

OVERVIEW OF DOCTORAL EDUCATION STUDIES AND REPORTS: 1990 - PRESENT

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SUMMARY OF THE FINDINGS AND RECOMMENDATIONS ON DOCTORAL EDUCATION

American doctoral education has evolved in fits and starts throughout the 20th century. Research and reports have come in waves, coinciding with times of system stress and change. System stress is particularly propelled by changes in the supply and demand for Ph.D. holders. Notable time periods during which there is considerable attention paid to doctoral education include:

- Turn of the century. Thousands of doctoral students travel from U.S. to Europe to study. They return and developed doctoral programs in the U.S.
- Circa 1945. The National Science Foundation is started, formalizing Vannevar Bush's vision of housing federally funded research within universities. There is a shortage of Ph.D.s to teach the swelling ranks of undergraduates, lured to college by the G.I. Bill.
- 1960s. Sputnik and the Cold War increase demand for science and engineering Ph.D.s. Number of S&E Ph.D.s granted triples in the decade.
- 1970s. There is a surplus of Ph.D.s, unneeded in academic positions. The National Board on Graduate Education convenes and issues 5 reports (1972-75).

The latest wave of reports and research has been of the longest duration, beginning in the early 1990s. This reflects large changes in the doctoral education environment, generally catalyzed by a growth in the number of Ph.D.s produced at the same time that a predicted wave of faculty hiring failed to materialize. From her perspective as leader of the Re-envisioning the Ph.D. project, Jody Nyquist noted, "The oversupply issue has enabled and prompted us to ... rethink the purpose of doctoral education and the kinds of training that Ph.D.s undergo."

Several debates have persisted throughout the century, and are alive today. These include:

- What is the purpose of doctoral education? Is it to promote the pursuit of pure knowledge or is it dedicated to career preparation and training?
- For what careers are Ph.D. holders prepared – are faculty positions the normative path or should preparation for other careers be given equal standing?
- Are the "best and brightest" being attracted to doctoral study or are they drawn to other opportunities?
- Should enrollments be reduced or should we encourage more students to pursue the Ph.D.? A contemporary version of this debate is whether of US students should be privileged over international students. Efforts to diversify the workforce, the professoriate, and the pool of doctoral students adds another twist to this debate.
- What is the optimal time to degree, and how can rising time to degree be halted?
- How can additional experiences be incorporated into doctoral preparation without taking time away from research and scholarship and without increasing time to degree?

This white paper summarizes the major issues, data, and recommendations of the decade. They are categorized into four major themes: the doctoral pipeline, the process and content of doctoral study, career preparation and feedback mechanisms. **It is keyed to the list of the books, studies and reports that follow.**

1. THE POOL AND FLOW OF STUDENTS

With access to computerized data bases there has been an effort to document and think critically about who enrolls and who completes the Ph.D. Using the metaphor of “a pipeline” raises questions about pools and flows: what is the pool of entering students, how leaky is the pipe, how quickly do students flow through it, and what pipelines do they enter thereafter?

A. Diversity of student population

What is the optimal composition of the student population?

- It is in the nation’s best interest to work hard to increase the racial and ethnic diversity of the pool of doctoral students. [5; 6; 37; 38; 44]
- Minorities and women continue to be underrepresented in science and engineering fields. A good deal of data exists about these pipeline and job markets, and much research has documented the “chilly climate” that often faces underrepresented students. Many solutions to these continuing problems have been suggested: increasing the pool of students at the K-12 level, better recruitment, and better retention efforts. [16; 28; 29; 31; 33; 34; 45]
- Students of color less likely to aim to become faculty than white students. [22]
- Number of international students should not be capped, but should also not continue to expand unchecked. [5; 13; 19; 36]

B. Number of Ph.D.s produced

In most disciplines, there is a mismatch between the number of Ph.D.s produced and the number of academic positions, and this situation will not change. Currently Ph.D. production is “managed” in a decentralized manner by each department, and through funding policy levers.

- Overall, most students are satisfied with the experience and the decision to attend graduate school. [16; 24; 33; 39; 47]
- Demand for doctoral students may be less related to labor market demands than to institutional demands for people to teach and do research and the size of the undergraduate pool. The demand for students has largely been filled by international students. [10; 21; 25; 44]
- There is a systemic mismatch between the number of PhDs and the number of academic jobs available, although this varies considerably by discipline. [24; 37]
- One solution is to reject the reliance on part-time and adjunct faculty and to increase the number of full-time faculty. [32]
- Some call for the number of Ph.D.s in particular fields to be capped, at least in some departments. [32; 36; 37]
- Others do not, arguing that it is too difficult to predict job markets and that the nation (and the world) needs top flight S&E researchers to maintain our national status. It is unclear if the “best and brightest” are opting out of doctoral study. [13; 19; 21; 28; 29; 37; 50]
- Prestige quest has led to an increase in the number of doctoral programs. New doctoral programs, at least in established fields, should be not started. [5; 36; 44]

C. Progress through the pipeline

A chronic problem in doctoral education is the high failure rate and the ever-increasing time to degree.

