The Survey of Doctoral Education and Career Preparation

The Importance of Disciplinary Contexts

Chris M. Golde, Timothy M. Dore

The 1990s brought considerable attention to doctoral education. As summarized elsewhere in this volume, a number of reports and studies emerged during that period. Notable among them were In Pursuit of the Ph.D. (Bowen & Rudenstine, 1992), the so-called COSEPUP report (Committee on Science, Engineering, and Public Policy, 1995), and reports on doctoral education from the Association of American Universities (1998) and the National Science Board (1997). This flurry of attention, we believe, was largely spurred by changes in the academic job market. There were not only fewer tenure-track faculty jobs available than in the past but the promised wave of hiring failed to materialize. At the risk of oversimplifying, we believe that this relatively high level of attention signals a time of sustained distress and change in the doctoral education system. (Compared with other sectors of the American educational system, doctoral study attracts little attention. In the past, there have been similar flurries of attention at other periods of stress and change, including the early 1970s and the post–World War II period.)
Background and Purpose

Notably absent from the reports of the 1990s and the conferences they generated, however, was information about the actual experiences of doctoral students. We sought to remedy this gap by collecting data on the experiences of students in their programs. The Survey of Doctoral Education and Career Preparation was conducted in the summer and fall of 1999, premised on the assumption that students’ experiences reveal how the system is functioning—what is working and what is not. A summary report, At Cross Purposes: What the Experiences of Doctoral Students Reveal About Doctoral Education, was released in January 2001 (Golde & Dore, 2001).

Rather than repeat information that is already provided in the report, this chapter delves more deeply into the questions of how well doctoral students are being prepared for faculty careers. Although students in eleven arts and sciences disciplines were surveyed, here we focus on the experiences of students in two fields that differ in interesting ways—English and chemistry. Disciplines have different cultures that influence the work faculty members do and how future faculty members are prepared. Thus, explorations of doctoral preparation must take into account and build on the particularities of the various disciplines. We selected English and chemistry because both had large pools of respondents in our data and both are core liberal arts disciplines that are found on all college campuses. They also differ, as we will describe later, in the strategies they use for undertaking doctoral education. These strategies largely reflect differences in the nature of knowledge and how knowledge is produced in each discipline. Chemistry is a team-oriented, laboratory-based science in which knowledge advances incrementally through experiment. English, by contrast, is a relatively solitary scholarly pursuit that relies on writing, reading, and interpretation to illuminate the human condition. By focusing on two disciplines with differing cultures and approaches to knowledge, we emphasize that the nature of the discipline must be considered in analyzing, understanding, and seeking to improve doctoral education.

Methods

Several research questions motivated the project, and two are particularly relevant here:

- Why are doctoral students pursuing the Ph.D.?
- How effective are doctoral programs at preparing students for the careers they pursue, especially faculty careers?

We created a twenty-page survey that we sent to doctoral students at twenty-seven universities and to participants in the Compact for Faculty Diversity. We surveyed students in eleven arts and sciences disciplines. Currently enrolled doctoral students who had spent at least two complete years in their programs composed the survey sample. The resulting data set includes 4,114 completed surveys, a 42.3 percent response rate. Here we focus only on those students who said that, at some point in their careers, they desired a faculty position. Details of the methods, the disciplines, the universities, and the survey instrument can all be found at the project Web site at www.phd-survey.org.

Key Findings

Overall Results

Before delving into the differences in the preparation for faculty careers between chemistry and English doctoral students, we review the general findings of the study about faculty preparation. These data reflect the entire sample of 4,114 survey respondents, of whom 2,505 were interested in faculty careers.

Interest in Faculty Careers

We learned that, despite the decade’s worth of attention to the difficulty of securing academic jobs, most arts and sciences doctoral students were primarily interested in faculty careers. Levels of interest varied by discipline, from a high of 88.7 percent in philosophy to a low of 36.3 percent in chemistry (see Table 2.1).

Not surprisingly, students in disciplines with strong connections to industry were least interested, collectively, in faculty careers. Although students believed that their goals were realistic, a third (35.4 percent) of them also reported that their interest in faculty careers had declined since the start of their programs. We attribute this decline to the clearer view of faculty life that becomes available to students when they are in graduate school.
Table 2.1. The Career Interests, Goals, and Available Resources of Doctoral Student Respondents

