

INTRODUCTION

REASONS FOR INTEREST IN GRADUATE STUDENT SUPPORT

Two main developments underlie the current policy interest in graduate student support. One is a growing concern that graduate science and engineering⁸ (S&E) education in the United States is too narrowly focused to be able to meet the needs of the student or the workplace. The second is the increasing call for greater accountability by Federal agencies as exemplified in the Government Performance and Results Act of 1993 (GPRA). These developments have increased the attention paid to the outcomes of graduate student support and the mechanisms through which it is administered. This report focuses on the latter issue—the modes of financial support.

Many analyses relating to graduate financial support have focused solely on students' *primary* support (COSEPUP 1995, NSF 1996b, NSB 1998, NSF 1998a). But in fact, most graduate students tend to use multiple modes of support over the course of their doctoral studies, making it difficult to rely only on a clear primary or secondary support mode for information on their financial support. Therefore, those examining the efficacy of various support modes should be aware of and take into account the multiple modes of support. They should also be aware of the extent to which such support modes vary by characteristics such as field, sex, race/ethnicity, and citizenship status of S&E doctorate recipients and the type of institution from which they received their doctorates. The purpose of this report is to examine the entire range of support patterns of S&E doctorates, showing the distribution of various modes of support to individuals. The analysis partitions data by a number of individual and institutional characteristics. The objective of the study is to provide contextual and background information about the nature of graduate financial support to those thinking either about the impacts of support modes on graduate S&E education or how to evaluate the impacts of specific graduate support programs for GPRA purposes.

⁸Throughout this report, the terms science and engineering doctorates and science and engineering Ph.D.s refer to research doctorates in agricultural sciences, biological sciences, computer and information sciences, mathematics, physical sciences, earth, atmospheric, and ocean sciences, psychology, social sciences, and engineering, as well as the health sciences (e.g., environmental health, nursing, pharmacy, and veterinary medicine).

U.S. S&E GRADUATE EDUCATION

In recent years, policy makers, academics, and other interested parties have been examining the changes in science and technology, employer needs, demographics, and the international environment, with an eye to the adjustments these may require in the U.S. graduate education system (COSEPUP 1995, NSB 1996, NSF 1996a, AAU 1998). Among the most frequently made recommendations are the following:

- broader and less specialized training;
- shorter time-to-degree;
- increased experience in nonacademic settings;
- improved communication skills;
- greater ability to work in teams;
- heightened awareness of possible career choices, particularly of the options available outside academia; and
- greater focus on attraction and retention in higher education of underrepresented minorities.

In these discussions, graduate support modes—that is, the various ways in which graduate students are supported financially—are often viewed as helping or hindering the achievement of many of these recommendations. A report by the National Academy of Sciences' Committee on Science, Engineering, and Public Policy (1995), *Reshaping the Graduate Education of Scientists and Engineers*, focused on Ph.D.s and discussed the changing context of graduate education, employment trends and prospects for graduate scientists and engineers, the impacts of sizeable populations of foreign students, time to employment, and information needs. The report indicated that research assistantships had become the dominant mode of Federal support for graduate students, but cited several drawbacks to this dependence on research grants. A major recommendation was that government agencies should adjust their support and include new education/training grants to institutions and departments.

The National Science Board Task Force on Graduate Education, established in 1995, examined the merits and mix of the several modes of funding support (i.e., research assistantships, fellowships, traineeships) used by the National Science Foundation (NSF) and their impacts on graduate students' experience and preparation. The task force determined that data were insufficient to

support recommendations for major revisions in the mix of NSF funding. The report concluded that:

- limited studies should be conducted on alternative modes of graduate support, with defined goals and assessment criteria; and
- data collection and/or research on funding mechanisms and their influence on various aspects of graduate student education and employment should be supported.

THE GOVERNMENT PERFORMANCE AND RESULTS ACT

Congress passed the Government Performance and Results Act (GPRA) of 1993. GPRA aims to shift the focus of Federal agencies away from traditional concerns, such as staffing and the level of services provided, and toward the achievement of stipulated results of government programs and activities. GPRA requires every Federal agency to prepare multiyear strategic plans and annual performance plans and reports. These documents are intended to give agencies formal tools with which to set forth goals, prepare plans to meet those goals, and to assess and measure progress and accomplishments.