- Attrition is high: 40-50% nationally; it is highest in humanities, then social sciences, then sciences. Women are more likely to leave than men, although the gender gap has closed over time. American students are more likely to leave than international students. Students of color are more likely to leave than white students. The causes of attrition are not a deficit of academic skills, but are generally related to a lack of integration into the department. [8; 10; 17; 30; 35; 42]
- Time to degree is rising and remains a concern. Some recommend keeping it within 6 years. A number of factors affect time to degree, including the structure of the program, funding, departmental climate and resources, and the job market. [6; 11; 13; 17; 19; 29; 34; 38; 44; 49]

- Data on completion rates and time to degree should be kept and made available to prospective students. Currently such data are not routinely shared. [5; 13; 16; 24; 33]

D. Post doc issues

Although time to degree is considerably higher in the humanities than the sciences, once the normative time that Ph.D.s spend in post doctoral traineeships is taken into account, the mean “time to career” is roughly ten years in most disciplines. There is very little information about people serving as postdocs, many of whom lack any formal institutional status or mentorship.

- In many fields the number of students in postdoc positions, the number of postdocs each student serves, and the duration of each postdoc, are all increasing. This adds another 2-4 years of training. There are an increasing number of people in the “post doc holding pattern.” Thus time to career continues to rise. [36; 40; 41]
- Post docs need independence and status within, and to be better integrated into, the university structure. Some suggest that one person be made responsible for postdoctoral affairs. [35; 38; 41]

2. PROCESS AND CONTENT

Mostly we think about the content of doctoral programs, the courses, the exams and the dissertation. It is less common to consider the process of doctoral education. Ann Austin and her colleagues [7] emphasize thinking about doctoral students in developmental terms. This perspective focuses attention on the process of doctoral education, and how we develop students as researchers and scholars.

- The process of doctoral education and how students can best navigate it is often mysterious. The structures and processes ought to be made clear. [10; 24; 30]

A. Breadth/interdisciplinary work

One tension facing students and faculty as they construct a program of study is striking a balance between depth and breadth. Depth and specialization allow students to become experts, however breadth can provide the ability to move in more directions following the Ph.D. New knowledge is often created in the interstices of disciplines, but existing departmental structures mitigate against multi-disciplinary exploration. Learning to collaborate is a critical skill.

- Students are interested in interdisciplinary work, but their programs do not prepare them for it. [24; 47]
- Students ought to be better prepared to work on multi- and inter-disciplinary problems and teams. These skills are important in a variety of work settings: industry, teaching, and cutting edge research. Programs should provide mechanisms for learning these skills. [5; 13; 19; 39; 44]
- Programs that foster collaboration between faculty and students positively effect student’s socialization into the discipline and reduce episodes of exploitation. [2]
- The federal government should support ways to foster interdisciplinary work. NRSA is an example of mechanism that encourages interdisciplinary work; increasingly there are others, including IGERT from NSF. [37; 38]

B. Advising and mentoring

The underlying model of doctoral education is apprenticeship, it presumes that the faculty advisor is the mentor and the student is the protégé. Today’s research university faculty are pulled in many directions, and mentoring often is a low priority.

- Most students are satisfied with their advisor, and report positive mentoring relationships, including the quality and quantity of time they spend together. [24; 33]
- Students don’t know very much about the process of doctoral education when they arrive. They need help understanding how doctoral education works, and how to navigate the system. [24]
- Mentoring matters, but is not sufficiently rewarded. It should be better rewarded. [4; 5]

- Students who take many criteria into account when selecting an advisor are more satisfied with their advisor than those who use few criteria. [24]
- Students are well served to have multiple mentors. The responsibility for a student's progress should rest with the entire department, not one faculty member solely. Only half of students do. [13; 16; 20; 24]

C. Funding

Doctoral students are funded through a variety of mechanisms. Relative to 30 years ago, they are poorly paid, many accumulate considerable debt. Funding streams vary – in the sciences most students are assured funding as research assistants for the duration of their student careers, in the humanities teaching assistantships form the basis of funding, but are typically less assured.

- Since Vannevar Bush's manifesto "Science the endless frontier" (1945), there has been a strong federal role in graduate education, primarily in science and engineering. This role should continue, although it may need to be adjusted. [29; 38]
- The optimal mix of funding mechanisms (fellowship/traineeships, RAships and TAships) is not completely clear. It has been argued that:
 - Training grants are more effective than RAships, because of the flexibility they offer students and faculty, and because there is peer oversight of the training process which leads to pedagogically better programs. The government ought to fund more of them. [13; 36; 37]
 - Traineeships in early years can help reduce time to degree. [46]
 - Research and teaching assistantships not only provide financial support, but increase professional growth and accomplishment. [10; 18]
 - Funding through TAships and RAships are related to degree completion. Absence of funding or over reliance on fellowships is related to attrition. [17; 30]
 - Funding the dissertation years helps students to finish. Foundations can play a role in this. [10; 44]
- Clear information about funding should be made available; currently uncertainty abounds, especially in non-science fields. [5; 24]
- Students should be supported at a level sufficient that they do not need to work outside of school. The poor pay contributes to turning top people away and taking time away from timely completion. Many students, particularly in the humanities, graduate with debt from graduate school. [1; 5; 29; 33; 34]
- The dependencies and conflicts of interest (is the faculty's research or the student's education of primary concern?) fostered by the federal system of grant funding are a concern. Some call for moving more funding directly to students. [29]

