

# SRI International

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## **EVALUATION OF THE RESEARCH EXPERIENCES FOR TEACHERS (RET) PROGRAM: 2001-2006**

### **Executive Summary**

Prepared by:  
Susan H. Russell, PhD  
Mary P. Hancock, MEd  
SRI International

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The National Science Foundation  
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# EXECUTIVE SUMMARY

## INTRODUCTION

In FY 2001, the National Science Foundation's (NSF's) Directorate for Engineering (ENG) initiated the Research Experiences for Teachers (RET) Program. The Program, inspired by the popularity of the Research Experiences for Undergraduates (REU) funding mechanisms, is intended to bring knowledge of engineering and technological innovation to the pre-college classroom. The goal is to help build long-term collaborative partnerships between K-14 science, technology, engineering, and mathematics (STEM) teachers<sup>1</sup> and the NSF research community by involving the teachers in ENG-funded research and then helping them translate their research experiences into classroom activities. Partnerships with inner-city schools and schools in other less well-funded districts are especially encouraged, as is participation by underrepresented minorities, women, and persons with disabilities. It is intended that the research activities occur over a period of at least 6 weeks,<sup>2</sup> usually during the summer, with "sustained follow-up" over the course of the subsequent academic year. RET also funds teacher workshops.

There are two mechanisms of RET support: Supplements and Sites. RET Supplements may be included in proposals for new or renewal ENG grants or as supplements to ongoing ENG-funded projects. RET Sites are based on independent proposals to initiate and conduct research participation projects for a number of K-12 teachers and/or community college faculty.

In 2003, NSF contracted with SRI International (SRI) to evaluate the ENG RET Program. The primary objective was to better understand how the Program experiences of ENG RET participants affected their teaching techniques, attitudes about teaching, and professional development activities. Outcomes and impacts beyond the teachers' own classrooms, such as knowledge transfer activities, formal partnerships formed between the RET Principal Investigator (PI) and the teacher's school system/district also were examined. The study did not assess the impacts of RET on students, other than through participants' reports of Program impacts on their students. Also, because the workshop experience is fundamentally different from the longer-term RET projects, the study was limited to individuals whose summer RET activities lasted for at least 2 weeks.

Data collection for the study was conducted through three online surveys, one in the summer and fall of 2004, one in the spring of 2006, and one in the spring of 2007. The 2004 survey population consisted of all 2002 and 2003 participants in ENG RET Site awards and all 2001 to 2003 participants in ENG RET Supplement awards made by the Engineering Research Centers (ERC) Program, the Division of Bioengineering and Environmental Systems (BES), and the Division of Design, Manufacture, and Industrial Innovation (DMII). The 2006 survey population included 2004 and 2005 participants in all RET Site and Supplement awards made through ENG. The 2007 survey population included 2006 participants in all RET Site and Supplement awards made through ENG. The results reported here are based on the 898 responses from the three surveys combined.

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<sup>1</sup> The Program encourages the participation of both inservice teachers and preservice teachers (education majors who are still pursuing their degrees). In FY 2001 and FY 2002, the program included only K-12 teachers; in FY 2003, community college faculty were added to the target audience.

<sup>2</sup> In FY 2007, the minimum period for RET Sites was increased from 4 to 6 weeks.

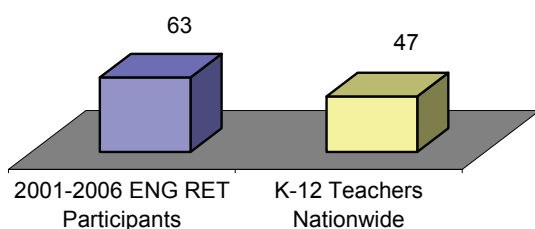
## KEY SURVEY FINDINGS

### ENG RET Participants Were Diverse

ENG RET participants were a diverse group demographically, as well as in terms of the schools in which they taught, the kinds of students they taught, and the STEM subjects they taught. Proxy questions for student income level<sup>3</sup> suggested that, consistent with NSF's interest, low-income schools were indeed represented by RET participants, but there were at least as many teachers who appeared to be from relatively affluent schools. Neither school nor teacher characteristics had appreciable effects on project outcomes.

