

## I. INTRODUCTION

Undergraduate education is central to the National Science Foundation's mission in human resource development. Whether preparing students to participate as citizens in a technological society, to enter the workforce with two- or four-year degrees, to continue their formal education in graduate school, or to further their education in response to new career goals or workplace expectations, undergraduate education provides the critical link between the Nation's secondary schools and a society increasingly dependent upon science and technology. Increasing the number of undergraduate students obtaining degrees in science, technology, engineering, and mathematics (STEM) fields will provide a workforce that is prepared to ensure a healthy economy, respond to demands for national security, and maintain and elevate the quality of life and standard of living in the United States through technological and scientific advancements. The essential role of science and technology in the economy was highlighted in a recent report from the National Academies of Science, *Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5* (National Academies Press, 2010). The report noted that "Substantial evidence continues to indicate that over the long term the great majority of newly created jobs are the indirect or direct result of advancements in science and technology, thus making these and related disciplines assume what might be described as disproportionate importance."

## II. PROGRAM DESCRIPTION

### All Type 1 Proposals

Program activities under the STEP Type 1 competition should be efforts aimed at adapting and implementing best practices that will lead to an increase in the number of students (United States citizens or permanent residents) obtaining STEM degrees at institutions with baccalaureate degree programs or completing associate degrees in STEM fields or completing credits toward transfer to a baccalaureate degree program in STEM fields at community colleges. The goal of the project must be to increase the total graduation numbers of such students at the institution(s), and all STEP proposals must include specific numerical targets for these increases. If a project focuses efforts on only a subset of STEM fields, increases in those fields must not be at the expense of degrees granted in other STEM fields. Projects may focus on the retention and/or recruitment of undergraduate students into STEM fields. Outreach efforts are appropriate only if the efforts can be expected to result in additional STEM majors and graduates at the submitting institution(s) within the grant period.

All Type 1 projects are considered to be institutional efforts. A Type 1 proposal should be identified as falling into one of two categories: 1A or 1B.

A **Type 1A** proposal is submitted by an institution that has not previously been the lead institution on a STEP Type 1 award.

A **Type 1B** proposal is submitted by an institution that has previously been the lead institution on a STEP Type 1 award. The proposal is for a new five-year implementation project that is not intended to simply continue efforts for which funding was provided under the original award or to support a project that represents a small adjustment in activities or a simple change in the targeted population. It is intended to fund efforts that are substantially different from those supported in the original award. A Type 1B proposal must provide information about the previous Type 1 grant, including (1) evaluation information that supports claims of successes that have been achieved, (2) the degree to which the previous project has been institutionalized, (3) a description of significantly new directions in which the project will be heading, (4) the rationale for choosing these new directions, and (5) the relationship between the previous project and the proposed project. At least four years of data about the effects of the previous STEP Type 1 grant on student enrollments and graduation rates in STEM must be provided.

As examples, Type 1A or 1B projects might propose a comprehensive effort that uses some combination of the following approaches in order to increase the number of graduates in STEM fields:

Programs that intend to increase the number of students persisting in STEM courses and majors by focusing directly on the quality of student learning, including efforts that encourage (a) high-caliber teaching, including enabling faculty to spend additional time teaching participating students in smaller class settings, including in the laboratory environment; (b) opportunities to implement new pedagogical approaches such as the implementation of active learning strategies, webbased course strategies, distributed and collaborative digital teaching tools, or interactive course modules; and (c) training of teaching assistants;

Programs that expand the capacity of institutions of higher education to incorporate current advances in science, technology, engineering, and mathematics (STEM) into the undergraduate learning environment;

Programs including interdisciplinary approaches to undergraduate STEM education;

Bridge programs that enable students at community colleges to matriculate directly into baccalaureate STEM programs;

Programs among collaborating academic institutions designed to increase the number of pathways available for achieving a degree in STEM, or to improve the articulation among programs at the institutions;

Mentoring programs that involve faculty or peer student mentoring;

Programs that focus on increasing enrollments in STEM undergraduate majors through the incorporation of strategies targeted at traditionally underrepresented students (low-income, ethnic and racial minority students, first-generation college students, women, and persons with disabilities);

Programs that (a) facilitate student exposure to potential careers, including cooperative programs with industry or government that place students in internships as early as the summer following their first year of study; (b) provide part-time employment in industry during the school year; or (c) provide opportunities for undergraduates to participate in industry- or

4

government-sponsored research;

Programs to encourage undergraduate research, particularly in the early undergraduate years, on- or off-campus;

Programs that assist institutions of higher education in states that participate in the Experimental Program to Stimulate Competitive Research (EPSCoR) to broaden the STEM student base or increase retention in these fields;

Programs that recruit and retain Veterans in STEM fields;

Programs that provide financial incentives to students entering and persisting in the study of STEM; or

Other approaches to achieving program goals.

