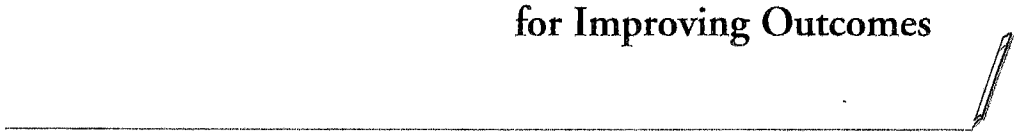
THE ASSESSMENT OF DOCTORAL EDUCATION

Emerging Criteria and New Models for Improving Outcomes



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PATHS AND PERCEPTIONS

Assessing Doctoral Education Using Career Path Analysis

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Over the past few years, doctoral education has faced criticism about its relevance in preparing students for the careers they pursue following graduation. Critics both within academia and in industry (e.g., business, government, and nonprofit [BGN] sectors) argue that new educational approaches are needed to prepare doctoral students for the jobs and jobs skills that await them.[1] Those in BGN have argued that doctoral students are educated too narrowly and are not prepared to work collaboratively in teams. Those in the academy have argued that doctoral students are not prepared to teach, publish, write grants, or present their work in professional settings. Others assert that while doctoral education is sufficient, there are simply too many doctoral students for the job market that awaits them (Goldman & Massy, 2001). As a result of these criticisms, researchers such as Nerad, Cerny, Golde, and Dore have studied the relationship between doctoral education and Ph.D. career paths. In addition, Nerad and Cerny have studied Ph.D. holders' perceptions of the relevance and value of their doctoral education. It is, after all, the Ph.D. recipients who are in the best position to judge the relevance and value of their doctoral education in relation to their careers and lives.

Certainly that is the logic that informed Nerad and Cerny's national study, Ph.D.s Ten Years Later (Nerad & Cerny, 1999a, 1999b), which in turn inspired Golde and Dore's 2001 survey of doctoral students currently in U.S.

doctoral programs. The interest in and value of these studies subsequently inspired the National Research Council to recommend that student perspectives be included in future doctoral program assessments (Ostriker & Kuh, 2003). Nerad and Cerny (1999a) and Golde and Dore (2001) argue that student and former student (Ph.D. recipient) perspectives need to be included when assessing doctoral education. Whereas Golde and Dore focused their survey on current students who had not yet entered the job market and thus were not certain about their future employment, Nerad and Cerny surveyed former students and asked them about their education in light of their actual careers, thus providing an additional perspective.

Drawing from the Nerad and Cerny survey, this chapter focuses on the results of student responses in two disciplines, English and mathematics, to demonstrate the assessment value of understanding student career paths and student evaluations of doctoral programs in light of their career paths. We chose to focus on these two disciplines because they represent traditional arts and science fields, yet they differ in a number of ways. The job markets in English are different from the job markets in math. Math has a postdoctoral phase that, although not mandatory, does function as part of the career path for a third of the survey respondents and the time to stable employment differs between the two fields. Further, English has a greater representation of women, and the representation of women in a field has been shown to impact the labor market in that field (Reskin & Padavic, 1994).

First, we describe the basic career path in terms of the careers followed according to job titles and level of job satisfaction reported. Second, we summarize Ph.D. recipient evaluations of specific aspects of the curricula and professional development they experienced in their doctoral programs. These evaluations were done at the time of the survey, 10 to 14 years after students received their degrees. Since the retrospective accounts were made in light of the actual career paths Ph.D. recipients pursued, they are a particularly useful lens that faculty and administrators can use to assess their programs.

The Ph.D. Ten Years Later Study

The Ph.D.s Ten Years Later study was a national survey of nearly 6,000 Ph.D.s. It targets doctorates in six disciplines from five major fields of study: life sciences (biochemistry), engineering (computer science, electrical engineering), humanities (English), physical science (mathematics), and social

science (political science). Three consecutive cohorts who received their doctorates from 61 U.S. doctoral-granting universities between July 1982 and June 1985 were surveyed. This group accounted for 57% of the total Ph.D.s awarded in the United States in these six fields during these three years. The response rate reflected 66% for domestic Ph.D.s and 52% for international Ph.D.s. The data generated by this survey are extensive, including information on career goals before starting and after completing the Ph.D., details about all postdoctoral appointments, experiences with initial (non-postdoc) job searches, detailed job history since Ph.D. completion, the importance of different aspects of first and current job, satisfaction with current job, doctoral program evaluation including instruction in teaching, advice and mentoring received from advisors and other faculty members, the usefulness of doctoral education in light of careers pursued, and the subjective value respondents placed on their doctoral education. We have not included a full analysis of all survey items. However, we have included the survey questions addressed in this chapter in Appendix A.

English and Mathematics: Similarities and Differences in the Career Paths

We begin with some general findings for the fields of English and mathematics. Overall, the survey includes 814 respondents in English (a 67% response rate) and 752 in mathematics (a 63% response rate). The gender breakdown within English was 46% men to 54% women, while mathematics was 82% male to 17% female. On average, time to degree was two years longer in English than mathematics with respondents in English reporting 8.3 years compared to 6.3 years for mathematics respondents. Mathematics, unlike English or any of the other four fields of the study, was unique in that its degrees can be relatively cleanly distinguished as either applied or theoretical. Fifty-five percent of the mathematics degrees awarded were for various purely theoretical mathematics fields, whereas 45% of the degrees awarded were for applied mathematics fields. Women respondents completed applied mathematics degrees in higher proportions than the men, 55% as compared with 43%. International Ph.D.s were more likely to enter the professoriate than domestic Ph.D.s. Theoretical mathematicians were more likely to enter the professoriate than applied mathematicians. Men in math were more likely to enter tenure-track academic jobs than were women in math. Analy-

sis of qualitative data (responses to open-ended questions) suggests that more men than women go into the professoriate because of the difficulty for mathematics graduates in finding faculty positions for dual-career couples, and more women with Ph.D.s in math face this dilemma than their male counterparts.

For ease of analysis, the basic career paths for English and mathematics were divided into three general categories: Academic Ladder faculty (tenure-track and tenured faculty), BGN (business, government, or nonprofit job sectors), and Academic Other (administrative or nontenure-track faculty). Figure 4.1 shows that at the time of the survey—which ranges anywhere from 10 to 14 years after degree completion—survey respondents in English and mathematics look fairly similar in terms of academic placement. Ten to fourteen years after receiving their Ph.D.s, roughly 60% of the respondents were working in either tenured or tenure-track positions.

Notable differences between the two fields were in the proportions of respondents in BGN sectors and the Academic Other sector. About 30% of mathematics Ph.D. recipients were employed outside the academy in the BGN job sectors compared to only 19% of English respondents. Considerably more English doctorate holders than their mathematics counterparts were working in the academy not as Academic Ladder faculty (21% for English compared to 10% for mathematics; Nerad & Cerny 1999a).

Placement by Sector and Gender

Figure 4.2 illustrates Ph.D. placement by sector and gender for both fields. In general, the representation of women in Academic Ladder positions was lower in both fields, while their proportional representation was higher in the BGN and Academic Other sectors. Managers and executives in the BGN sector (a component of the BGN sector not illustrated) represented about 5% of all Ph.D.s regardless of field or gender.

Since women's disadvantage in any labor market—especially in a highly skilled professional labor market—accumulates with time (Martell, Lane, & Emrich, 1996; Ridgeway, 1991, 1997), examining the gendered nature of career paths several years after degree completion can be more illustrative than looking at placement at or immediately following degree completion. The data show that 10 to 14 years after degree completion, men were disproportionately likely to achieve tenure in either English or mathematics. In English, higher proportions of women had not yet achieved tenure or were in