### Participants Tended to Be Well-Qualified Teachers

Percentages of 2001-2006 ENG RET Participants and K-12 Teachers Nationwide Who Have a Master's Degree

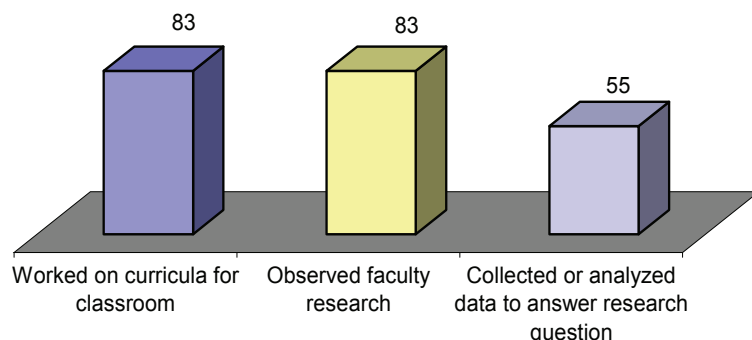


Sources: SRI International RET surveys, 2004, 2006, and 2007; 2003-04 Schools and Staffing Survey, National Center for Education Statistics.

All but 4% of ENG RET participants were teachers immediately before participating in RET, and 92% were teachers at the time of the survey. Participants were considerably more likely than K-12 teachers nationwide to have obtained an advanced degree. To the extent that an advanced degree can be considered an indicator of higher-quality teaching, this finding suggests that, like many teacher enrichment programs, RET has tended to attract the better-qualified teachers.

### For Most, Focus Was on Relating Research to K-12 Classroom Subjects, Rather Than on Research *Per Se*

Percentage of 2001-2006 ENG RET Participants Who Did Each Activity



Sources: SRI International RET surveys, 2004, 2006, and 2007.

Relative to the typical undergraduate research experience, the RET experience focused much more on watching, listening, and developing classroom plans than on hands-on research. For example, over 8 in 10 worked on classroom plans and observed faculty research activities, but only a little over 5 in 10 collected or analyzed data to try to answer a research question. By comparison, 86% of undergraduates in 2002 REU projects collected or analyzed data.<sup>4</sup>

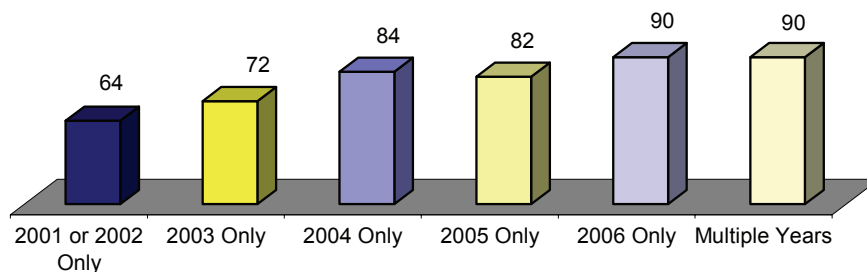
<sup>3</sup> Estimated percentage of students eligible for a free or reduced-price lunch and estimated percentage of students who have access to the Internet at home.

<sup>4</sup> Russell, S. H. (2005). *Evaluation of NSF support for undergraduate research opportunities: Survey of NSF-program participants* (Report to the National Science Foundation). Menlo Park, CA: SRI International.

## Projects' Focus on Classroom Applications Increased Over Time

RET 2006 participants were much more likely than earlier participants—especially the 2001-02 participants—to have engaged in activities specifically related to their classroom activities. For example, the percentage who attended lectures or workshops about strategies for teaching STEM concepts increased from 31% of the 2001-02 participants to 64% of the 2006 participants, and the percentage who worked on developing classroom curricula increased from 64% to 90%.

Percentage of 2001-2006 ENG RET Participants Who Worked on Curricula for the Classroom, by Year of Participation

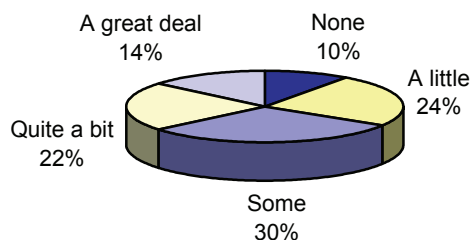


Sources: SRI International RET surveys, 2004, 2006, and 2007.

## Academic-Year Follow-up Appeared to be Less Common Than Was Envisioned by NSF

RET Program solicitations for FY 2002 and FY 2003 indicated that follow-up should be a central element of the Program activities, and the FY 2007 solicitation requires that a plan for follow-up be included in the proposal. Despite these requirements, the surveys suggest that, to date, follow-up has typically played a relatively tangential role. Thirty-four percent of respondents said there was little or no follow-up interaction during the academic year following their RET project; only 14% said there was a great deal of it. Moreover, follow-up appeared to have decreased over time rather than increased: 38% and 41% of respondents to the 2004 and 2006 surveys, respectively, reported quite a bit or a great deal of follow-up, whereas in the 2007 survey, only 28% reported this amount of follow-up.

Amount of RET Follow-up Interaction Reported by 2001-2006 ENG RET Participants



Sources: SRI International RET surveys, 2004, 2006, and 2007.