<table>
<thead>
<tr>
<th>Variable</th>
<th>All Respondents (%)</th>
<th>English (%)</th>
<th>Chemistry (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interested in a faculty job at any point in the future</td>
<td>63.0</td>
<td>76.7</td>
<td>36.3</td>
</tr>
<tr>
<td>Definite interest in faculty career as next step</td>
<td>47.9</td>
<td>66.5</td>
<td>19.8</td>
</tr>
<tr>
<td>Realistic to see faculty career as next step</td>
<td>48.2</td>
<td>42.7</td>
<td>40.4</td>
</tr>
<tr>
<td>Decline in interest in faculty career as next step since start of program</td>
<td>35.4</td>
<td>32.9</td>
<td>41.7</td>
</tr>
<tr>
<td>Workshop on academic job search available</td>
<td>57.7</td>
<td>82.0</td>
<td>49.0</td>
</tr>
<tr>
<td>Workshop on career opportunities outside academia available</td>
<td>45.6</td>
<td>50.6</td>
<td>49.0</td>
</tr>
<tr>
<td>Advisor would support any career path chosen</td>
<td>70.7</td>
<td>70.7</td>
<td>68.2</td>
</tr>
<tr>
<td>Advisor provides information on possible career paths</td>
<td>42.0</td>
<td>36.6</td>
<td>42.5</td>
</tr>
<tr>
<td>Interested in working at (realistic to work at):*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community college</td>
<td>3.9 (16.6)</td>
<td>52.1 (72.8)</td>
<td>6.0 (25.1)</td>
</tr>
<tr>
<td>Liberal arts college</td>
<td>54.3 (80.5)</td>
<td>98.0 (92.4)</td>
<td>58.5 (45.7)</td>
</tr>
<tr>
<td>Comprehensive university</td>
<td>43.8 (26.8)</td>
<td>98.2 (86.0)</td>
<td>34.2 (27.2)</td>
</tr>
<tr>
<td>Research university</td>
<td>54.1 (19.6)</td>
<td>84.7 (53.2)</td>
<td>34.5 (14.0)</td>
</tr>
</tbody>
</table>

Sample: Except as noted, the sample is of all students responding; all = 4,114, English = 506, chemistry = 574.

*The sample for the data reported in this part of the table included only those who indicated interest in ever being a faculty member; all = 2,505, English = 391, chemistry = 200.

Note: For items on career interests, percentages indicate those respondents saying "yes" or "definitely"; other choices were "perhaps/possibly" and "no/not at all." For items on workshops, percentages indicate those respondents saying "yes"; other choices were "no" and "don't know." For items on advisor, percentages indicate respondents saying "strongly agree" or "agree"; other choices were "disagree" and "strongly disagree." For items on institutional preferences, percentages indicate respondents saying "very much"; other choices were "somewhat" and "not at all."
Table 2.2: Percentage of Doctoral Student Respondents Providing Affirmative Answers on Their Preparation for and Opportunities to Conduct Research

<table>
<thead>
<tr>
<th>Variable</th>
<th>All Respondents (%)</th>
<th>English (%)</th>
<th>Chemistry (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepared by program to conduct research</td>
<td>70.9</td>
<td>56.8</td>
<td>48.7</td>
</tr>
<tr>
<td>Conduct research</td>
<td>65.1</td>
<td>42.9</td>
<td>27.1</td>
</tr>
<tr>
<td>Collaborate in interdisciplinary research</td>
<td>44.7</td>
<td>35.0</td>
<td>36.2</td>
</tr>
<tr>
<td>Take progressively responsible roles in research</td>
<td>44.7</td>
<td>35.0</td>
<td>36.2</td>
</tr>
<tr>
<td>Present research findings at conferences</td>
<td>Encouraged to present at conferences</td>
<td>Encouraged to present at conferences</td>
<td></td>
</tr>
</tbody>
</table>

Sample: Except as noted, the sample is of all students responding; all = 4114, English = 956, chemistry = 574.

Note: For categories labeled "prepared," percentages indicate respondents saying "very much." Other choices were "somewhat" and "not at all." For categories labeled "opportunity," percentages indicate respondents saying "yes." Other choices were "no" and "somewhat."

More than half (53.6 percent) of students said that their doctoral programs required them to serve as teaching assistants (see Table 2.3). It is important to recognize that such requirements might be motivated by educational concerns and a genuine desire to help students learn how to construct a course, deliver lectures, grade work fairly, and help undergraduates learn. Teaching requirements also serve as mechanisms for financial aid and provide a labor pool of junior instructors for the university. However, serving as a teaching assistant might not fully prepare students for running their own courses. Ideally, students who aspire to become faculty should take progressively more responsible roles in teaching (as many do in research), but slightly fewer than half of the students (49.8 percent) reported that such opportunities were available. Fully prepared teachers have a variety of skills in their repertoire, including advising students and teaching a variety of courses, from introductory undergraduate classes to specialized graduate seminars. Students reported being "very prepared" by their programs to lead discussion sections (57.9 percent), teach lab sections (44.7 percent of science students), and teach lecture courses (36.1 percent). These are the teaching tasks most often performed by doctoral students, so these relatively low percentages are not welcome news. Even smaller proportions of students reported being prepared by their programs to advise students, develop teaching philosophies, incorporate information technology (IT) into the classroom, and create inclusive classroom environments.

