

INTRODUCTION

WestEd conducted an evaluation of the National Science Foundation's Graduate Research Fellowship (GRF) Program. The evaluation was designed to provide information useful to ongoing NSF efforts to strengthen its programs and support the agency's commitment to make optimal use of its resources across program options that address its goals. This report provides findings related to the GRF Program's overall effectiveness in meeting program objectives. To enhance the evaluation's usefulness to NSF, we also examine important contextual issues surrounding the educational experiences and career directions of graduate students to understand how they shape the overall impact of the GRF Program. We consider the implications of GRF Program effectiveness and the contextual issues surrounding the program vis-à-vis the overarching purposes of the GRF Program and those of the Education and Human Resources Directorate within which it is housed.

Taking this more macro perspective is intended to afford NSF the opportunity to confirm and/or strengthen the goodness-of-fit between its programs and goals. We begin by placing the Graduate Research Fellowship Program in its historical and organizational context and then discuss its intended role and contribution within the current science, mathematics, engineering, and technology (SMET) research and education reform landscape.

The National Science Foundation Act of 1950 (PL 810-507) established NSF as a Federal agency, with the mission "to promote the progress of science, to advance the national health, prosperity, and welfare; and [to promote] other purposes" (NSF, 1997b, p. 2). Activities and programs authorized to receive NSF support include:

1. basic scientific research and research fundamental to the engineering process,
2. programs to strengthen scientific and engineering research potential,
3. science and engineering education programs at all levels and in all of the various fields of science and engineering,
4. programs that provide a source of information for policy formulation, and
5. other activities to promote these ends. (NSF, 1995, p. 11)

Since the agency's inception and through its program portfolio, the NSF has served as an effective catalyst for the nation's continued progress in the areas of science, mathematics, engineering, and technology research and education. It has done so by functioning primarily as an investment agent, awarding merit-based grants and contracts to public and private institutions and individuals throughout the U.S. to support investments in three broad functional categories:

research projects (55% of NSF budget), research facilities (19%), and education and training (20%). The remaining 6% of the agency's budget of approximately \$3.773 billion support its administration and management.

According to NSF's *GPRA* [Government Performance and Results Act] *Strategic Plan FY 1997-FY 2003*, the agency expects its investments to produce, collectively and over time, five outcomes (NSF, 1997b, p. 3):

1. Discoveries at and across the frontier of science and engineering;
2. Connections between discoveries and their use in service to society;
3. A diverse, globally oriented workforce of scientists and engineers;
4. Improved achievement in mathematics and science skills needed by all Americans; and
5. Timely and relevant information on the national and international science and engineering enterprise.

All NSF proposals and awards are managed through eight program directorates, each with a distinct purpose that supports the agency's overall mission. The GRF Program is housed within the Education and Human Resources (EHR) Directorate, the purpose of which is to provide national leadership in improving SMET education by supporting reform at all levels of the education system and strengthening education pipelines. Specifically, the GRF Program is situated within the EHR Directorate's Division of Graduate Education (DGE), which promotes the early career development of scientists and engineers in order to ensure a steady flow of diverse, high-ability graduates to the nation. DGE seeks to accomplish this aim by providing fellowships and traineeships for graduate and postdoctoral study.

The Graduate Research Fellowship Program was established in 1952, making it one of the agency's oldest programs. Its intent is to promote the strength and diversity of the nation's scientific and engineering base by offering recognition and awarding three years of financial support to approximately 900 outstanding graduate students annually. Support takes the form of a portable stipend and a cost-of-education allowance that the NSF fellow can use at the institution of his/her choosing. The three years of support must be used within a five-year period, and fellows may elect to go on reserve status with NSF for up to two years during this period.

The Minority Graduate Fellowship (MGF) competition awarded fellowships to highly qualified underrepresented minority applicants from 1978 to 1998 to promote increased diversity within SMET fields. The GRF Program also offers fellowship awards to enhance the participation of women: Women in Engineering (established in 1990) and Women in Computer and Information Sciences (established in 1994) in both the Graduate Fellowship (GF) and Minority Graduate Fellowship (MGF) competitions. The MGF competition was discontinued in 1998.

Of the five outcome goals specified in the NSF Strategic Plan, the GRF Program most directly supports Outcome Goal 3: A diverse, globally oriented workforce of scientists and engineers. The performance goals associated with this outcome goal as identified in the FY 1999 GPRA Performance Plan are as follows:

NSF is minimally effective when: opportunities and experiences of students in NSF-sponsored activities are comparable to those of most other students in their field; and when the participation of underrepresented groups in NSF-sponsored science and engineering projects and programs increases. NSF is successful when: participants in NSF activities experience world-class professional practices in research and education, using modern technologies and incorporating international points of reference; when academia, government, business, and industry recognize their quality; and when the science and engineering workforce shows increased participation of underrepresented groups. (NSF, 1998, p. 7)

In light of these performance goals, key to evaluating the GRF Program's effectiveness is assessing the extent to which there exists evidence of the program's contribution to both the quality and diversity of the SMET workforce. However, as noted in the Strategic Plan:

External factors have a significant impact on NSF's [and GRF Program] performance. In particular, the circumstances of our institutional partners in academia, the private sector and the government affect how the individuals [supported by NSF programs] are able to respond in both proposing and conducting research and education activities. (NSF, 1997b, p. A1-2)

With regard to the specific goal of ensuring a diverse, globally oriented SMET workforce, the Strategic Plan goes on to caution:

The characteristics of the workforce of scientists and engineers are highly dependent on the systems through which they are educated and trained. While NSF can influence these systems through the types of proposal solicitations generated and types of awards made, the agency does not control them.... NSF programs influence educational systems and the public that supports them, but are only one influence among many. (NSF, 1997b, p. A1-3)

Therefore, to be maximally meaningful and useful, an evaluation of the NSF Graduate Research Fellowship Program must attend to more than just standard program processes (fellowship application and selection procedures) and outputs (numbers, demographics, completion rates, and career accomplishments). In addition, contextual factors that lie beyond the direct influence of the program, but that nonetheless affect its operation, should be identified and addressed. During the course of this study, we noted several such external factors, and this report speaks to the ways, for better or worse, they have an impact on the GRF Program's ability to fulfill its goals.