The intent of a STEP project should be to make a significant impact on the culture at an institution(s) with the expectation that major portions of the impact will be sustained after the completion of the project. The most competitive proposals are those based on an institutional self-study that has determined when and why students leave STEM majors at the institution or identifies untapped recruitment opportunities and that focuses on changing the situation through appropriate strategies. A project that supports only a targeted cohort of students without including strategies for on-going institutional change is not likely to be competitive. Finally, although the use of scholarships is allowed as one part of a larger strategic effort to retain students, if the project is intended to rely largely on scholarships, it should be submitted to the [NSF Scholarships in Science, Technology, Engineering, and Mathematics \(SSTEM\) Program](#).

For projects that are considering outreach to high school students, such activities are appropriate only if they will recruit students to

the proposing institution(s) and if the high school students will be entering and progressing through undergraduate STEM majors within the five-year period of the proposed project. In most cases, this requires that outreach and recruitment efforts be limited to juniors and seniors in high schools that have a history of sending their graduates to the proposing institution(s).

**Outcomes**

The outcomes expected of funded Type 1A and Type 1B STEP projects include all of the following:

Significant progress toward achieving the specific proposed increases in the number of students who are United States citizens or permanent residents obtaining STEM degrees at institutions with baccalaureate degree programs or completing associate degrees or completing credits in STEM fields at a community college toward transfer to a baccalaureate degree;

A description of the activities that have been institutionalized as a result of the project;

A description of the expectations, following the end of the grant period, for continued efforts at the institution to increase the number of STEM degrees in established or emerging fields at institutions with baccalaureate degree programs or completing associate degrees in established or emerging fields or completing credits in STEM fields at a community college toward transfer to a baccalaureate degree;

An evaluation, using the preliminary indicators and benchmarks defined in the proposal, that informs the institution and others about the effectiveness of specific implementation strategies; and

Effective dissemination of project processes and results to the broader community.

All Type 1A and Type 1B grants will be reviewed during their third year to determine whether satisfactory progress has been made, with continued funding contingent on the result of the third-year review.

In addition to the individual project evaluation, Principal Investigators of all Type 1 awards will be required to participate in evaluation activities related to the Directorate for Education and Human Resource's program monitoring and program evaluation.

**Type 2**

Program activities under the STEP Type 2 competition represent educational research on factors affecting associate or baccalaureate degree attainment in STEM. The results are expected to contribute to the knowledge base of scholarly research in education. Proposals requesting up to a total of \$1.5 million for projects of up to a duration of four years should be based in a research design that incorporates appropriate and proven methodologies and strategies. The proposal should identify the research questions, and the results should provide convincing evidence of the relationship of the factor(s) (including departmental/institutional) studied to the issues of associate and/or baccalaureate degree attainment, and/or undergraduate access to STEM careers, and/or persistence to STEM graduate study. These educational research studies should reflect explicit cognizance of the broad variety of institutions of higher education, and should address the unique challenges and opportunities posed by that variety. Studies that involve a single institution are discouraged unless the proposal provides compelling arguments that the results can be generalized to the larger community. The proposed research should be developed with the intent to provide the education community, including faculty, administrators, policymakers, and parents, with practical information to consider with respect to the impact of the factor(s) being studied within the educational system. The results should enable the education community to guide better the future development of learning experiences, and to foster the retention and academic success of diverse students in STEM. Faculty in STEM disciplines are strongly encouraged to collaborate with appropriate experts in educational research when developing a Type 2 proposal.

Note that broader research opportunities in student learning and student academic success are eligible for support under the [Research and Evaluation on Education in Science and Engineering \(REESE\) Program](#).

**Outcomes**

The outcomes expected of funded Type 2 STEP projects include all of the following:

Evidence concerning an important factor(s) and its role(s) in associate and/or baccalaureate degree attainment, and/or undergraduate access to STEM careers, and/or persistence to STEM graduate study;

Practical information useful to educators about the impact of the factor(s) that has been studied within the educational system; and

Dissemination of the research results to the education community.