**Preparation for Service**

Service is usually the least respected of the three components of faculty life, and yet in many ways the continued health of American colleges depends on faculty members taking an active role in campus governance and in service beyond the borders of the campus. Students reported strong levels of interest in activities such as spending time with undergraduates outside of class (69.0 percent are interested), serving on a university governing body (52.3 percent), and providing service to the community (52.1 percent). This
Table 2.3. Percentage of Doctoral Student Respondents Providing Affirmative Answers on Their Preparation for and Opportunities to Teach

<table>
<thead>
<tr>
<th>Variable</th>
<th>All Respondents (%)</th>
<th>English (%)</th>
<th>Chemistry (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>required: Teaching assistantship</td>
<td>53.6</td>
<td>50.6</td>
<td>83.8</td>
</tr>
<tr>
<td>Opportunity:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Workshop-seminar on teaching in the discipline</td>
<td>51.2</td>
<td>68.3</td>
<td>45.7</td>
</tr>
<tr>
<td>TA training, at least one term</td>
<td>46.4</td>
<td>79.2</td>
<td>28.4</td>
</tr>
<tr>
<td>Take progressively responsible teaching roles</td>
<td>49.8</td>
<td>65.1</td>
<td>38.4</td>
</tr>
<tr>
<td>Prepared by program to:*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teach discussion sections</td>
<td>57.9</td>
<td>77.9</td>
<td>50.0</td>
</tr>
<tr>
<td>Teach lab</td>
<td>44.7</td>
<td>NA</td>
<td>59.8</td>
</tr>
<tr>
<td>Teach lecture courses</td>
<td>36.1</td>
<td>30.4</td>
<td>36.2</td>
</tr>
<tr>
<td>Create inclusive classroom climate</td>
<td>28.0</td>
<td>43.1</td>
<td>21.6</td>
</tr>
<tr>
<td>Advise undergraduates</td>
<td>26.8</td>
<td>24.7</td>
<td>32.7</td>
</tr>
<tr>
<td>Develop teaching philosophy</td>
<td>26.6</td>
<td>42.9</td>
<td>20.1</td>
</tr>
<tr>
<td>Teach graduate courses</td>
<td>23.3</td>
<td>17.6</td>
<td>22.7</td>
</tr>
<tr>
<td>Advise graduate students</td>
<td>16.5</td>
<td>12.3</td>
<td>23.9</td>
</tr>
<tr>
<td>Incorporate IT in class</td>
<td>14.1</td>
<td>18.6</td>
<td>21.7</td>
</tr>
</tbody>
</table>

Sample: Except as noted, the sample is of all students responding; all = 4,114, English = 506, chemistry = 574.

*The sample for the data reported in this part of the table includes only those who indicated interest in ever being a faculty member; all = 2,605, English = 391, chemistry = 206.

Note: For categories labeled "required" and "opportunity," percentages indicate those respondents saying "yes." For categories labeled "prepared," percentages indicate those respondents saying "very much"; other choices were "somewhat" and "not at all."
from the ten largest universities represented in the survey data. Among the respondents to the survey, 506 were studying English, with 391 (77.6 percent) interested in faculty careers. The following demographic data refer only to those interested in faculty careers, as this is the emphasis of this chapter. In regard to the gender ratio, 65.4 percent were female and 34.6 percent male (nearly the opposite of the gender ratio for chemistry). Just over half (59.3 percent) were partnered, and 16.8 percent had dependent children. There were few international students in English studies; fully 94.0 percent of the sample held U.S. citizenship. Of the U.S. citizens, 89.3 percent reported their race-ethnicity as White. The mean age of English student respondents was 32.8 years, reflecting the later start in and the longer duration of the Ph.D. program in English compared with chemistry and many other fields. Few of the English students started a doctorate straight from undergraduate study; only 16.2 percent did so compared with 63.6 percent of the chemists. In fact, over half (53.6 percent) took more than two years off; the mean pause between bachelor’s end and doctoral start was 4.0 years. (By comparison, only 16.7 percent of the chemists took two or more years off, and the mean pause was 1.32 years.) About two-thirds (70.5 percent) of the respondents in English had advanced to candidacy (similar to the chemists), and the mean time of enrollment was 5.3 years.