FIGURE 4.1
Job sector at time of survey

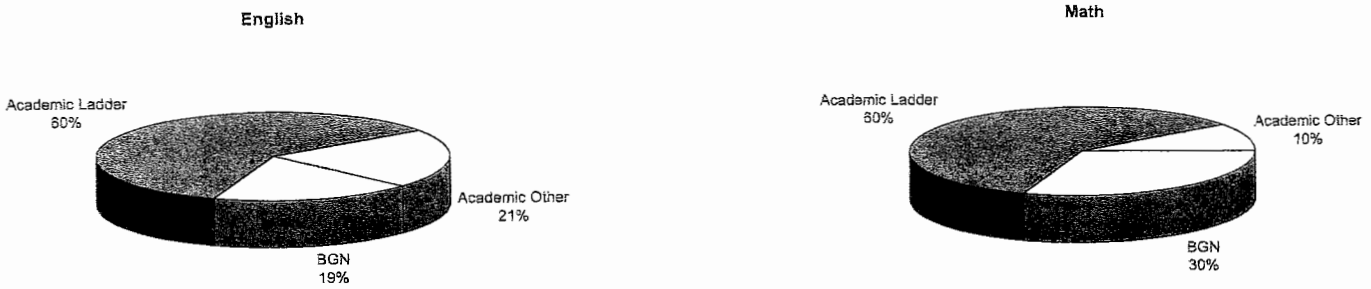
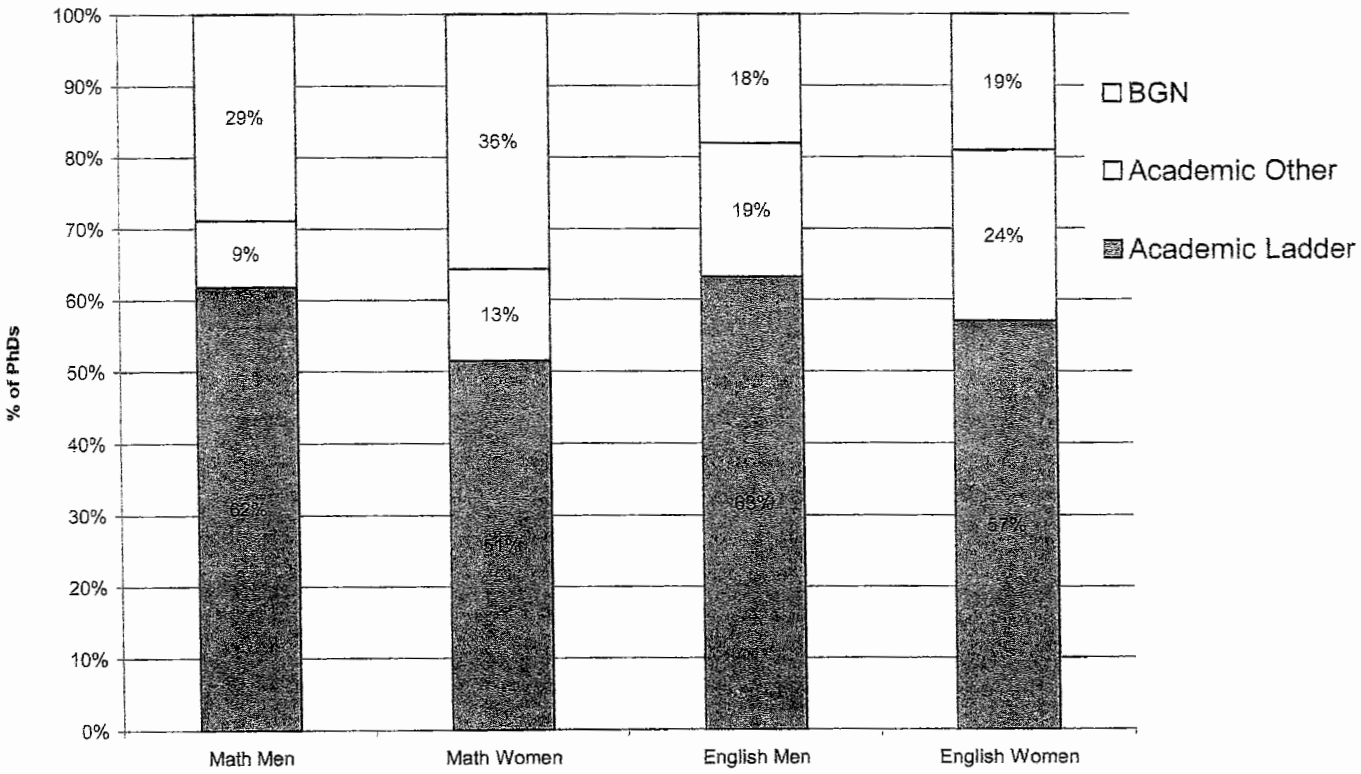


FIGURE 4.2
Job sector by field and gender



Academic Other positions. In mathematics, higher proportions of men (relative to women) were in the tenure-track but not-yet-tenured category. While the overall patterns are more apparent after 10 to 14 years, examining differences in initial placement, such as postdoctoral appointments, may help illustrate the overall disparate pattern of placement by gender 10 to 14 years later.

There is a relatively high representation of women mathematics graduates in the BGN sector (over one-third). This pattern is related to the unique role that a postdoctoral appointment plays in the career paths of mathematics graduates. Mathematics, unlike English, was more likely to have a postdoctoral appointment phase of the education process (31% and 8%, respectively). A postdoctoral fellowship provides an opportunity to gain additional knowledge and expertise in an area of research that differs in some way from the doctoral research. In can also be a means of developing one's research agenda beyond the dissertation. In general, more postdocs are available in the STEM (science, technology, engineering, and mathematics) fields than in the humanities or in the social sciences. These postdocs allow Ph.D. recipients to engage in cutting-edge research early in their careers and learn to teach independently. For example, the National Science Foundation awards prestigious postdoctoral fellowships for research as well as for teaching in math institutes and departments.[2] In general, completing a postdoctoral appointment was strongly associated with an academic career path: 15% of those graduates with a postdoc went on to hold a tenured faculty position at one of the top quartile research programs in 1995 versus 5% of graduates who did not spend any time in a postdoctoral position.

An important gender difference emerged with postdoctoral positions in mathematics based on the kind of postdoctoral appointment accepted. In general, postdoctoral appointments fall into two categories: portable or faculty-specific, with the former being far more prestigious and more highly associated with a faculty career path. Our analysis reveals that there were two predictors for having the less prestigious faculty-specific postdoc:

1. The age of the recipient at time of degree completion: Portable postdocs tended to be represented by younger Ph.D. holders.
2. The gender and marital status of the recipient: Married women who had a postdoc were far more likely to have a faculty-specific postdoc.

Women married at the time of receiving their degree took faculty-specific postdocs in proportions that far exceeded the proportion of married women

in the population. The challenge that many women Ph.D. recipients faced in both fields, but particularly in mathematics, was the "two-body" problem. First, women in mathematics were more likely than their male peers to be married at degree completion, and those women were far more likely to be married to a man with a Ph.D. or a man working toward one. For married couples both in the job market, one possible way to manage the two-body problem is for institutions to bring more women into this faculty-specific postdoc. For women married to men completing their Ph.D. or also doing a postdoc at the same institution, the postdoc for women proved to be a common holding-pattern strategy. One respondent explained that she took the postdoc while waiting for her husband to complete his degree. We think this is not at all atypical. Because these faculty-specific postdocs are less prestigious, women may have a lesser chance of being hired into a faculty position. Moreover, women concentrated in applied mathematics, which is a subfield with fewer faculty positions. Whatever combination of factors was at play, many women left the academy following the postdoc.

In English the closest parallel to the faculty-specific postdoctoral appointment is the nontenure-track teaching position in which women are still disproportionately represented. According to our analysis, we found that in English women are still disproportionately represented in nontenure-track positions. In any given year, the odds that a woman will be in a nontenure-track teaching position will be two to three times greater than the odds for a man. Although a poor job market for English tenure-track jobs fueled the nontenure career path, many women with Ph.D.s in English reported taking these nontenured positions as a means not only to mediate a poor job market, but also to remain in the same location as their spouse.

Using Career Outcomes in Assessing Doctoral Programs

We want to highlight the assessment value of understanding the career path according to empirical rather than anecdotal data. The Ph.D. is a research degree that for many people is primarily needed for research careers and for producing the next generation of academic researchers (i.e., ladder faculty at most higher education institutions except two-year colleges). However, in light of the data from the Ph.D.s Ten Years Later survey, we know that the majority of Ph.D. recipients (more than 80%) did go on to careers in which their primary activities would likely include teaching, management, and in-

dustry- or government-based research. We argue that doctoral programs should track the career paths of their graduates—to understand the various kinds of jobs that Ph.D. recipients actually do obtain.

Figure 4.3 shows that of the survey respondents who were tenured at the time of the survey, about 15% of the Ph.D.s in mathematics and just under 10% of the Ph.D.s in English were tenured at Research 1 institutions. The majority were teaching in other doctoral, comprehensive, and liberal arts institutions. In both fields, fewer than 55% of respondents had tenure 10 to 13 years after completing their degree, in any type of academic institution. However, as Nerad, Aanerud, and Cerny (2004) make clear, controlling for the career goal of becoming a professor greatly increases the overall odds of getting tenure in English (60% of those who wanted to become a professor were tenured at the time of the survey), and 64% were tenured in mathematics.