D. Quality of life

Many students raise concerns about the overall quality of their lives. The long duration of doctoral study, financial pressures, and expectations that students work very hard (either in the lab or classroom), combine to put students under stress. One response to these stresses are efforts to unionize.

- Many students believe that they are primarily viewed by faculty as a cheap source of labor, and feel exploited. [2; 5; 16; 25]
- Basics of quality of life must be accorded: adequate office space, freedom from discrimination, freedom of expression. [1]
- Are students employees? Some say "yes" and affirm their right to organize. [1] Others say "no." [5] The presence of a union does not appear to hinder the educational dimension of the faculty-student relationship, despite concerns that it might do so. [27]

3. CAREER PREPARATION AND PH.D. AS TRAINING

Whether or not one sees doctoral education as primarily a training ground or primarily about the pursuit of knowledge, doctoral recipients will spend the bulk of the rest of their lives in professional endeavors that use their skills and knowledge.

- Little data is collected on where students actually go to work, and these data should be available to prospective students. [5; 13; 16; 19; 24; 32; 33; 36; 37; 40]
- Career guidance, for all sectors of work, should be a component of doctoral programs and universities, and is often missing. [5; 13; 16; 24; 33; 38; 40]
- Most physical science students report entering graduate school with only vague career goals. [47]
- Most arts and sciences start graduate school with the goal of being faculty. Over time, the proportion of students interested in faculty careers decreases, and interest in other options increases. [24; 40; 47]
- Academic careers are emphasized in the academic culture, and many students are unwilling to express other goals because they are devalued. This situation must change. [13; 19; 24; 33; 40; 47]
- The ability to balance work and family, and the work goals of a spouse, serve to profoundly influence many students' options, particularly women. [40]

A. Preparation for non-academic careers

Today, only about half of doctoral recipients will find work as tenure track faculty in a college or university. Whether, and if so how, doctoral programs should prepare students for a broader array of careers is the subject of some debate.

- At least half (although it varies by discipline) of new Ph.D. recipients will not enter academic careers. [13; 24; 36; 37; 40]
- Students are generally not exposed to non-academic career options, especially relative to their exposure and grooming for academic careers. Information about alternative careers must be actively disseminated. [7; 13; 16; 24; 32; 33; 36; 38; 40; 44]
- Programs should be structured to help students develop the skills to succeed in a variety of settings. [5; 13; 29; 38]
- Some are concerned that the research focus of Ph.D. should not be diluted by the press towards alternative careers. [36]
- Students should be encouraged to engage in internships and other off-campus experiences. These are not often available. [13; 16; 24; 33; 36]

B. Preparation for faculty careers

Many argue that doctoral programs do not adequately prepare students to enter faculty careers. Being an effective faculty member requires playing a range of roles in a variety of institutional settings.

- Future faculty should be prepared for the wide range of roles that faculty play and more clearly understand what faculty life entails. [7; 20; 24]
- Effective, comprehensive preparation for faculty careers is not widely available, although students are generally satisfied with their preparation. In any case, students desire it, and many faculty at non-research universities are eager to share information. [16; 20; 24; 33]
- Pedagogical training and TA training is underemphasized and more needs to be done. [5; 15; 16; 24; 32; 33; 44; 47]
- Service roles of faculty are undervalued, but they are important and should be encouraged. [22; 23; 24; 44]
- Future faculty are not taught about the ethical underpinnings or dimensions of faculty work. [2; 20; 24; 44]
- Students don't know about the range of institutions at which most faculty work and should be exposed to them. [20; 24; 32; 44]

- The life of academics in research universities turns many students away from academic careers. [24; 44; 48]

4. FEEDBACK LOOPS AND OVERSIGHT

Increasing the number, quality, and attention paid to feedback mechanisms in the system can be a lever for change. These feedback loops can happen at all levels of the system.

- Students ought to be annually reviewed and encouraged to engage in a process of self-reflection to check on their progress and the fit of the program of study they are on with their goals. [5; 7; 19; 24; 33]
- Information about departmental time to degree, completion rates, placement, and funding should routinely be made available to prospective students. Of these, funding information is most frequently provided. [5; 13; 16; 19; 24; 32; 33; 36; 37; 38; 40]
- Students ought to review their programs, this will provide pressure for change. [5; 15]
- Departments should engage in self-study to make sure that number of students, and type of preparation are aligned with what the students really end up doing. [5; 19; 32]

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