### Nature of Doctoral Study in English

Nearly 150 universities grant the doctorate in English language and literature, awarding a total of about one thousand such degrees each year. Over half are granted at the 41 universities whose programs are the largest, those granting at least ten doctorates a year (Laurence, 2002). A doctorate in English is time consuming; the National Research Council reports an average registered time to degree of ten years for the top quartile of programs (Goldberger, Maher, & Flattau, 1995). The study of English usually involves several years of specialized coursework, after which students write a book-length dissertation. (In our survey, 82.5 percent of students indicated that their dissertation would reflect work from one project, rather than several, as is the case for many science students.) Examinations of students are often canonical, with students expected to demonstrate mastery of “Beowulf to Virginia Woolf.” After graduation a dissertation is rewritten and (ideally) published.
as a book by a university press. During the dissertation stage, the life of the English Ph.D. student is fairly solitary, involving library work, thinking, and writing. Among the survey respondents in English, 69.7 percent indicated that their dissertation research was conducted individually, whereas 28.9 percent said their research was done in close collaboration with a faculty member; 95.0 percent said the library was the primary setting for their work. This is noteworthy when compared with the experience of the chemists.

Graduate studies are typically funded by a combination of fellowships and teaching assistantships. English Ph.D. students also often take out loans and graduate with significant debt (Hoffer et al., 2002). Because summers are generally unfunded, students often interrupt their studies to earn money. The reliance of English programs on the teaching assistantship for funding students (in doctoral granting departments 35 percent of undergraduate course sections are taught by graduate students [Laurence, 2001]) has resulted in many departments developing elaborate teaching preparation strategies and sequenced teaching opportunities in which students become increasingly independent instructors. A 1986 survey of doctoral programs showed that 76 percent offered courses in teaching methods (Huber, 1989).

Doctoral study in English is almost entirely geared to the preparation of future faculty. Although many Ph.D. holders work outside of academia, even the possibility of creating the demand for nonacademic positions has been controversial (Leatherman & Wilson, 1998). The phrase “job crisis” is bandied about in English departments, and for good reason. Data from the Modern Language Association (MLA) show that the proportion of new Ph.D. recipients getting tenure-track positions immediately upon receipt of the Ph.D. (English graduates do not do postdoctoral fellowships) was 48 percent in 1977, peaked at 54 percent in 1992, and tapered to 36 percent in 1997 (Laurence, 2002). The rates of attrition are notoriously high in English, as in most humanities, in part because time to degree is long, leading one scholar to compute that his department must admit six students to produce one tenured faculty member (Scholes, 1998).²

**Interest in Faculty Careers**

The data from our survey bear out the perception of graduate study in English as geared primarily to the preparation of new faculty members. Of the respondents in English, 82 percent said that their departments offer workshops on the academic job search (see Table 2.1). Half of the respondents said that their departments offer help in finding nonacademic positions, and 70 percent said that their advisors would support any career path that they chose. The departmental culture reinforces students’ desire for faculty positions. Two-thirds to three-quarters (depending on how the question is asked) of English studies students desired a faculty position. About 48 percent saw this career path as realistic, and almost 33 percent reported that their interest in a faculty career had declined since they enrolled. These data reflect a remarkably accurate assessment of the job market for English Ph.D. holders, since about 60 percent ultimately can expect to land tenure-track positions (MLA Ad Hoc Committee on the Professionalization of Ph.D.s, 2002; Nerad & Cerny, 2000); about 85 percent are hired in college teaching positions upon graduation, although only half of those are tenure-track positions (MLA, 2003).

When those interested in faculty positions were asked about which kinds of institutions they wanted to work in and which career paths they thought were realistic, their responses to these two questions differed, but not markedly. Liberal arts and comprehensive colleges were the overwhelming preference, revealing a clear emphasis on and desire to teach, as these are teaching-intensive institutions. Even community colleges—in which only 4 percent of the survey respondents, overall, expressed an interest—were deemed a “very strong” preference by 52.1 percent of the English students. Furthermore, when assessing their chances of employment at a particular type of institution, very high proportions of English students interested in an academic career felt they had realistic employment possibilities in liberal arts colleges and comprehensive universities, and to a slightly lesser extent, community colleges. Half thought it realistic that they would obtain a position at a research university. Again, this shows a remarkable savvy or perhaps fortuitous sorting of the graduate students as a group: federal data show that tenure-track English faculty are distributed 32 percent each at doctoral and master’s granting institutions, respectively, 13 percent at baccalaureate granting colleges, and 23 percent at community colleges (National Center for Education Statistics, 1999).
Preparation for Research

Inquiry in English is often referred to as "scholarship" rather than "research." It tends to be based on analysis of texts or the use of texts, and is more a matter of understanding and interpretation than discovery. It is relatively rare for students to apprentice to faculty members (this is typical in the humanities and very different from the sciences). The data (see Table 2.2) bear out this observation; only a quarter of the respondents reported the opportunity in their programs to take progressively more responsible roles in research. Scholarly work (like experimental research) is presented at conferences and then published. Most of the students were encouraged to present, but fewer than a third said that their programs had prepared them to publish work. And only a small proportion (13 percent) felt that they were prepared to participate in interdisciplinary research collaborations, although over half were interested in doing so (53.9 percent).