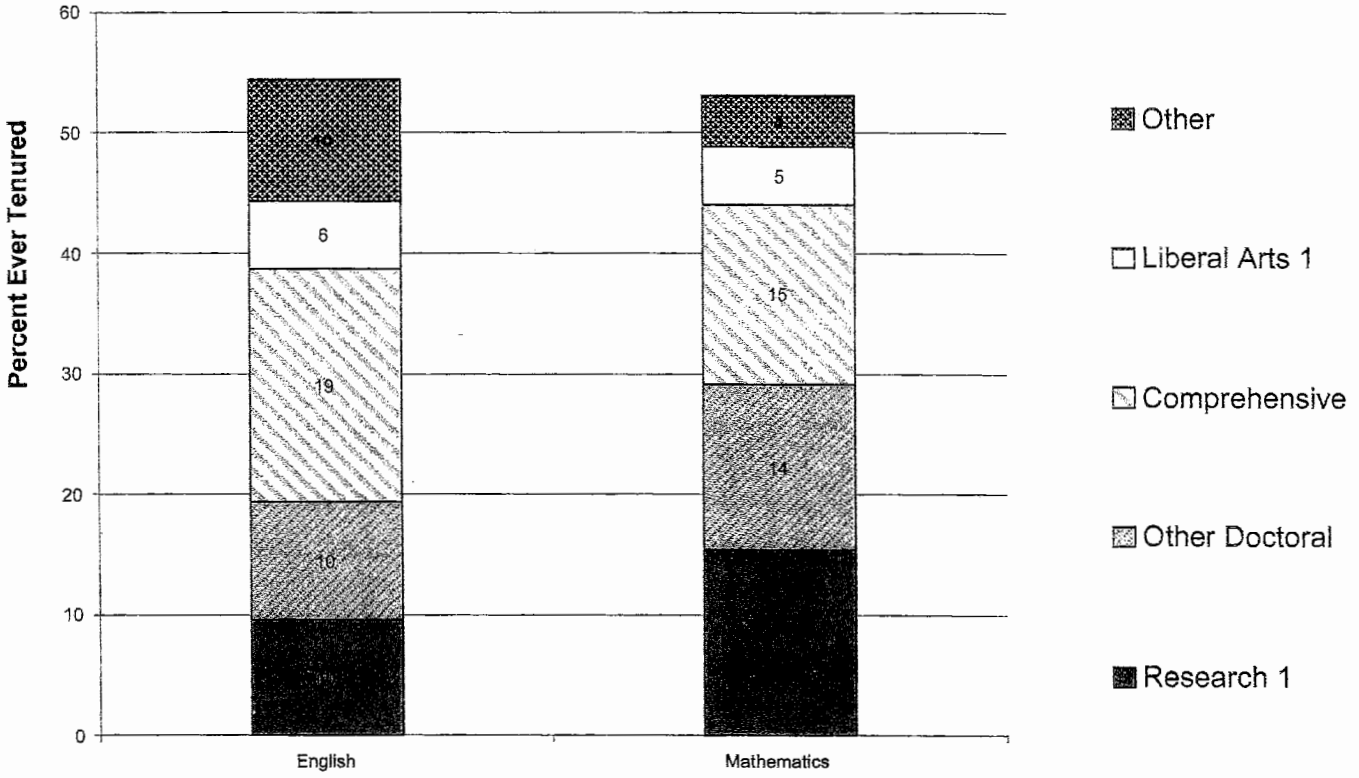
By implication, not only did Ph.D.s take a variety of jobs outside the Academic Ladder route, but many of them knew when they completed their degree that it was not their intent to become a professor. Therefore, doctoral program evaluation should control for student career goals when assessing career outcomes. However, attempting to control for goals while students are still enrolled may prove unreliable since many people in the survey commented that it was not acceptable to express interest in any career other than becoming a professor while they were in their program. After all, most Ph.D. recipients in our study received their degree at a Research 1 university. They and their faculty often assume that this kind of institution is where they find employment.

At the heart of our discussion is this basic question: Should the ideal outcome of a doctoral education be placement in a ladder faculty position at a Research 1 university? Analysis of the data from the Ph.D.s Ten Years Later survey leads us to a resounding *no*. It is clear that doctoral education serves both individuals and society in many ways, some far removed from the traditional academic path. Given the evidence that the Ph.D. is a passport to multiple career destinations, we suggest that doctoral education assessment include an understanding of career paths, *how students feel about the jobs they actually take*, what they say about the *preparation* they experienced during the course of their doctoral education, and what they say about the *personal value* of the doctoral education.

Understanding the career paths of Ph.D. recipients through a study such as the Ph.D.s Ten Years Later provides important information for assessment

FIGURE 4.3

Percent ever tenured by Ph.D. field and Carnegie classification of placement



because it interrupts the anecdotal information that exists about doctoral programs. While it is certainly true that most Ph.D. recipients will not go on to tenure-track jobs at Research 1 universities, it is also not the case that they go into jobs where they are largely dissatisfied. To evaluate this claim, we looked at the Ph.D.s' job satisfaction ratings.

Ph.D. Recipients' Job Satisfaction

Respondents evaluated their satisfaction with 23 different aspects of their jobs, as well as assigning an overall satisfaction rating. The 23 individual items were factor analyzed, resulting in six dimensions of job satisfaction. These six dimensions and examples of each are illustrated in Table 4.1.

Figures 4.4 (English) and 4.5 (mathematics) compare the six job satisfaction dimensions plus the overall job satisfaction rating for those employed in the academic and BGN sectors. Because there is reason to expect job satisfaction to differ for groups that vary by occupational or organizational status (Brown, Gardner, Oswald, & Qian, 2005; Oshagbemi, 2003, 1999; Singh, 1994), job satisfaction was analyzed using four job sector categories:

1. Academic Ladder
2. Academic Other
3. BGN Manager/Executive
4. BGN Other

(To simplify our findings, job satisfaction is illustrated and discussed comparing all academic to all BGN in Figures 4.4 and 4.5; differences within these sectors are only discussed when statistically significant.)

Job satisfaction analysis revealed the following pattern: just under 25% of the Ph.D.s in the academic sector of both fields and about 33% in the BGN sector for both fields reported being "very satisfied" overall with their jobs. In both fields, Ph.D.s in the academic sector tended to be more highly satisfied with the "intrinsic rewards" of the job. This dimension of job satisfaction included use of doctoral education, content and autonomy of work, and satisfaction with opportunities to do research. Item-specific analyses indicated that Ph.D.s in the Academic Ladder and Academic Other sectors in both mathematics and English were more satisfied with the use of their doctoral education than were their counterparts in the BGN Other and BGN Manager and Executive sectors. Interestingly, in both fields the groups did

TABLE 4.1.
Dimensions of Job Satisfaction and Sample Items

Intrinsic Rewards
- Use of doctoral education
- Content of work
- Autonomy of work
- Opportunity to do research
- Opportunity to teach

Work Place Resources
- Equipment, lab space, or other physical resources
- Work environment

Tolerance
- Supportive environment for women
- Supportive environment for people of color

Quality of Life
- Level of stress at work
- Time for leisure, family, and my own interests

Compensation and Benefits
- Health and retirement benefits
- Salary level

Family/Geography
- Job opportunities for my spouse/partner in the area
- Geographic location
- Good location for raising children

Overall
- Overall level of satisfaction

not differ in their satisfaction with autonomy or content of work, nor with their opportunities to do research.

Ph.D.s working in the BGN sector in mathematics and English were more satisfied with the level of access to adequate workplace resources. Not surprisingly, English Ph.D.s in Academic Ladder and executive BGN positions were more satisfied with compensation and benefits than English Ph.D.s employed in the Academic Other positions or nonexecutive BGN sectors. Somewhat surprisingly, mathematics Ph.D.s did not differ across