As part of GPRA, every Federal agency is expected to provide information about the outputs and outcomes of its activities. Graduate education is one such activity for NSF: a key investment strategy in its broader outcome goal for a diverse, globally-oriented workforce of scientists and engineers. NSF supports graduate students directly through graduate fellowships and traineeships and indirectly through research assistantships as part of NSF grants. This study provides contextual information that can be used by those responsible for assessing the impacts of specific programs relating to graduate support for GPRA purposes.

STUDY DATA: STRENGTHS AND LIMITATIONS

NSF has two annual sources of data on graduate support patterns—the Survey of Graduate Students and Postdoctorates in Science and Engineering (GSS) and the Survey of Earned Doctorates (SED). However, GSS collects data on full-time S&E graduate students' primary support mode only from academic departments. SED collects data directly from doctorate recipients at

the time of Ph.D. conferral regarding primary, secondary, and all other modes of support used over the course of graduate study. Thus, only SED data are used in this report. Almost the entire report is based on the 1995 responses of 27,865 recipients of a science or engineering doctorate. However, the beginning of chapter 2 contains some references to 1986 SED data for comparison purposes.

The SED is a universe survey of all recipients of research doctorates in the United States. The data are representative only of doctorate recipients, not of all graduate students. The SED is the only national source of data on modes of support, which is asked of every individual receiving a research doctorate in the United States. The response rate to the survey is high—94.3 percent in 1995. The response rate for mode of support was 94 percent, but only 76 percent report a primary source of support and 63 percent a secondary source.⁹ Because this is not a sample survey, results are not subject to sampling error, thus statistical significance is not an issue. Results are subject, however, to nonsampling error, for example, underreporting of primary and secondary mode of support. Profiles of nonrespondents are available in appendix tables A2 and A3.

A further point to note is that neither of the two surveys collects information on dollar amounts of support. Thus, the report focuses on the number or percentage of new Ph.D.s reporting use of a particular mode or combination of modes of support. The reader should bear in mind that changes in modes of support over time or differences among groups in types or combinations of support modes do not necessarily imply changes or differences in amounts of funding.¹⁰ The decrease in use of loans from 1986 to 1995, for example, does not imply a decrease in the amount of debt.¹¹

Although this study examines demographic and institutional factors that may affect support patterns, other factors not considered here may influence the nature of

⁹After 1995, the questionnaire form was changed to obtain a higher response rate. In 1996, the response rate to primary and secondary support rose to 87.9 and 76.1 percent, respectively.

¹⁰Another report, relying on the National Center for Education Statistics' National Postsecondary Study Aid Study, addresses the financial aid profile of graduate students enrolled at master's and doctoral levels. See NSF, *Financial Aid Profile of Graduate Students in Science and Engineering*, forthcoming.

¹¹For information about indebtedness at the time of receipt of the doctorate, see the two NSF issue briefs dealing with this issue (NSF 1998b and NSF 1999b).

support patterns or may interact with some of the attributes being examined in this study to affect support patterns. Such other factors include age of doctorate recipients, geographical location of institution from which degree is received, and part-time/full-time status of students.

ORGANIZATION OF THIS REPORT

Chapter 2 introduces and defines the seven distinct modes of financial support examined in this study and reports on the frequency with which each of these is reported as a primary, secondary, or any mode of support by S&E Ph.D. recipients. The chapter's main focus is the *number* of support modes used. It examines this

variable, by broad field of study, for 1995 S&E Ph.D.s as a whole as well as by sex, race/ethnicity and citizenship, public versus private institutions, and Carnegie Research I (Research I) institutions vs. other institutions.¹² Chapter 3 looks at *combinations* of support modes and examines how these combinations vary with field of study and the other analytical categories employed in chapter 2. Chapter 3 also presents information on the percentage of 1995 S&E Ph.D.s reporting each of the seven support modes as one of their modes of support, or as their primary mode of support.

Appendix A – Technical Notes contains a detailed description of the survey, variables, and data used.

¹²See the definitions of Research I and all other Carnegie-classified institutions in appendix A.