## Satisfaction Levels Were High for the Experience Overall but Lower for Some Key Aspects, Such as Mentor Interest in Developing Classroom Plans

A large majority of participants were enthusiastic about their RET experiences overall: 76% were very satisfied with the experience as a whole, and similar percentages said that the amount of time spent on hands-on research and curriculum development was “about right.” Said one participant, “I was invigorated, informed, broadened, and enriched by the experience. This is one of the best summer programs I ever participated in.” On the other hand, fewer than 6 in 10 were very satisfied with their mentor’s knowledge of the roles/responsibilities of K-12 STEM teachers or with their mentor’s interest in helping them develop classroom plans.

## Almost All Participants Reported Positive Project Outcomes and Impacts

Twenty-seven of the 37 potential positive project outcomes that were listed in the questionnaire were reported by more than half of the respondents, and 14 were reported by three-fourths or more, indicating that the Program overall had a wide variety of positive short-term effects. Below are outcomes reported by 80% or more of respondents.

Increased my general knowledge base in STEM	98%
Increased my motivation to find ways to improve my students' learning	94
Increased my ability to convey the excitement/vitality of STEM to students	92
Increased my confidence in my ability as a STEM teacher generally	90
Increased my awareness of current STEM research issues	90
Increased my professional opportunities	83
Included examples or applications from my RET activities in my teaching	83
Tell students more about or use more new technologies	82
Increased my understanding of STEM applications in everyday life	81

Over 80% of respondents also reported positive effects on their students. Most common were students' increased awareness of STEM career options (57%), more positive attitudes about STEM subjects in general (53%), and greater interest in the respondents' classes (46%).

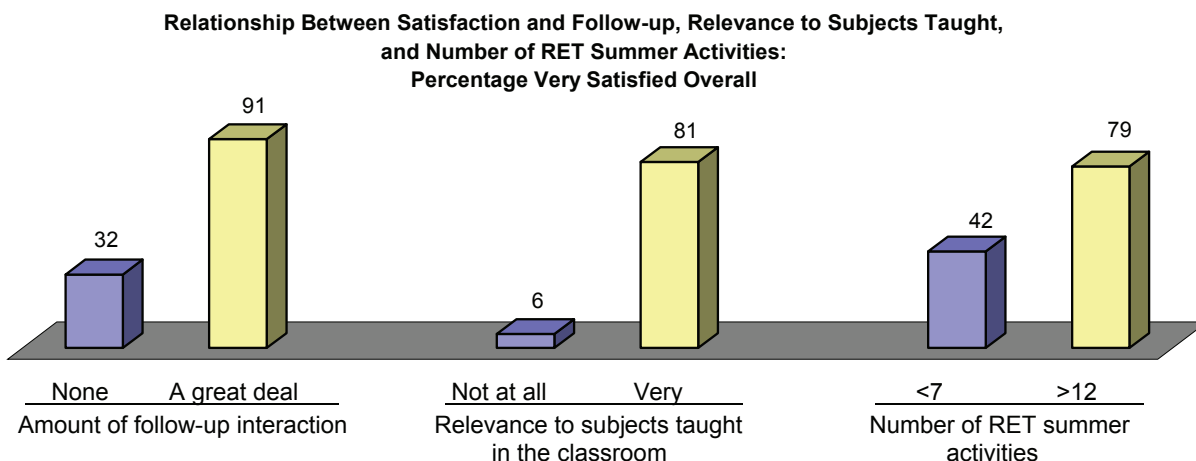
## Ongoing Collaborative Relationships Appeared to Be Rare

Just as there appeared to be less follow-up interaction in the RET Program than NSF envisioned, the Program's goal to help build long-term collaborative relationships between K-14 STEM teachers and the NSF research community did not appear to have gained much traction. Few teachers (21%) participated in the RET program for more than 1 year, and most were the only individual from their school to have participated; a mere 4% reported that as many as four individuals from their school had participated. There was no improvement in these statistics from the earlier surveys to the 2007 survey. However, with the FY 2007 NSF mandate to recruit at least two teachers from the same school and the Foundation's "strong encouragement" to allow participation for two consecutive years, we expect that these statistics will improve in the future.