FIGURE 4.4
Job satisfaction of English Ph.D.s by job sector

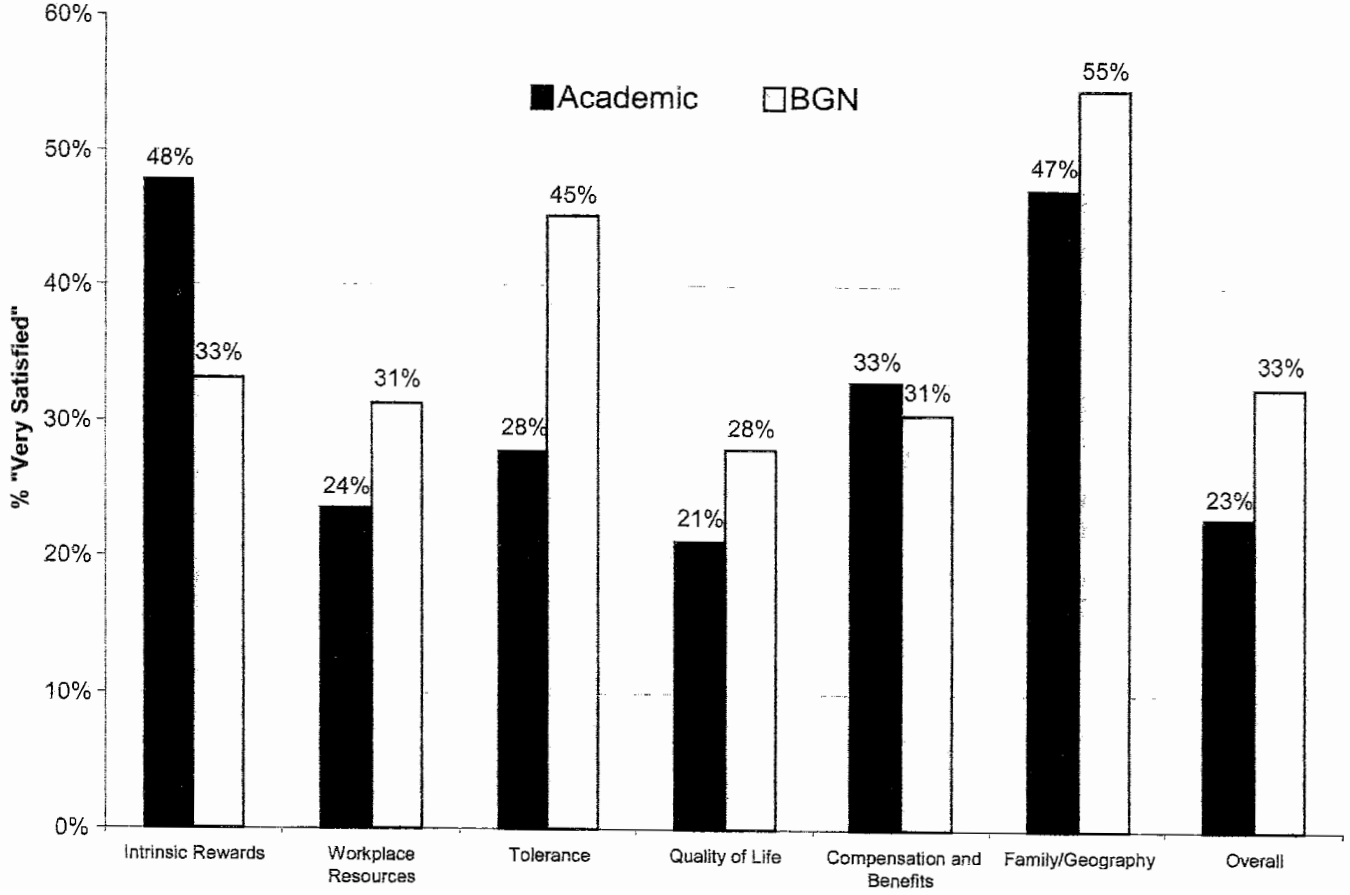
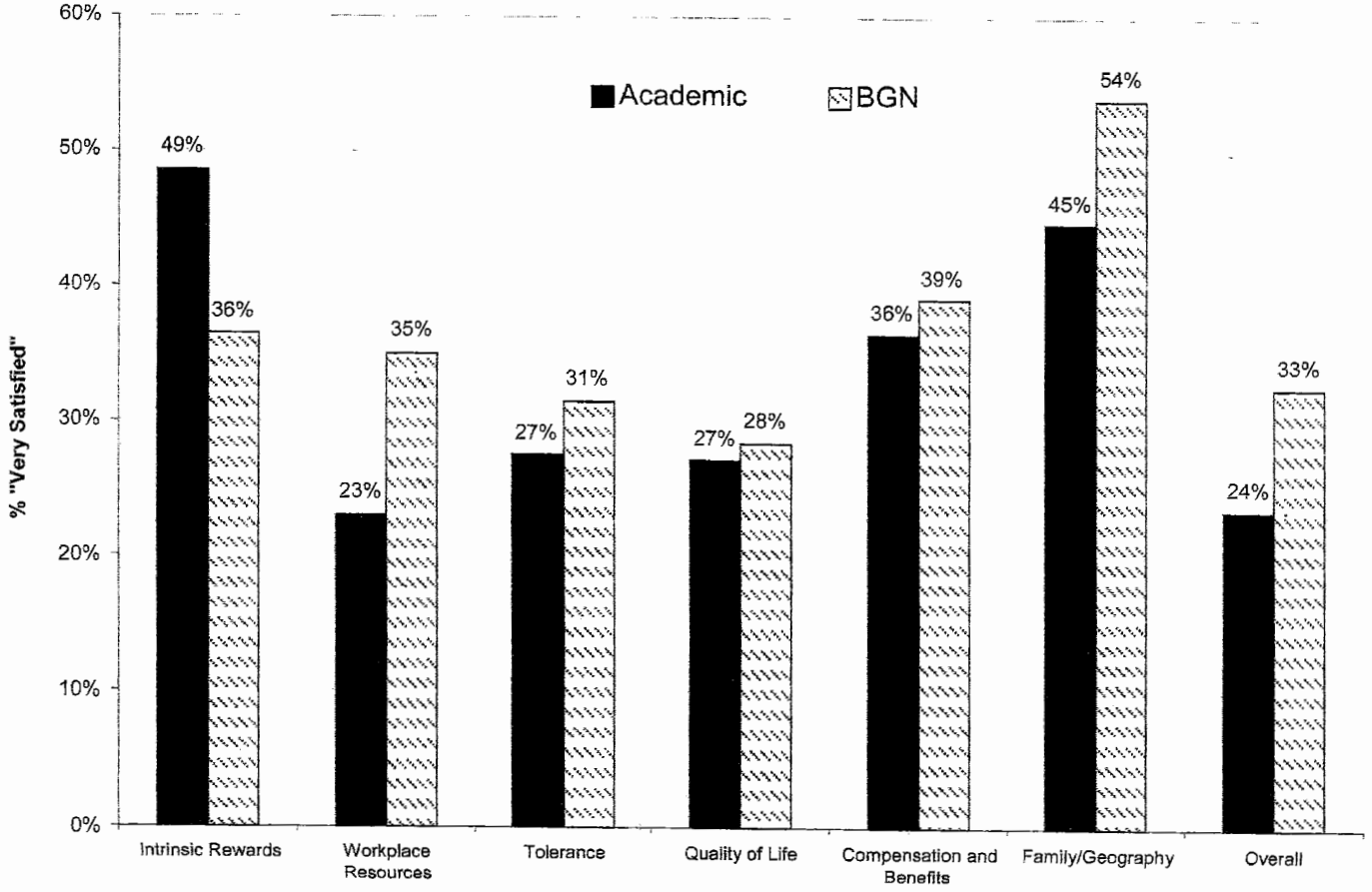


FIGURE 4.5
Job satisfaction of math Ph.D.s by job sector



these job categories, or four sectors, in satisfaction with compensation and benefits. In fact, except for the two dimensions already mentioned (intrinsic rewards where Academic Ladder faculty were more satisfied, and workplace resources where those working in BGN were more satisfied), mathematics Ph.D.s did not differ statistically in satisfaction levels across all other dimensions and sectors.

English Ph.D. recipients working in the BGN sector were more satisfied with having a work environment that supports women and people of color and with the family/geography aspect of their jobs than their counterparts in the academic sector.

The overall patterns of difference in job satisfaction are similar in mathematics and English. In English, the more extreme differences and the somewhat larger sample size may both contribute to more statistically significant findings. While it is true that Ph.D. recipients in Academic Ladder positions reported greater satisfaction with their jobs in terms of how well the jobs made use of their education, when we looked more broadly at the job satisfaction of English and mathematics Ph.D. recipients across several dimensions and included those who were "fairly satisfied" as well as those who were "very satisfied," people with Ph.D.s, regardless of job sector, reported high levels of satisfaction with their jobs. From the standpoint of the Ph.D. recipients, most felt that they had fulfilling work that met many of their personal needs for family support, compensation, and intellectual stimulation, even though most did not find placement in Research 1 institutions, and many did not pursue academic careers at all.

Career path analysis that includes job satisfaction data makes an important contribution to the assessment activities of doctoral programs primarily in terms of mentoring and career development. Mentoring helps with completing the degree as well as preparing for a career. By understanding the overall level of job satisfaction enjoyed by Ph.D. holders, as well as the variations between and within different job sectors, doctoral programs are in a stronger position to mentor and advise students accordingly. For example, as one component of helping students work through various career options, graduate schools and faculty advisors might want to consider asking students to reflect on what dimensions of job satisfaction they expect to be most important to them, such as flexibility of work schedule, autonomy of work, workplace resources, prestige of the organization, time for leisure, compensa-

tion and benefits, career growth prospects, geographic location, job opportunities for the spouse, and so on.