Science students) felt competent in. Nevertheless, teaching graduate courses, advising students, and using instructional technology in the classroom were still areas in which most students did not feel prepared.

Preparation for Other Professional Responsibilities

The ethical dimensions of academic life, whether conducted by students or faculty members, seem from our data (see Table 2.4) to be too often neglected as part of the doctoral preparation process. To the extent that the majority of students felt that they clearly understood customary practices, it was generally in areas that were covered in written policy and in areas that they might confront in their lives as students. The future ethical dilemmas that they will face as faculty members seem not to be part of the conversation during doctoral preparation. In English, the three most clearly understood domains are appropriate relations with undergraduates, appropriate use of copyrighted material, and grading student work fairly. Three domains that seem outside the ken of students in English are the use of research funds, resource care, and patent policies. It may be said that these are beyond the realm of expertise of most English faculty members, but as members of the larger institutional community they will probably be called upon to help craft policy in these arenas. Of concern is that few students seem to understand clearly the practices for refereeing papers for publication or determining the authorship order on co-authored papers. Perhaps the relative rarity of co-authorship in English studies explains this finding.

Chemistry

There were responses from 574 chemists, 200 (34.8 percent) of whom were interested in faculty careers. Of the "faculty-oriented" chemistry students, 35.9 percent were female (nearly the opposite composition of the English respondents). 46.4 percent reported that they were partnered, and 9.3 percent had children. The survey was overrepresentative of U.S. citizens relative to the overall population of chemistry Ph.D. recipients (Hoffer et al., 2002); 81.8 percent of the chemists were domestic students. Again, at somewhat higher proportions than the overall chemistry doctoral
population, of the U.S. citizens, 91.8 percent described themselves as White. The mean age of the students was 28.4 years (somewhat younger than their English counterparts), the mean duration of enrollment was 4.3 years (one year shorter than the English students), and 80.0 percent had advanced to candidacy.

**Nature of Doctoral Study in Chemistry**

Chemistry is widely considered a central science, bridging the gap between the physical and biological sciences, and doctoral study in chemistry is geared toward the preparation of laboratory scientists. Although 190 departments in the United States grant the doctorate, the thirty largest programs produce about half the graduates. The average size of chemistry departments is eighty-four students and twenty-two faculty. There are about two thousand Ph.D.'s conferred each year, and about half of the graduates take postdoctoral positions following graduation. Most Ph.D. chemists work in industry, not academia: nearly 60 percent in industry, a third in academia, and about 5 percent in government (American Chemical Society [ACS], 2002a).

Graduate work in chemistry takes an average of 6.29 years in the highest-ranked departments (Goldberger et al., 1995). Students generally complete coursework in their first year or two of study by taking survey courses (ACS, 1997). An ACS survey of students showed that many believe that they would have benefited from additional coursework, especially outside their areas of specialization or outside their departments (ACS, 1999). Principally, doctoral students spend most of their time working in laboratories under the direction of their research advisors. (In our survey, 96.2 percent of chemists reported that they did their dissertation research in labs.) After the first year, students continue to learn in more informal settings: seminars, journal clubs, lab meetings, and during proposal writing. Their studies are usually funded in the first year by teaching assistantships and in the remaining years by research assistantships that come from their advisors' research grants or a program's training grant. Some select students are able to obtain fellowships from government agencies (National Science Foundation, National Institutes of Health, and so on) or private foundations.

Life in the laboratory defines the experience of graduate students in chemistry—they spend most of their time there working on research experiments. It is impossible to distinguish between the research conducted by the student as a research assistant and her own research; they are one and the same. (Again, the contrast with English is illustrative: 43.2 percent of the chemistry students agreed or strongly agreed that their dissertation topics were of their own choosing, compared with 95.6 percent of those in English.) The dissertation is usually composed of a collection of related research projects conducted by the student and written as a series of papers already in the publication pipeline with a synthesizing chapter. (In our survey, 70.5 percent of students reported that the dissertation would include work from several projects.) Students often felt dependent on the advisor, who was frequently the sole determiner of when a student had completed sufficient experimental work to graduate.

