sand, 2000; Zuckerman, 1977). Emotional support was found to be negatively related to the number of publications for students in some disciplines. Thus, greater emphasis by graduate programs on career support might be warranted.

- The findings suggest there should be more **support of undergraduate research**. This study provided evidence that undergraduate research was positively related to intellectual property events, presentations at conferences, and progress toward degree.

- Mentoring is considered to be an important factor in research on doctoral completion. This study assessed proximal outcomes, but longer-term dependent variables might be more appropriate. **More work is needed to assess the time latency of mentoring effects on doctoral outcomes, including attrition rates**.

It is unclear if the high attrition rate is related to lack of mentoring, poor selection, or other factors. Attrition has not been examined carefully in part because of a sense that some attrition is 'good' or perhaps inevitable. However, an attrition rate as high as 50% would seem to be an inefficient use of scarce resources.

Mentoring is a pervasive element of American education, yet there is a surprising paucity of empirical information about it and its consequences. It is hoped that this study helps advance the research into the nuances of mentoring relationships, the effect of mentoring networks, and refinement of mentoring outcomes.

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