Recommendations Based on Job Satisfaction

Because Ph.D. recipients do, in fact, enter careers in a range of job sectors, doctoral programs should be able to help their students determine the best career options for themselves and not limit career development and mentoring activities simply to preparation for Research 1 institutions. We argue that assessment of doctoral programs should include focusing on the programs' ability to help students make the transition to a post-Ph.D. career in a range of fields. Job satisfaction information based on empirical data, rather than assumptions (for example, the assumption that faculty jobs offer the most flexibility for raising families), provides another helpful tool for this transition. Next, we investigate students' perception of their doctoral programs in terms of the professional socialization they received and the skills they acquired in light of their current job.

Preparation for Careers: Professional Socialization

Faculty interaction with doctoral students is likely the most important aspect of the professional socialization that occurs in any doctoral program (Austin, 2002; Tierney, 1997; Weidman, Twale, & Stein, 2001). Socialization happens through transmitting both attitudes and professional skills. Students' perspectives on the socialization they experienced and the skills they acquired in their doctoral program *in light of their subsequent career paths* is valuable because it helps answer the question of whether the doctoral program prepared them for their jobs.

Despite the evidence that many Ph.D.s obtained employment outside the academy, survey respondents reported that faculty who expressed an opinion about career options tended to encourage academic careers. Table 4.2 summarizes students' perceptions of the career guidance and encouragement offered by the faculty in their respective graduate programs. Mathematicians were more likely to experience encouragement to pursue both academic and nonacademic careers (27%).

In both the English and mathematics fields, 19% of Ph.D. recipients said faculty did not have specific ideas about which career options graduate students should choose. Although this may be interpreted as merely a neutral stance, given that respondents could have selected the second option (faculty

TABLE 4.2.
Perceptions of Faculty Expectations with Regard to Students' Post-Ph.D. Careers

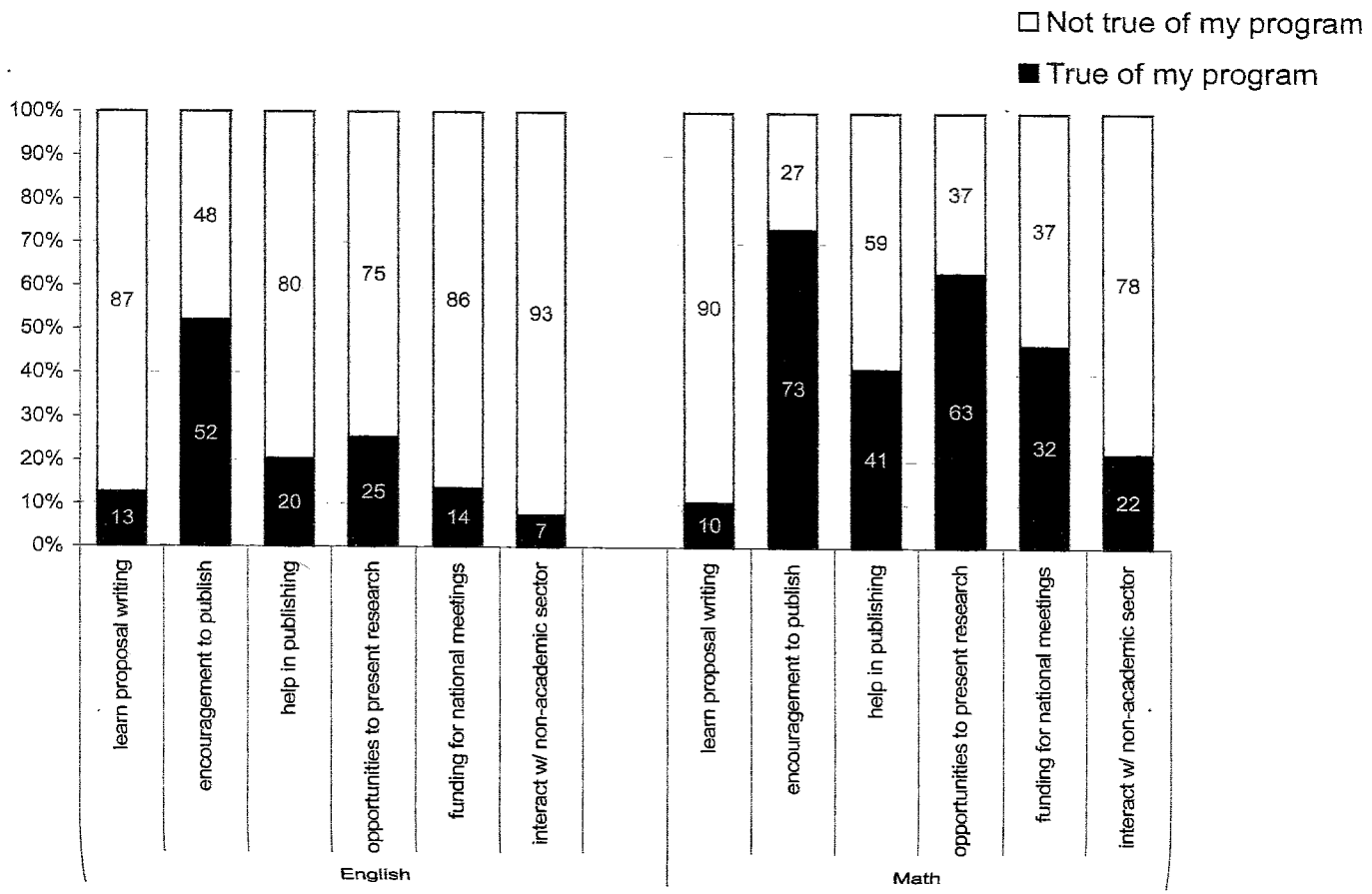
Faculty Expectations	*English*	*Mathematics*
Faculty mainly encouraged graduate students to pursue academic professions or jobs	73%	54%
Faculty encouraged both academic and nonacademic professions or jobs	8%	27%
Faculty mainly encouraged nonacademic professions or jobs	–	–
Faculty did not seem to have specific ideas about which professional options graduate students should choose	19%	19%

encouraged *both* academic and nonacademic professions), this seemed a likely indication of students' perceiving faculty as not being invested in students' careers.

Survey respondents were also asked to look back on six aspects of faculty mentoring (learning proposal writing, encouragement to publish, help in publishing, opportunities to present research, funding for national meetings, and interaction with nonacademic sectors) and to evaluate each statement according to whether each aspect of mentoring was "basically true" of their program or not. Figure 4.6 provides a summary illustration of English and mathematics Ph.D.s' perception of faculty mentoring. In both fields, the only aspect that these former students recalled being more true of their program than not was faculty encouragement to publish, while mathematics also included opportunities to present research. A great majority of English Ph.D.s (at least 75%) reported that they did not experience faculty mentoring in the following areas:

- learning how to write proposals
- getting assistance with publishing
- identifying opportunities to present research
- identifying sources of funding for national meetings
- identifying opportunities to interact with individuals from the nonacademic sector

FIGURE 4.6
Mentoring received from faculty, by field



Similarly, a majority of mathematics Ph.D. recipients (59%) said they did not experience faculty mentoring in learning to how to write proposals, learning about publishing, obtaining funding for attending national meetings, and identifying opportunities to interact with individuals from the nonacademic sector.

Faculty assistance with publishing (e.g., *assisting* with the mechanics, etc., not to be confused with encouragement to publish) has been shown to predict future productivity in a faculty career path (Spalter-Roth, Kennelly, & Erskine, 2004). The data (only 20% of English Ph.D.s and 41% of mathematics Ph.D.s reported receiving help from faculty in publishing) are relevant for assessing how well various programs mentor their students in research skills critical for success in research positions, especially when compared with the greater proportions of Ph.D.s who reported being encouraged to pursue academic careers. Indeed, department chairs, graduate school administrators, and students who wish to pursue careers in research and publishing may be very interested in what previous students have said about the mentoring they received within a program, or even how it compared to national averages, as a method of assessing faculty socialization in this area specifically.