## Relevance, Follow-up, and Variety Were Key to Positive RET Outcomes as Well as to Participant Satisfaction

Among participants who currently teach, 58% reported that, overall, the RET activities were "very relevant" to the subjects they currently teach, 38% said RET activities were "somewhat relevant," and only 4% said they were "not at all relevant." Participants for whom the RET experience was very relevant were much more likely than those for whom the experience was somewhat or not relevant to report high satisfaction, positive personal outcomes, and positive effects on their students. Participants who reported a great deal of follow-up interaction and those who participated in a variety of summer RET activities also were much more likely than those who had no follow-up and who participated in only a few kinds of activities to have positive outcomes and to be highly satisfied. For example, 91% of those who reported a great

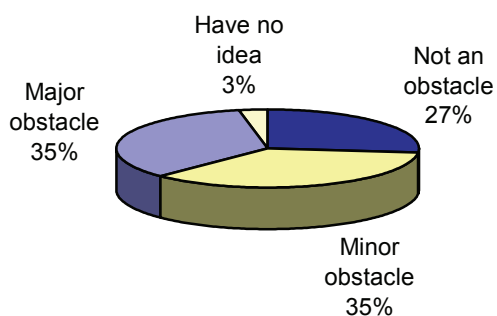
deal of follow-up interaction were very satisfied overall with their RET experiences, compared with only 32% of those who reported no follow-up interaction.



Sources: SRI International RET surveys, 2004, 2006, and 2007.

### High Cost of Materials and Equipment Was Most Common Obstacle to Transferring RET Knowledge to the Classroom, but Its Importance Had Declined Somewhat

**Expense of Materials and Equipment as an Obstacle to Transferring RET Knowledge to the Classroom, 2001-2006 ENG RET Participants**



Sources: SRI International RET surveys, 2004, 2006, and 2007.

By a considerable margin, the high cost of materials and equipment was overall the biggest obstacle to transferring RET knowledge to the classroom. Across all three surveys, 35% rated it as a major obstacle and 36% as a minor obstacle. Encouragingly, however, the percentages who experienced this and other implementation problems declined after the early days of the Program. In particular, the percentage who reported materials and equipment cost to be a major obstacle declined from 44% in 2004 to 29% in 2006 and 33% in 2007. The FY 2007 solicitation increased the amount allowed per teacher for materials and equipment from \$1,000 to \$2,000, so this may be less of an issue in the future.

### OVERVIEW AND RECOMMENDATIONS

A large majority of 2001-2006 ENG RET participants were enthusiastic about their participation in the Program. Almost all reported that they had received a variety of personal and professional benefits from the Program, including new enthusiasm for their STEM teaching; new teaching strategies; a greater awareness of STEM research methods, issues, and career opportunities; and enhanced professional opportunities. Moreover, the vast majority said that their students also had benefited, most often through increased enthusiasm for STEM subjects and increased awareness of STEM careers.

We are gratified that the Program's FY 2007 revisions reflected a number of our earlier recommendations. The revisions include stronger requirements for follow-up, recruitment of multiple teachers from the same school, increased support for classroom materials, and encouraging teachers to participate for two consecutive years. We believe that these revisions will do a good deal to enhance the Program's already substantial effectiveness and help to ensure that its effect is long-lasting. Our recommendations going forward are as follows:

- Continue to emphasize the importance of substantive and continuing follow-up.
- Encourage PIs to make every effort to "match" participants to projects and to focus on explicitly relating summer activities to subjects the participants teach in the classroom.
- Use renewal proposals to monitor how effectively PIs have recruited multiple participants from the same school and have encouraged two-summer participation.
- Encourage PIs to develop strategies for including past participants in some aspect of summer activities and developing participant networks. Consider providing a small amount of supplemental funding for these activities.

## **HIGHLIGHTS OF PARTICIPANT FEEDBACK**

*The RET program does an outstanding job of widening the horizons of teachers. It reenergizes teachers. It helped re-center me and remind me why I took physics in the first place. The energy and excitement translate to a more interactive classroom experience for the students.*

*RET programs train one teacher to help hundreds of students. No books can offer the kind of skill and true understanding of scientific inquiry that teachers gain from participating in current research. This is a great program and I hope it continues.*

*Over the years I have participated in numerous professional development activities. None of my other PD experiences can come close to comparing to RET. RET has made me a better and more thoughtful teacher, a careful and thoughtful research scientist, a more professionally diverse and connected member of the "larger" learning community, and a proponent for future RET involvement.*

*The biggest impact was when my students started telling students on the other teams about their "cool" activities. The other teachers then came to me to learn about the activities, including how to use the equipment. ... So instead of just reaching my students, I was able to connect with the entire eighth grade, approximately 400 students.*

*As a direct result of my RET involvement, I won a \$10,000 grant through which I was able to involve my students in research and set up an ongoing collaboration with my host institution.*

*The partnership with the [RET university] has helped me create a summer camp to encourage middle school students to seek engineering careers.*

*Because we had a graduate student, we were able to bring in neat labs and run an after-school program. This opened the eyes of students so they could see and hear about someone doing real research. Also, my students took a tour of the university and the program I was involved in. This was a great opportunity for them to be exposed to STEM in the real world.*