**Interest in Faculty Careers**

When asked if they were considering a faculty job at any point in the future, 36.3 percent of the chemistry students in our survey answered in the affirmative, which represents the lowest level of interest in the eleven disciplines we studied (see Table 2.1). Interestingly, a slightly higher percentage (40.4 percent) believed that a faculty career was realistic, yet 41.7 percent reported that their interest in a faculty career declined while in graduate school. An even smaller number (19.8 percent) of respondents indicated that they had a definite interest in a faculty position as a next step. The low level of interest in a faculty career compared with other disciplines is probably attributable to the wide range of research careers available to chemists in industry and government. Indeed, 57.1 percent of Ph.D. chemists under the age of forty work in industry, while 34.7 percent and 5.4 percent work in academia and government, respectively (ACS, 2002a). The nonacademic career track seemed to be supported; two-thirds of students believed that their advisors would support any career path they chose. Despite popular wisdom, survey respondents in chemistry who were considering a faculty career were not primarily interested in a faculty position at a research university. Fully 58.5 percent had a very strong preference for teaching at a four-year liberal arts college; 34.5 percent and 34.2 percent indicated a strong preference for working at a research university and at a comprehensive university, respectively. Although the distribution of preferences for
working at research and comprehensive universities mirrors the
distribution of tenure-track faculty (37 percent and 35 percent,
respectively), only 14 percent of faculty are at bachelor’s granting
colleges, so this aspiration is unrealistic (National Center for Edu-
cation Statistics, 1999). Although the data revealed no statistical
gender difference in considering a faculty career, of those who
were considering a faculty career, women were less likely to be
interested in positions at large research universities than their male
counterparts.

Preparation for Research
Doctoral students in chemistry usually work on research projects
as part of a team with a common, broad research goal. The team
is composed of other graduate students, postdoctoral associates,
technicians, and faculty members at the same or other depart-
ments and institutions. (In our survey, 35.0 percent of the chemists
said their research was conducted as part of a group of more than
twelve people, and another 44.4 percent as part of a smaller group.
By contrast, only 1.4 percent of the English students said they were
part of a small research group, and none were part of a large one.)
Overall, 70.9 percent of the chemistry students felt their programs
were preparing them to conduct research; 83.1 percent of the
respondents had the opportunity to present their research at con-
ferences; and 75.4 percent were encouraged to do so. A good
research program should place increasingly more responsible roles
on the student over time, yet only 55.1 percent reported that this
was the case for them. Other aspects of research appear to be
shortchanged as well; 56.8 percent felt prepared to publish, and
43.7 percent believed their programs prepared them to collabor-
ate in interdisciplinary research (see Table 2.2). Considering how
much influence chemistry has on other disciplines and the pre-
vailing sentiment that the most interesting research problems are
found at the interface between disciplines, we find the low level of
preparation to conduct interdisciplinary research disappointing.

Preparation for Teaching
Teaching requirements are more common in science fields, chem-
istry in particular (83.8 percent reported that a teaching assistant-
ship was required; see Table 2.3), than in other disciplines. Ideally,
students who aspire to become faculty should take progressively
more responsible roles in teaching (much as many do in research),
yet only 38.4 percent of the survey respondents reported that this
was the case. Further, 45.7 percent reported that a workshop on
teaching in chemistry was available to them, but only 28.4 percent
said that they could take a teaching assistant training course, last-
ing at least one term. So although chemistry students serve as teach-
ing assistants, usually in introductory lab courses, most of them do
not have access to the broad scope of teaching-related training and
experiences available to students in fields such as English.
Chemistry students believed themselves to be best prepared to
teach discussion sections (50 percent reported being “very pre-
bpared”; see Table 2.3) and laboratory sections (about 60 percent).
Nevertheless, the lack of pedagogical preparation is borne out in
the low levels of perceived preparation for various activities, such
as teaching lecture courses (36.2 percent reported being “very pre-
bpared”), creating inclusive classroom environments (21.6 per-
cent), developing teaching philosophies (20.1 percent), teaching
graduate students (22.7 percent), and incorporating instructional
technology in the classroom (21.7 percent). Respondents also
reported low levels of preparation to advise undergraduates (32.7
percent reported being “very prepared”) and graduate students
(23.9 percent).