Multivariate regression analyses of faculty mentoring further indicates that Ph.D. recipients in English and mathematics as a group were less favorable about faculty mentoring they received than the comparison group of all other survey respondents (Ph.D. recipients in all of the other four fields surveyed), while Academic Ladder faculty in mathematics and English were generally more favorable across all the dimensions. These results indicate a rift between the retrospective perceptions of mentoring for Ph.D. recipients in mathematics and English in Academic Ladder positions and their counterparts in mathematics and English who were working in other sectors. Indeed, these results suggest that at some point during their doctoral program, students may have experienced disparate treatment with regard to faculty mentoring. Perhaps students that faculty deemed most worthy of investment received more/better mentoring in research skills. Since these results are retrospective, it may also be the case that students who ended up in the Academic Ladder track remembered their mentoring more favorably. Although this could be a valid alternative hypothesis, we do not currently have the data to test the relative validity of the competing hypotheses—the question of validity of retrospective analyses is an area for further inquiry. Based on the

mentoring survey data we conclude that although academic careers were encouraged during their time as students, most respondents were not getting the research and publication mentoring critical for their success within academic (research) careers.

Preparation for Careers: Skills Development

Stereotypical ideas about the types of jobs Ph.D. recipients hold (Academic Ladder positions, for example) may not emphasize other skill dimensions, including broad interdisciplinary research skills or interpersonal skills such as collaboration, teamwork, and managerial techniques. Figure 4.7 illustrates the Ph.D. recipients' evaluation of the importance of these skills for doctoral education. A majority of Ph.D. recipients (employed in business, nonprofit, government, *and academic* sectors) said each of these skills was an important aspect of doctoral education, with one exception. In mathematics, only 48% of the respondents rated managerial skills as being either "very important" or "important," while another 34% of the mathematics Ph.D.s acknowledged management skills were "somewhat important" for doctoral education. For mathematics Ph.D. recipients, collaboration was most frequently seen as important (72% said it was "very important" or "important"). English Ph.D.s were most likely to say the ability to conduct interdisciplinary research was either "very important" or "important" (75%). Overall, interdisciplinary research skills, teamwork, collaboration, and managerial skills generally were seen by Ph.D. recipients as being important for doctoral education.

Survey respondents were also asked whether or not their own doctoral program included experience in or exposure to each of these four skill areas (interdisciplinary research, teamwork, collaboration, and managerial) and whether their current job involved using each of these four skills. Figure 4.8 illustrates the skills match between what the doctoral education included and what the jobs required for mathematics and English Ph.D. recipients.

A sizable proportion of English (40%) and mathematics (38%) Ph.D.s said their doctoral education did not include working in teams and neither did their current jobs. However, comparable and slightly larger proportions said working in teams was not an aspect of their doctoral education, and yet they did work in teams in their jobs (English 43%, mathematics 41%). Interdisciplinary research skills, the category rated most important by English Ph.D. recipients for doctoral education, was also the category most used by English Ph.D.s in their current jobs. Analogously, mathematicians

FIGURE 4.7

Importance of interdisciplinary research and interpersonal skills for doctoral education

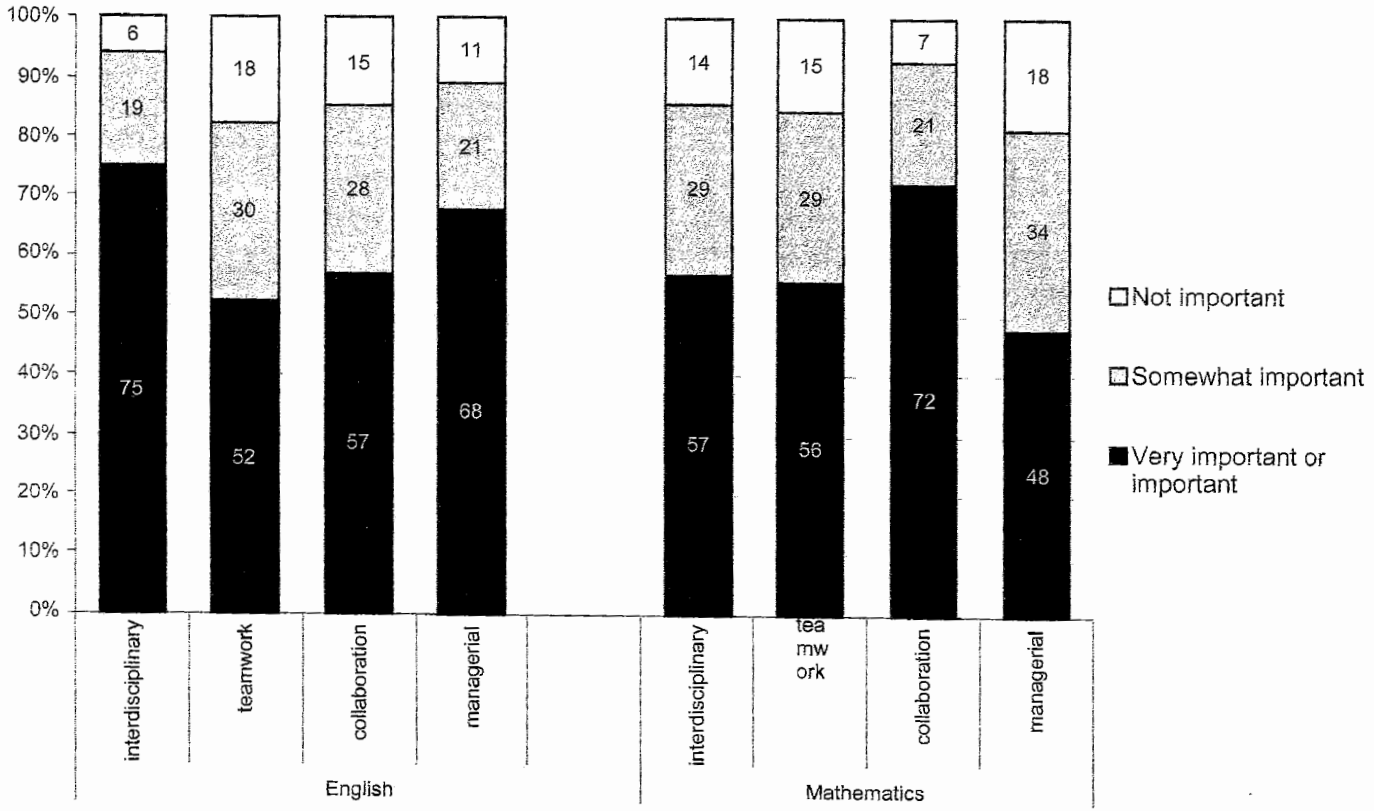
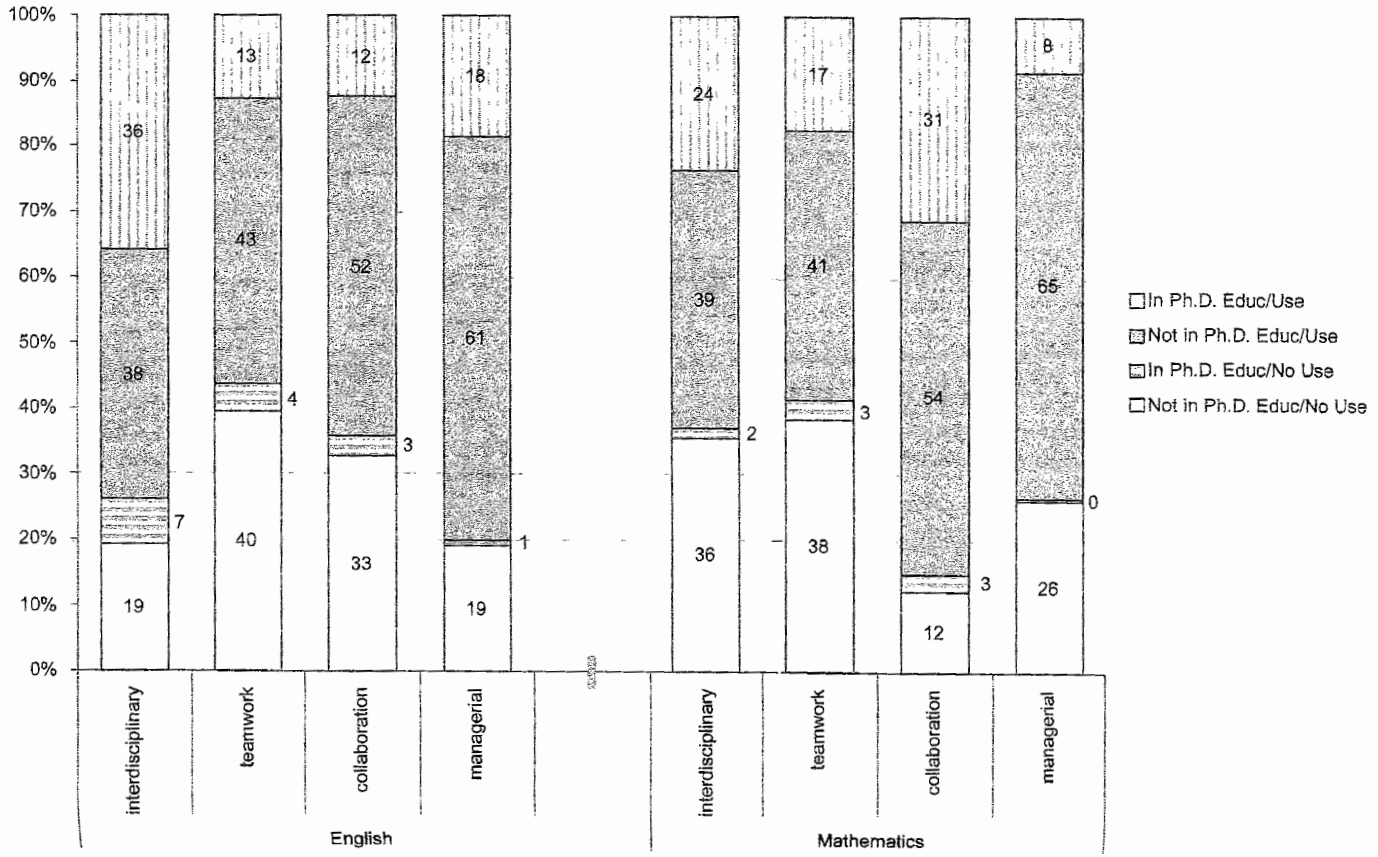


FIGURE 4.8

Match between skills gained in doctoral education and used in current job



were most likely to say collaboration was included in their doctoral education and was also the skill area that 85% of them reported using in their current jobs. Fifty-four percent said their doctoral education did not expose them to this skill, while a smaller 31% said their doctoral education did involve this skill.

Figure 4.9 illustrates the relationship between the skills gained in doctoral education and the current job within each employment sector (Academic Ladder, Academic Other, and BGN). For both English and mathematics, those working in the BGN sector were more likely to say the fit between the doctoral education and their current job was more loosely tied than in either of the academic sectors, with English Ph.D. recipients working in BGN reporting the "loosest" fit.

The information on the match between skills developed and those used on the job sheds further light on the question of whether doctoral education prepares students for the jobs they take, and the answer is an equivocal yes and no. Much of the time, the skills students developed while getting a Ph.D. were useful in later careers across a variety of settings, and yet there were skills even those in the Academic Ladder positions say they needed and didn't get in their education. While these data fail to give a single clear answer either critical or supportive of doctoral education generally, they are illustrative of the kinds of information that universities and departments may find useful in assessing doctoral programs. For example, a particular university or department may choose to amend its doctoral program if it finds that its students move into jobs that require a great deal of teamwork or collaboration or if it finds that former students report that they frequently use managerial skills in their jobs.

So far, we have examined the value of the doctoral education *in light of the jobs* the Ph.D. recipients acquired, and we have argued that this perspective is an important aspect of doctoral program assessment. However, many involved in education understand philosophically and intuitively that there is a value to education beyond the instrumental use of education (Strober, 2005). So, it also makes sense to include a less instrumental and more personal measure in doctoral program assessment methods.

Personal Value of the Doctoral Degree

When respondents were asked, "Was completing your Ph.D. worth it?" on average, over 90% said that it was (see Figure 4.10), although at 89%, English

FIGURE 4.9

How related is your current job to your doctoral education?

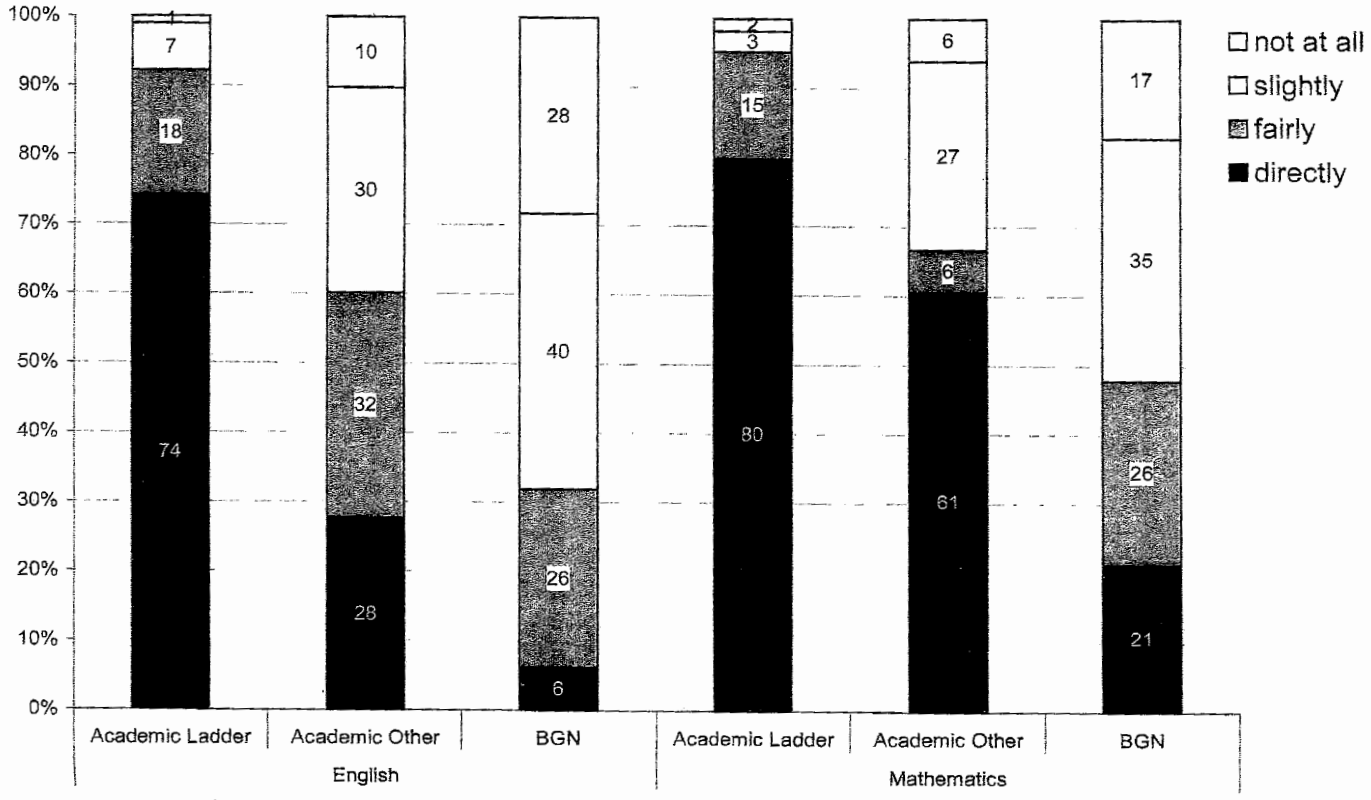
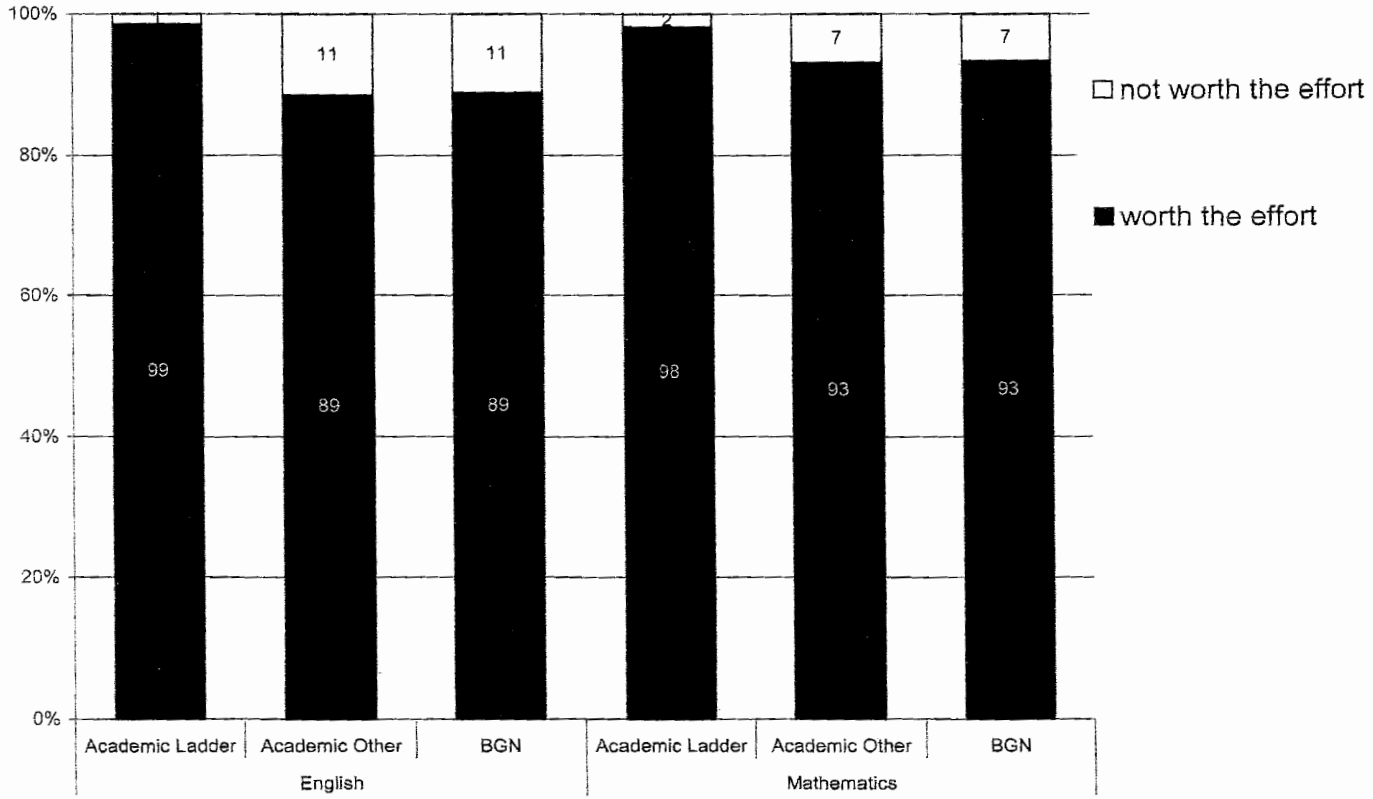