Preparation for Other Professional Responsibilities
In chemistry, students had a clear understanding of the issues that
confront graduate students regularly or that were codified in writ-
en policy (see Table 2.4). Respondents reported that they had a
clear understanding of what constitutes an appropriate relation-
ship with undergraduates (71.1 percent indicated a “very clear”
understanding). However, they were less certain about some issues
that chemistry graduate students will face at some point in their pro-
grams: the appropriate use of copyrighted materials (47.8 percent
indicated a “very clear” understanding), generating and using
research data (54.5 percent), grading student work fairly (51.4 per-
cent), and care of resources, including biosafety and human subjects
(40.1 percent). The low level of reported preparation in the area of
resource care might be due to the fact that it is relatively unusual
for chemists to work with human subjects during the course of their
dissertation research. Nevertheless, the rising importance of chem-
istry in the biological disciplines makes understanding biosafety
issues a matter of some importance. Issues more likely to face them after they have received the doctorate were quite unclear to most of the sample: determining authorship on papers (only 30.5 percent of the respondents in chemistry indicated a "very clear" understanding), appropriate use of research funds (33.5 percent felt "very clear"), refereeing papers (23.6 percent), and patent policies (11.7 percent). This last finding is of some concern because as many universities elect to license technology developed by faculty members, it is increasingly important for faculty to understand the ethical issues surrounding the interface between the academic and commercial research enterprises.

Comparisons Between English and Chemistry

Doctoral education is a highly individualized enterprise; no two students have the same goals and experiences. Looking at our data aggregated by discipline masks the range of experiences among students in the same program and hides important institutional variations. Nevertheless, comparisons between English and chemistry reveal some overall differences in the preparation of graduate students for faculty careers. Although we cannot make definitive claims, here we highlight some of those differences and speculate about the sources of those differences, which we believe are rooted in the different histories and norms for doctoral education embodied in these two fields of study.

A faculty career is the normative and desired career path for English graduate students, but it is not for chemistry students. A very high proportion of English students desire and expect such a career, and many English departments are (students say) geared to help them find academic careers. Multiple career paths are open to chemists, and we attribute this pattern to the historically strong connections between the chemical sciences industry and doctorate production, the likes of which are not apparent in English. Data from the disciplinary societies make this evident: only a third of Ph.D.-holding chemists work in academia (ACS, 2002a) and there is detailed information available about the work done by industrial chemists (ACS, 2001b), whereas 80 percent of new Ph.D. recipients in English find permanent or temporary college-level teaching positions in the first year (MLA, 2003).

Of those chemistry and English students interested in faculty careers, far greater proportions of English students said that they were interested in and believed that it is realistic to work at every type of college than their counterparts in chemistry. In some measure, this finding is likely a simple reflection that students in English desperately want to work as faculty members and are clearly willing to work in any setting to do so. Chemistry students, in contrast, are most interested in liberal arts college settings. Both chemistry and English students recognize that, if they are interested in faculty careers, the community college setting is a fruitful one—more students in each field see work in a community college as a realistic outcome than perceive it as desirable. This perception is, we believe, a fairly accurate read of the academic job market. One-third of faculty positions are at research universities; many more are in comprehensive and community colleges (National Center for Education Statistics, 1999). Another, not necessarily competing, explanation for the higher levels of interest in nonresearch institutions is that the socialization of doctoral students into the climate of research and scholarship in the discipline—socialization that is carried out at research universities—may have failed.

The survey did not focus as much attention on the component skills of research as it did on teaching. Nevertheless, we see that, at least in the terms that we set forth, chemistry students as a group, when compared with English doctoral students, perceive that they are better prepared to conduct and share research and scholarly findings. The nature of the research and scholarly enterprise is different in the two fields. In chemistry, knowledge is advanced incrementally by experiment and quickly published in scientific journals, whereas scholarship in English is about acts of interpretation and analytic application, more than discovery, and it is more frequently published in books rather than in time-sensitive journal articles (Donald, 2002; Greenblatt, 2002). Moreover, the research enterprise is funded by research grants from federal and industry sources in chemistry, but is often not funded at all in English. In turn, chemists are trained in labs, working on an advisor's research, whereas English students rarely have the opportunity to support a faculty member's scholarship or work collaboratively on a project (see Donald, 2002, Chapters Four and Eight; and the Carnegie essays by Kwiram, 2003, and Lunsford, 2003). These differences in
disciplinary work help explain why so few English student survey respondents, compared with their chemistry counterparts, reported having the opportunity to take progressively more responsible roles in research, and likewise, why so few had any experience with interdisciplinary collaboration.

Although the survey data do not initially suggest this, we know from the program descriptions we have reviewed that students in English teach more than their counterparts in chemistry. In fact, we suspect that the higher prevalence of teaching assistantship requirements in chemistry reflects an effort on the part of educators to provide a small sample of teaching to graduate students who might never have such an opportunity otherwise. It might also reflect need to ensure a flow of lab assistants for undergraduate chemistry courses. By all other measures in the survey, English students are able to participate in much more in-depth pedagogical preparation than students in chemistry. And as the students reflected in assessing their level of preparation, more English students felt better prepared in more teaching-related tasks than the chemists. However, we caution that, overall, both groups of students seemed unprepared in many areas.