FIGURE 4.10
Was completing your Ph.D. worth it?



Ph.D.s in the Academic Other and BGN sectors were slightly less favorable than their mathematics counterparts, 93% of whom said completing the Ph.D. was worth it.

Despite the evidence that many students reported feeling underprepared for the kinds of jobs they actually took, overall they still reported being satisfied with many aspects of their jobs and that completing the Ph.D. was personally valuable to them.

Conclusions and Recommendations

Critics of doctoral education have varied and sometimes competing opinions about what changes are most needed in doctoral education, but until recently, no one invited the population that either is currently or was recently in doctoral education to join the conversation. Golde and Dore (2001) and Nerad and Cerny (1999a, 1999b) have remedied this oversight through their surveys of students and former students, adding a valuable perspective to the debates about doctoral education assessment and reforms. In particular, Ph.D.s Ten Years Later helps graduate faculty, researchers, and policy makers to understand Ph.D. recipients' reflections on the value and usefulness of their doctoral education *in light of* the careers the Ph.D.s have pursued, adding a unique perspective to doctoral education assessment.

Ten to fourteen years after receiving their Ph.D.s, roughly 60% of the respondents were working in either tenured or tenure-track positions, and a much smaller proportion (10% to 15%) were at Research 1 institutions. While some may quote these statistics in support of the argument that too many Ph.D.s are produced, most of the Ph.D. recipients themselves are satisfied with the jobs they have regardless of working in the academic or BGN sectors, and an even larger proportion say that knowing what they know 10 to 14 years after getting the degree, they would still pursue a Ph.D. if they had it to do over.

Factoring in the Ph.D. recipients' perspective suggests that rather than reducing the number of Ph.D.s produced, doctoral programs may want to focus on the kinds of skills developed during doctoral education and career guidance given to doctoral students. Overall, career path analyses indicate doctoral education should be modified to prepare students for a broad range of careers. Further, adding the Ph.D. recipients' perspective strongly suggests that even doctoral programs that choose to stay focused on preparing doc-

toral students for academic careers should consider what that preparation looks like in terms of mentoring, skills development, and career guidance.

Doctoral programs should broaden their socialization practices to introduce students to viable and valuable careers outside academia, regardless of students' initial career intentions. Socialization in doctoral programs should also include developing specific skills, such as working collaboratively or in teams, conducting interdisciplinary research, and managing people and projects.

Today, doctoral education is undergoing a number of changes, including a shift in the demographic makeup of doctoral students and the broadening career paths of Ph.D. recipients. In response to these changes the activity of doctoral program assessment must itself become more detailed and more comprehensive. Studies such as Ph.D.s Ten Years Later point the way to a more complex and nuanced approach to assessment by providing a national scope that eschews anecdotal "data" and by listening to the very people most affected by doctoral education—Ph.D. recipients themselves.

Notes

1. For an overview of criticism of U.S. doctoral education, see Nerad (2004). See also Committee on Science, Engineering, and Public Policy (1995); Nyquist, Woodford, & Rogers (2004); and Pruitt-Logan & Gaff (2004).

2. These findings are consistent with previous studies on career paths of Ph.D. recipients (see National Academy of Sciences, 1971; Ahern & Scott, 1981).

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Appendix A

Questions from Survey Instrument Ph.D.s Ten Years Later

How satisfied are you with the following aspects of your current job at this time?

Please circle one answer for each item. If you are not currently employed please skip to question 12 at the top of page 10.

	Very Satisfied	*Fairly Satisfied*	*Not Too Satisfied*	*Not Satisfied*	*Not Applicable*
Salary level					
Career growth prospects					
Geographic location					
Use of my doctoral education					
Content of work					
Autonomy of work					

Job security					
Prestige of organization					
Staff support					
Equipment, lab space, or other physical resources					
Opportunity to do research					
Opportunity to teach					
Administrative responsibilities					
Level of intellectual stimulation from colleagues					
Work environment					
Supportive environment for people of color or differing nationalities					
Supportive environment for women					
Job opportunities for my spouse or partner in the area					
Location for raising children					
Flexible work situation (flex time, telecommuting, etc.)					
Health and retirement benefits					
Level of stress at work					
Time for leisure, family, and my own interests					

Did your doctoral experience involve the following? *Circle one answer for each item.*

	Yes	*No*
Working in a team (other graduate students, postdocs, etc.) in addition to your major advisor	1	2

Collaborating with another person	1	2
Undertaking interdisciplinary research	1	2
Learning organizational or managerial skills	1	2

Was your doctoral experience with the following positive or negative?

	Positive	*Negative*	*Not Applicable*
Working in teams	1	2	3
Collaborating	1	2	3

Does your *current* job involve the following?

	Yes	*No*
Working in a team of three or more	1	2
Collaborating with another person	1	2
Undertaking interdisciplinary work	1	2
Organizational or managerial skills	1	2

How important do you think the following skills are to doctoral research/education in preparing people for future jobs?

	Very Important	*Important*	*Somewhat Important*	*Not Important*
Working in a team	1	2	3	4
Collaborating with another person	1	2	3	4
Undertaking interdisciplinary research/study	1	2	3	4
Learning organizational or managerial skills	1	2	3	4

Please evaluate you Ph.D. program in terms of the following:

	Excellent	*Good*	*Fair*	*Poor*
The overall advice and guidance your department gave you regarding your studies				
The curriculum of the Ph.D. program				
The quality of the graduate-level teaching by faculty in your department				
The quality of your research experience				
The financial support you got from your department or university				
The quality of training for teaching assistants (doesn't apply, I wasn't a teaching assistant)				
The quality of training in research methodology				
The quality of advice received from your faculty dissertation advisor(s) in developing your dissertation topic				
The quality of the guidance provided by your faculty dissertation advisor(s) to help you complete your Ph.D.				
Advice and assistance from your major advisor and/or department during your job search as you finished your Ph.D.				

Below are statements some doctoral students have made about their experiences. Please indicate basically true or basically false for each statement as it relates to your experience during your doctoral education, unless it does not apply.

	Basically True	*Basically False*	*Does Not Apply to Me*
During this period faculty provided me with opportunities to learn about proposal writing for support of research activities	1	2	3
Faculty generally encouraged me to try to publish my work	1	2	3

I got quite a bit of help from faculty in publishing my work	1	2	3
My department/faculty/graduate school provided funding to attend national professional meetings	1	2	3
During my doctoral education, my department provided opportunities for me to interact with people from the nonacademic sector	1	2	3

From the Ph.D.s Ten Years Later study by M. Nerad and J. Cerny, 1996. Available at the Center for Innovation and Research in Graduate Education, http://depts.washington.edu/coe/cirge/. Adapted with permission of the authors.