Finally, when we look at the professional responsibility dimensions of faculty work, we see that students in chemistry had more often reached some clear understanding of how to comport themselves and how to proceed in the face of ethical dilemmas. We have two possible explanations for this finding. On the one hand, it is possible that the questions we posed were more salient for science students and that chemists have simply had to confront more of these issues. On the other hand, it is possible that, through forms of apprentice-master learning, more students in chemistry have had conversations about these issues in their programs and with their advisors. The tremendous difference in levels of contact between students and advisors in chemistry compared with English might yield, in this case, the positive outcome of conversations about faculty life.

Implications and Recommendations

These data show that there are strong connections between the nature of the research enterprise, the normative forms of doctoral education in each discipline, and the strengths and weaknesses of faculty preparation in each discipline. When it comes to recruiting talented students into faculty careers, more active recruitment into the professorate may be needed in chemistry (women and ethnic minorities are underrepresented in both graduate programs and the professorate [ACS, 2000, 2001a]). In English, the nonacademic vistas need to come into sharper focus. The centrality of research in chemistry students' lives, without competition from other activities, combined with the close working relationships between students and advisors, means that chemists feel better prepared for the activities of research and publication than English students do. Conversely, the importance that teaching plays for students in English, reflected in the broad range of courses taken and the amount of teaching done by students, results in stronger preparation for teaching activities, particularly in such areas as developing a teaching philosophy and creating an inclusive classroom environment. These findings reinforce for us the importance of thinking in discipline-specific ways in all matters related to doctoral education—in this case, the preparation of new faculty. The nature of doctoral education differs among disciplines, and not surprisingly, the preparation of new faculty also differs among disciplines.

Recognizing the need for making changes in the preparation of future faculty is, of course, only the first step. The responsibility for changing current practices—to prepare future faculty better and to improve doctoral education more broadly—lies with all the parties engaged in doctoral education. Suggestions are as follows:

- **Students can initiate and argue for change.** They should not hesitate to advocate for themselves. They must take responsibility for educating themselves about the academic profession and seek out experiences that provide them with mentored learning opportunities.
- **Faculty members can reflect on how they conduct themselves and what they communicate to students about the academic profession.** They have a responsibility to discuss openly and explicitly the choices they have made in their careers, as well as the daily professional decisions that they make.
- **Department chairs and directors of graduate study can ensure that realistic career outcomes are presented at all stages of the process and that opportunities to prepare for faculty careers at all kinds of institutions are available and valued.**
• Graduate deans can create policy, advocate with conviction, and provide resources aimed to catalyze change and support others. Indeed, many have supported Preparing Future Faculty programs and helped them gain an institutional foothold.

• Professional associations can help shift the norms of practice in the discipline by raising questions about how future faculty are prepared, collecting data on job placement and job requirements, and showcasing promising practices in the preparation of future faculty for the discipline.

Conclusion

We must emphasize again that compensatory strategies—both preparing future faculty and new faculty orientation programs—need to take disciplinary differences into account. For example, teaching development programs may be more important for chemists, whereas help navigating the publication process may be more pressing for English scholars. Cookie-cutter, one-size-fits-all policy responses are unlikely to be as effective as tailored efforts. Many programs, as described elsewhere in this volume, have taken this insight to heart. Current Preparing Future Faculty efforts, for example, are often centered in departments and emphasize aspects of faculty roles that have not traditionally been addressed. We offer the data from this survey, including the data from the disciplines we were unable to discuss in this chapter, as evidence for the need to craft interventions that are sensitive to the disciplinary contexts at which they are aimed.

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Notes

1. For more on disciplinary cultures see Becher & Trowler (2001), Clark (1997), Donald (2002), and Huber & Morreale (2002).

2. Additional information about doctoral studies in English and data about job placement are available in The Future of Doctoral Studies in English (Lunsford, Moglen, & Slevin, 1989). Refiguring the Ph.D. in English Studies (North et al., 2000), the Conference on the Future of Doctoral Education (Conference on the Future of Doctoral Education, 1999), the Carnegie Essays on the Doctorate in English (Graff, 2003; Lunsford, 2003), and the ADE Bulletin from the Association of Departments of English, part of the MLA (2003). Additional information about doctoral studies in chemistry and the job market for chemists can be found in the Carnegie Essays on the Doctorate in Chemistry (Breslow, 2003; Kwiram, 2003; Stacy, 2003), and the surveys and reports of the American Chemical Society, particularly a compilation of several studies entitled Graduate Education in Chemistry. The ACS Committee on Professional Training: Surveys of Programs and Participants (ACS, 2002b).

References


